



## Effect of Plyometric Training and Weight Training on Selected Motor Ability Components among Inter Collegiate Women Volleyball Players

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### KEYWORDS

*Plyometric Training,  
Weight Training,  
Muscular Endurance,  
Coordination,  
Flexibility and Motor  
Ability.*

### ABSTRACT

The present study aimed to investigate the effects of plyometric training and weight training on selected motor ability components namely muscular endurance, coordination and flexibility among inter-collegiate women volleyball players. Forty-five (N = 45) inter-collegiate women volleyball players aged 19–23 years, representing from the affiliated colleges of Bharathidasan University, Tiruchirappalli, Tamil Nadu, India, were randomly assigned to three equal groups (n = 15 each): the Plyometric Training Group (PTG), the Weight Training Group (WTG) and the Control Group (CG). The experimental groups participated in their respective training programmes for twelve weeks, with three sessions per week on alternate days in addition to their regular volleyball practice, whereas the control group continued only with regular volleyball activities. Muscular endurance, coordination and flexibility were assessed by using the sit-up test, wall toss test and sit-and-reach test respectively before and after the training intervention. The collected data were analyzed using Analysis of Covariance (ANCOVA) and whenever a significant F-ratio was obtained, Scheffé's post hoc test was applied to determine paired mean differences. The level of significance was set at  $p < 0.05$ . The findings revealed that both plyometric training and weight training produced significant improvements in muscular endurance, coordination and flexibility compared with the control group. Furthermore, the plyometric training group demonstrated significantly greater improvements than the weight training group across all selected motor ability components. It was concluded that plyometric training is a more effective training modality than weight training for enhancing selected motor abilities among inter-collegiate women volleyball players.

### 1. INTRODUCTION

Plyometric training is a specialized form of exercise designed to improve explosive muscular power by utilizing the stretch-shortening cycle (SSC), a natural muscle action involving rapid eccentric contraction immediately followed by a concentric contraction. This mechanism enhances the neuromuscular system's ability to produce maximum force in the shortest possible time, making plyometric exercises highly effective for improving athletic performance (Faigenbaum, 2010). Originally developed from the Soviet concept of "shock training" introduced by Yuri Verkhoshansky during the 1960s, plyometric training has become one of the most widely used conditioning methods in sports requiring explosive movements such as sprinting, jumping, throwing, and rapid changes of direction. The primary objective of plyometric exercises is to enhance the efficiency of the stretch-shortening cycle, thereby increasing muscular power, speed, agility, and overall athletic performance. The physiological effectiveness of plyometric training is attributed to enhanced neuromuscular coordination, increased motor unit recruitment, improved musculotendinous stiffness, and greater utilization of elastic energy stored during the eccentric phase of movement. These adaptations contribute significantly to improvements in explosive strength, reactive strength, movement efficiency, and sport-specific skills (Gjinovci, et. al., 2017)..

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Weight training is a kind of strength training that uses weights for resistance. By creating a stress to the muscle mass performed with unrestricted weights (e.g. barbells and dumbbells) or by using weight machines, these workouts will enable muscle mass to stay activated and get stronger (Stiegler, 2006). Weight training plays a fundamental role in the physical preparation of athletes across various sports. It contributes significantly to improvements in muscular strength, muscular endurance, power, speed, agility, and overall functional performance. When integrated with sport-specific training, resistance exercises improve movement efficiency, enhance athletic capabilities, and support long-term athletic development. Modern strength and conditioning programs incorporate scientifically designed resistance training protocols to maximize performance while minimizing fatigue and injury risk (Bompa and Buzzichelli, 2019).

Motor ability refers to the underlying physical capacities that enable individuals to perform a wide range of motor skills efficiently and effectively. It encompasses a combination of innate and developed abilities that influence the quality of movement, athletic performance, and the acquisition of sport-specific skills. These abilities form the foundation of physical fitness and are essential for success in activities requiring speed, strength, coordination, balance, agility, flexibility, endurance and reaction time (Grgic, 2022). Motor abilities are considered relatively stable characteristics that determine an individual's capacity to learn, execute, and adapt movement patterns. Unlike motor skills, which are learned through practice and experience, motor abilities represent the fundamental physical and neuromuscular attributes that support skill development and athletic performance. The interaction between these abilities and systematic training contributes significantly to improved movement efficiency and competitive success (Hrysomallis, 2011).

