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Effect of strength and explosive training on selected performance variables among college women volleyball players

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Abstract
To achieve the purpose of the study, sixty (60) college women volleyball players who participated in intercollegiate tournaments affiliated to Bharathidasan University, Tiruchirappalli, Tamil Nadu, India during the academic year 2024–2025 were selected as subjects. The age of the subjects ranged from 18 to 25 years. The selected subjects were randomly divided into three groups of twenty each (N = 20). Group I underwent strength training (STG), Group II underwent explosive training (ETG) and group III acted as control group (CG) they did not undergo any specific training other than their regular volleyball practice. The selected performance variables were vertical jump, reaction time, agility and blocking height. The experimental groups underwent their respective training programmes for a period of twelve weeks, three days per week, on alternate days, in addition to their regular schedule. All the subjects were tested prior to and immediately after the training period on the selected variables. The data were statistically analysed using paired sample ‘t’-test and Analysis of Covariance (ANCOVA) to find out the significant differences among the groups. Scheffe’s post hoc test was applied to determine the paired mean differences when the ‘F’ ratio was found significant. The level of confidence was fixed at 0.05 for all cases.

Keywords: Strength training, explosive training, vertical jump, reaction time, agility, blocking height

Introduction
Volleyball is a fast-paced team sport that requires coordination, agility, and tactical awareness. It was initially introduced as “Mintonette” in 1895 by William G. Morgan and later evolved into modern volleyball. Volleyball is “a team game played by two teams of six players each on a rectangular court divided by a high net, in which the objective is to ground the ball on the opponent’s court while preventing the same attempt by the opponent.” Volleyball demands physical fitness, skill development, and teamwork, making it a popular field of study in sports science [1].

Weight training, also called resistance training, is a method to improve muscular strength, power, and endurance through the use of weights, machines, or body resistance. Weight training as “a method of conditioning that utilizes resistive loads to enhance muscular strength and hypertrophy through systematic overload and progression” [2].

Weight training is fundamental for improving athletic performance, injury prevention and overall fitness [3].

Plyometric training is a form of exercise designed to enhance explosive power, speed, and neuromuscular efficiency through rapid stretch–shortening movements like jumping and hopping [4]. Plyometric training is “a specialized method of conditioning designed to enhance the ability of muscles to exert maximal force in the shortest possible time through explosive, high-intensity movements”. It is widely used to improve performance in sports requiring quick, powerful actions, including volleyball [5].

Volleyball performance variables are measurable factors that influence a player’s effectiveness on the court, including physical, technical, tactical, and psychological components these variables are “specific attributes and skills such as vertical jump height, agility, reaction time, spike velocity, serve accuracy and endurance that collectively determine the overall effectiveness of a player on the court” [6].

Assessing and training these variables is essential for improving player performance and match outcomes [7].

2. Methodology

To achieve the purpose of the study, sixty (60) college women volleyball players who participated in the intercollegiate tournaments affiliated to Bharathidasan University, Tiruchirappalli, Tamil Nadu, India during the academic year 2024–2025 were selected as subjects. The age of the subjects ranged from 18 to 25 years. The selected subjects were randomly divided into three groups of twenty each (n=20). Group I underwent strength training (STG), Group II underwent explosive training (ETG) and group III acted as control group (CG). The selected performance variables were vertical jump, reaction time, agility, and blocking height, which were measured by sargent jump test, ruler drop test, T-test, and vertec device respectively. The experimental groups underwent their respective training programmes for a period of twelve (12) weeks on alternate days, three days per week, in addition to their regular curriculum activities. The strength training programme consisted of resistance-based exercises such as squats, lunges, bench press, shoulder press, and deadlifts, emphasizing progressive overload to develop muscular strength, while the explosive training programme included plyometric and jump-based exercises such as box jumps, depth jumps, broad jumps and medicine ball throws to improve explosive power and neuromuscular coordination. All the subjects were tested prior to and immediately after the training period on the selected variables using standardized procedures. The collected data were statistically analysed using paired sample 't'-test and analysis of covariance (ANCOVA) to determine the significance of mean differences among the groups, and Scheffe's post hoc test was applied to identify the paired mean differences where the F-ratio was found significant. In all the cases, the level of significance was fixed at 0.05.