Volleyball is a dynamic and highly competitive team sport that requires the integration of technical skills, tactical awareness and physical fitness for successful performance. To perform these actions effectively throughout a match, volleyball players must possess well-developed motor abilities, including muscular endurance, coordination, flexibility, strength, agility and reaction ability. These physical qualities contribute significantly to the successful execution of volleyball-specific skills and overall competitive performance. Modern volleyball has evolved into a fast-paced sport in which players are required to perform repeated high-intensity actions while maintaining technical precision and tactical effectiveness. Consequently, physical conditioning has become an essential component of volleyball training programmes. Successful volleyball performance is strongly associated with specific physical and physiological characteristics, including muscular fitness, movement efficiency and neuromuscular capabilities. Therefore, the development of motor ability variables is considered fundamental for enhancing volleyball performance and achieving competitive success (Lidor, 2010).

## 2. METHODOLOGY

The present study was designed to examine the comparative effects of plyometric training and weight training on selected motor ability components among inter-collegiate women volleyball players. A total of forty-five ( $N = 45$ ) inter-collegiate women volleyball players, aged between 19 and 23 years, who representing from the affiliated colleges of Bharathidasan University, Tiruchirappalli, Tamil Nadu, India, during the academic year 2024–2025, were selected as participants for the study. The participants were randomly assigned into three equal groups ( $n = 15$  each): the Plyometric Training Group (PTG), the Weight Training Group (WTG) and the Control Group (CG). The PTG participated in a structured plyometric training programme, while the WTG underwent a structured weight training programme. The control group continued their regular volleyball practice without participating in any additional training intervention. Both experimental groups completed a twelve-week training programme consisting of three sessions per week on alternate days, in addition to their regular volleyball practice. Each training session was conducted under the direct supervision of the investigator to ensure uniform implementation of the prescribed training protocols. The selected dependent variables were muscular endurance, coordination and flexibility were assessed by using the sit-up test, wall toss test and sit-and-reach test respectively. Pre-test measurements were obtained before the commencement of the training programme and post-test measurements were recorded immediately after the completion of the twelve-week intervention using the same standardized testing procedures. The collected data were analyzed using the paired-samples 't'-test to determine within-group differences between the pre-test and post-test scores. Analysis of Covariance (ANCOVA) was employed to determine significant differences among the adjusted post-test means of the three groups while controlling for baseline scores. Whenever a significant F-ratio was obtained, Scheffé's post hoc test was applied to identify pairwise differences among the groups. The level of statistical significance was set at  $p < 0.05$  for all analyses.

## 3. RESULTS

The present study aimed to examine the comparative effects of plyometric training and weight training on selected motor

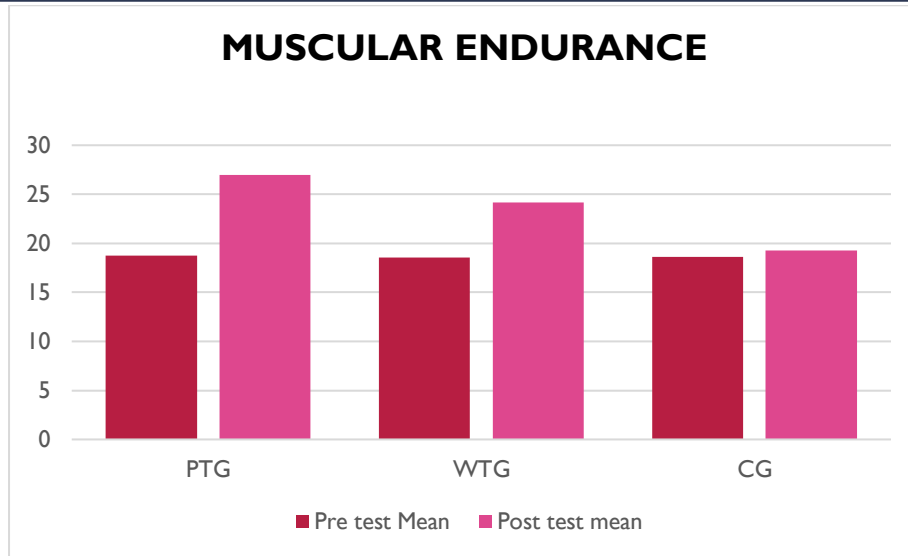
ability variables among inter-collegiate women volleyball players. The pre-test and post-test mean scores of the Plyometric Training Group (PTG), Weight Training Group (WTG) and Control Group (CG) for muscular endurance, coordination and flexibility are presented in Table 1.

**Table-1: Significance of Mean Gains/Losses Between Pre-Test, Post-Test and 't' Ratio of Plyometric Training Group (PTG), Weight Training Group (WTG) and Control Group (CG) on Selected Motor Ability Components among Inter-Collegiate Women Volleyball Players**

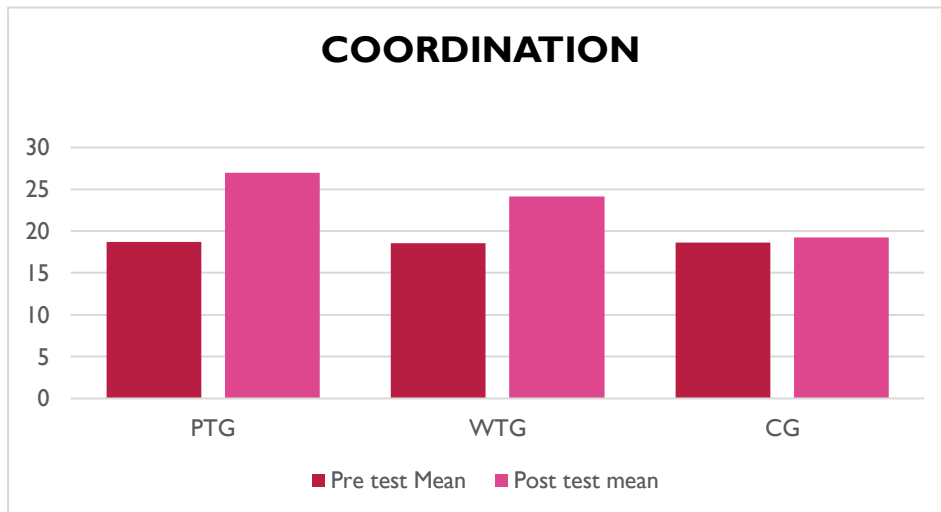
<b>Plyometric Training Group (PTG)</b>							
<b>Variables</b>	<b>Pre Test Mean</b>	<b>(±SD)</b>	<b>Post-Test Mean</b>	<b>(±SD)</b>	<b>MD</b>	<b>SE</b>	<b>'t' Ratio</b>
<b>Muscular Endurance (Repetitions)</b>	25.87	2.34	35.40	2.76	9.53	0.74	<b>12.88*</b>
<b>Coordination (Score)</b>	18.73	1.85	26.94	2.17	8.21	0.66	<b>12.44*</b>
<b>Flexibility (cm)</b>	21.46	2.08	29.38	2.41	7.92	0.63	<b>12.57*</b>
<b>Weight Training Group (WTG)</b>							
<b>Muscular Endurance (Repetitions)</b>	25.64	2.28	32.18	2.53	6.54	0.69	<b>9.48*</b>
<b>Coordination (Score)</b>	18.52	1.79	24.16	2.05	5.64	0.62	<b>9.10*</b>
<b>Flexibility (cm)</b>	21.32	2.01	27.04	2.29	5.72	0.61	<b>9.38*</b>
<b>Control Group (CG)</b>							
<b>Muscular Endurance (Repetitions)</b>	25.71	2.31	26.48	2.36	0.77	0.37	2.08
<b>Coordination (Score)</b>	18.61	1.82	19.24	1.88	0.63	0.34	1.85
<b>Flexibility (cm)</b>	21.38	2.04	22.02	2.09	0.64	0.35	1.83