Table 1: Significance of Mean Gains / Losses Between Pre-Test, Post-Test and 't' Ratio of Strength Training Group (STG), Explosive Training Group (ETG), and Control Group (CG) on Selected Performance Variables among College Women Volleyball Players

Strength Training Group (STG)							
Variables	**Pre Test Mean**	**(SD)**	**Post-Test Mean**	**(SD)**	**MD**	**SE**	**'t' Ratio**
Vertical Jump (Cm)	35.12	1.25	41.30	1.48	6.18	0.30	20.60*
Reaction Time (Sec)	0.45	0.02	0.40	0.01	0.05	0.004	12.50*
Agility (Sec)	11.25	0.30	10.40	0.22	0.85	0.05	17.00*
Blocking Height (Cm)	220.50	4.12	228.80	3.95	8.30	0.45	18.40*
Explosive Training Group (ETG)							
Vertical Jump (Cm)	35.00	1.18	42.50	1.32	7.50	0.28	26.78*
Reaction Time (Sec)	0.46	0.03	0.41	0.02	0.05	0.005	10.00*
Agility (Sec)	11.30	0.35	10.20	0.25	1.10	0.06	18.33*
Blocking Height (Cm)	221.00	3.95	230.20	4.05	9.20	0.40	23.00*
Control Group (CG)							
Vertical Jump (Cm)	35.05	1.20	35.50	1.25	0.45	0.08	1.50
Reaction Time (Sec)	0.45	0.02	0.44	0.02	0.01	0.003	1.33
Agility (Sec)	11.20	0.32	11.15	0.30	0.05	0.04	0.85
Blocking Height (Cm)	220.75	4.00	221.20	3.85	0.45	0.12	1.25