**\*Required  $t (.05), (df = 14) = 2.14$  Significant at .05 level of confidence**

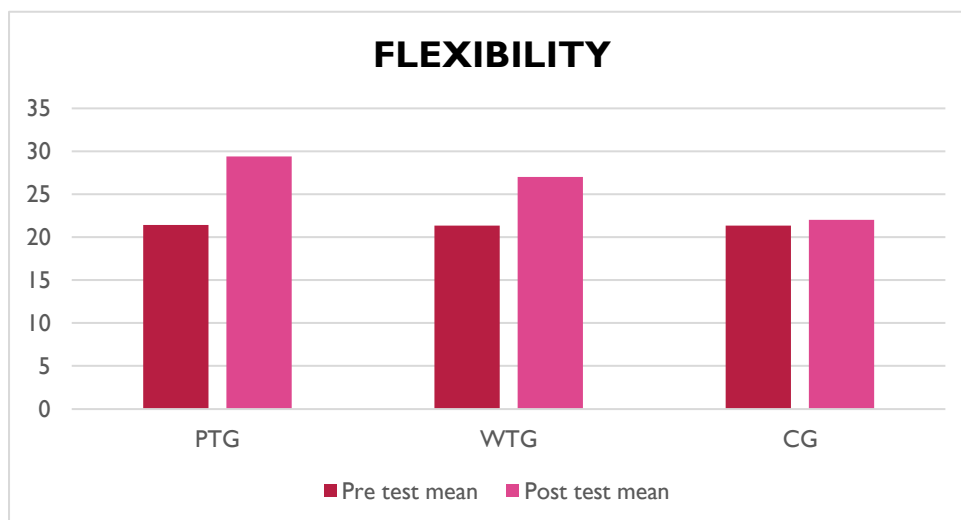
Table-I shows that the obtained t-values of the Plyometric training group (PTG), Weight Training Group (WTG) and Control Group (CG) for the muscular endurance, coordination, flexibility were 12.88, 12.44, 12.57; 9.48, 9.10, 9.38; 2.08, 1.85, 1.83; respectively. The obtained t-values of the PTG and WTG were significant at the .05 level for the degree of freedom 14, as the required critical value was 2.14. Hence, the obtained t-values on the selected motor ability variables were higher than the required critical value. The control group values on the selected variables were lower than the required critical value. It was therefore concluded that both plyometric training and weight training produced significant positive changes from pre-test to post-test on muscular endurance, coordination and flexibility among inter-collegiate women volleyball players. Further, the plyometric training group demonstrated comparatively greater improvement than the weight training group on all the selected motor ability components. The pre and post-test mean value of experimental groups and control group on muscular endurance, coordination and flexibility were shown in figure 1-3.



**Figure 1: Pre and post-test mean value of experimental groups and control group on Muscular endurance**



**Figure 2: Pre and post-test mean value of experimental groups and control group on Coordination**



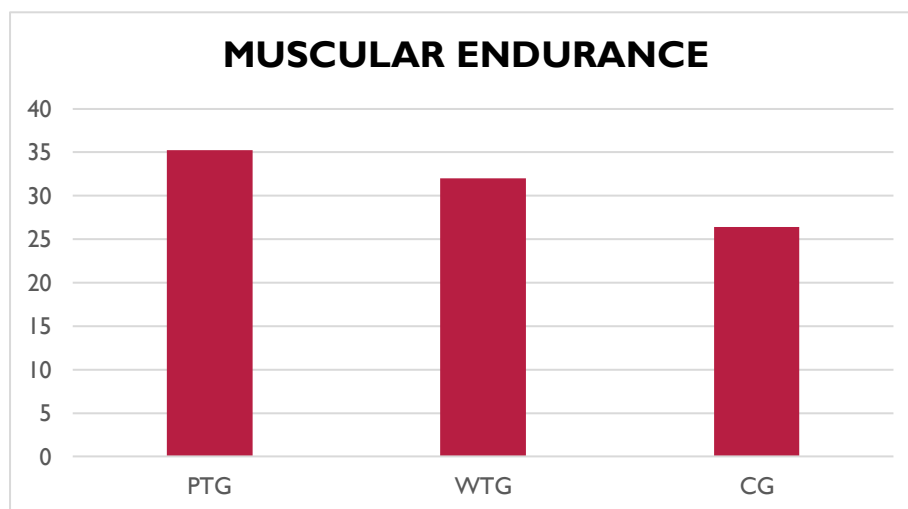
**Figure 3: Pre and post-test mean value of experimental groups and control group on Flexibility**

**Table 2: Analysis of Covariance of Adjusted Post Tests Scores of Experimental and Control Groups on Muscular Endurance, Coordination and Flexibility**