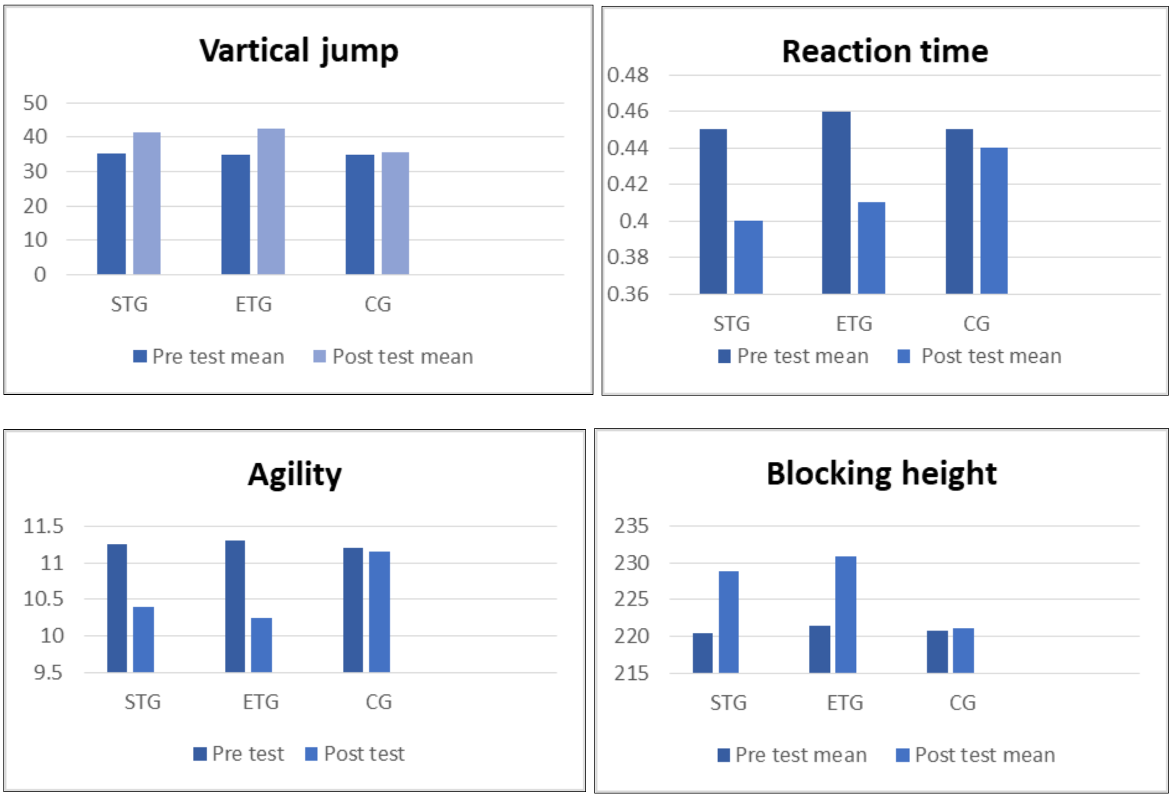

Fig 1: Pre and Post Test Means Values of Experimental and Control Groups on Vertical Jump, Reaction Time, Agility and Blocking Time among Women Volleyball Players.

The table 1 shows that the obtained t-values of the strength training group (STG) on vertical jump, reaction time, agility and blocking height were 20.60, 12.50, 17.00 and 18.40 respectively. The obtained t-values of the explosive training group (ETG) on the same variables were 26.78, 10.00, 18.33 and 23.00 respectively. The obtained t-values of the control group (CG) were 1.50, 1.33, 0.85 and 1.25 respectively. The obtained t-values of both experimental groups were higher than the required t-value (2.09) at 0.05 level of significance, whereas the control group values were lower than the required t-value. Hence, it was concluded that strength training and explosive training produced significant positive changes in vertical jump, reaction time, agility, and blocking height among college women volleyball players, while the control group showed no significant improvement. The figure – 1 shows that the pre and post test mean values of all the groups.

Table 2: Analysis of Covariance (ANCOVA) of Post-Test Means on Selected Performance Variables among College Women Volleyball Players of Strength Training Group (STG), Explosive Training Group (ETG) and Control Group (CG)

Adjusted Post Test Mean							
STG	**EPG**	**CG**	**SOV**	**SS**	**Df**	**MS**	**F- Ratio**
Vertical Jump (Cm)							
41.30	42.50	35.50	B.S	235.40	2	117.70	28.20*
			W.S	70.05	57	1.23	
Reaction Time (Sec)							
0.40	0.41	0.44	B.S	0.012	2	0.006	22.15*
			W.S	0.015	57	0.00026	
Agility (Sec)							
10.40	10.20	11.15	B.S	15.60	2	7.80	25.00*
			W.S	17.80	57	0.31	
Blocking Height (Cm)							
228.80	230.20	221.20	B.S	760.40	2	380.20	30.40*
			W.S	713.10	57	12.51	

Required F (0.05), (df 2, 57) = 3.15 Significant at 0.05 level of confidence

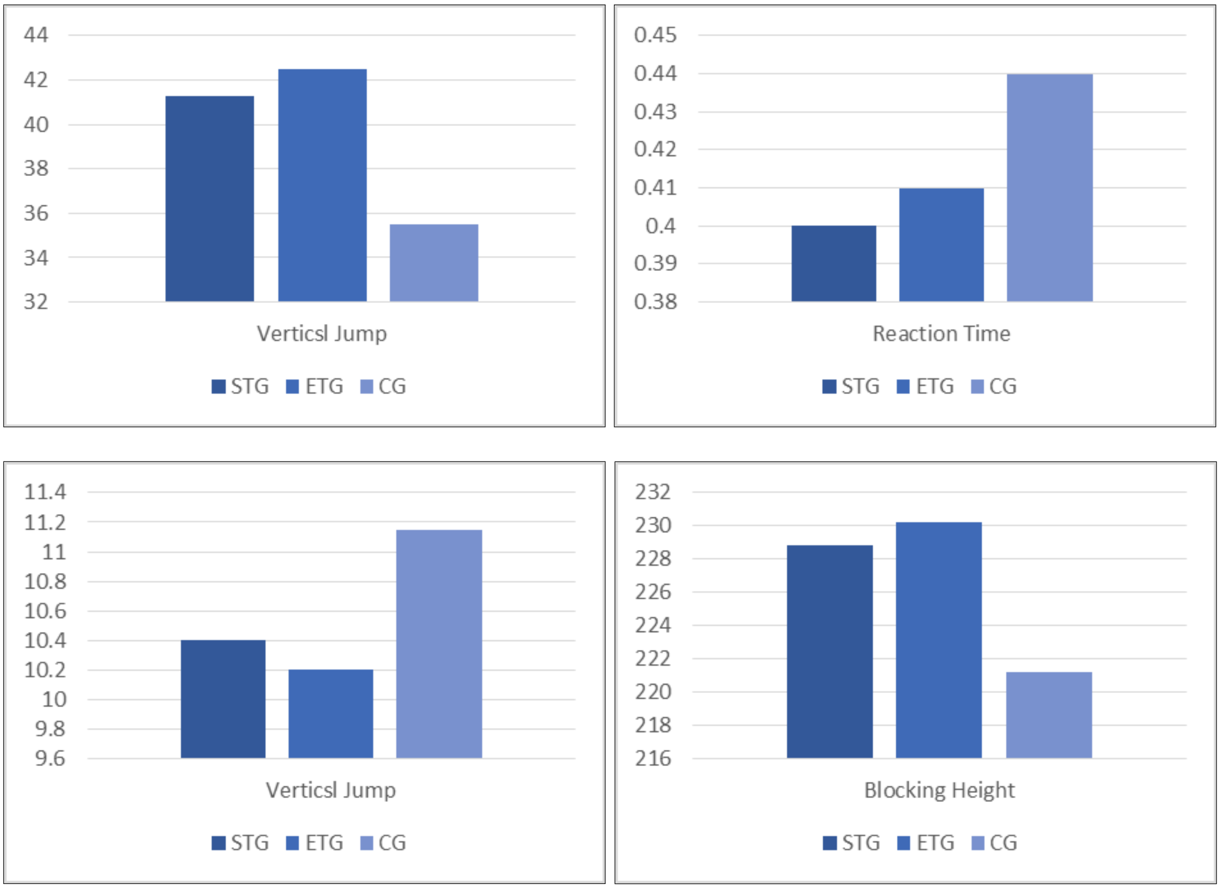

Fig 2: Adjusted Post-Test Means Values of Experimental and Control Groups on Vertical Jump, Reaction Time, Agility and Blocking Time among Women Volleyball Players.

Table – 2 The adjusted post-test mean values for vertical jump, reaction time, agility and blocking height for STG, ETG and CG were 41.30, 42.50 and 35.50. The obtained F-ratio for vertical jump was 28.20, which is greater than the required F-value of 3.15 at 0.05 significance level (df = 2, 57), indicating a significant difference among the groups. For reaction time, 0.40, 0.41 and 0.44 sec, with an F-ratio of 22.15, exceeding the critical value of 3.15, showing a significant difference among groups. Similarly, for agility were 10.40, 10.20 and 11.15 sec (CG), and for blocking height were 228.80, 230.20 and 221.20 cm (CG). The corresponding F-ratios were 25.00 for agility and 30.40 for blocking height, both exceeding the table F-value, confirming significant differences among the three groups. The above figure – 2 shows that the adjusted post test mean values of all the groups.

3. Discussion on Findings

The results of the study indicate that the STG, ETG and CG showed significant improvement in performance variables when compared with control group. Hence, twelve weeks of STG, ETG and CG showed considerable improvement in vertical jump, reaction time, agility and blocking height among women volleyball players. At the same time when the two experimental groups were compared, to CG showed significant improvement on performance variables such as vertical jump, reaction time, agility and blocking height. Hence, the STG and ETG schedule has influenced performance variables. The results of the study are in conformity with the findings of Singh and Kaur, (2020) [8], Silva, et. al., (2019) [9] and Sheppard, et. al., (2008) [10].

4. Conclusions

The experimental groups namely as strength training group and explosive training group had achieved significant improvement on selected performance variables such as vertical jump, reaction time, agility and blocking height when compared to the control group.

It was concluded that the strength training group demonstrated greater gains in reaction time when compared to the explosive training group.

It was concluded that the explosive training group showed notable improvement in vertical jump, agility and blocking height when compared to the strength training group.

It was concluded that college women volleyball players should practice strength training and explosive training for enhancement of performance variables.

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