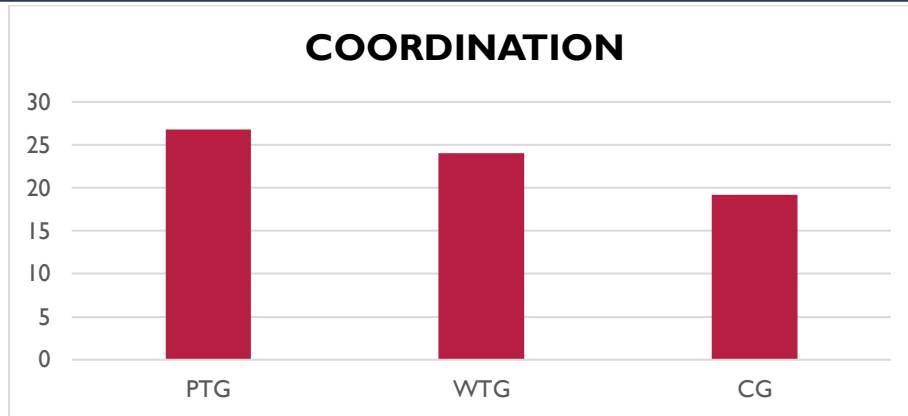
PTG	WTG	CTG	SOV	SS	Df	MS	F-Ratio
<b>Muscular Endurance</b>							
35.28	32.04	26.42	<b>B.S</b>	612.84	2	306.42	<b>38.67*</b>
			<b>W.S</b>	308.95	41	7.92	
<b>Coordination</b>							
26.82	24.03	19.18	<b>B.S</b>	428.76	2	214.38	<b>31.84*</b>
			<b>W.S</b>	262.64	41	6.73	
<b>Flexibility</b>							
29.24	26.91	21.95	<b>B.S</b>	394.58	2	197.29	<b>29.46*</b>
			<b>W.S</b>	261.14	41	6.70	

\*Required F-value at 0.05 level of significance (df 2, 42) = 3.24 \*Significant at 0.05 level

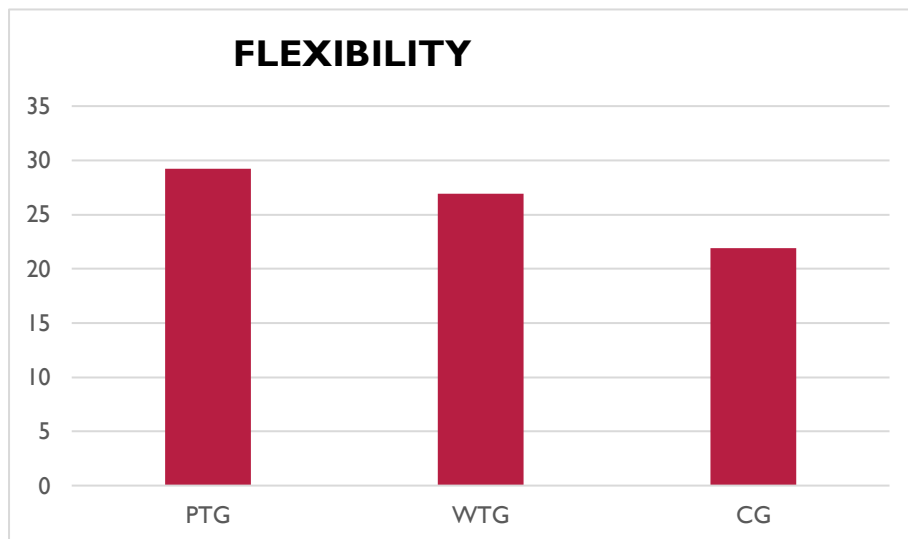
Table-II shows that the adjusted post-test mean values of Plyometric training group (PTG), Weight Training Group (WTG) and Control Group (CG) for the muscular endurance, coordination, flexibility were 35.28, 32.04, 26.42; 26.82, 24.03, 19.18; 29.24, 26.91, 21.95 respectively. The obtained 'F' ratios for muscular endurance, coordination and flexibility were 38.67, 31.84 and 29.46 were greater than the table value of 3.24 required for significance at the 0.05 level of confidence with degrees of freedom 2 and 41. The results of the study indicated that there were significant differences among the adjusted post-test means of the plyometric training group, weight training group and control group on muscular endurance, coordination and flexibility. The findings further revealed that both plyometric training and weight training were effective in improving the selected motor ability variables among collegiate women volleyball players, with the plyometric training group demonstrating superior improvement compared to the weight training group and control group. The adjusted post-test mean values of experimental groups and control group on muscular endurance, coordination and flexibility were shown in figure 4-6.



**Figure 4: Adjusted post-test mean value of experimental groups and control group on muscular endurance**



**Figure 5: Adjusted post-test mean value of experimental groups and control group on coordination**



**Figure 6: Adjusted post-test mean value of experimental groups and control group on flexibility**

#### 4. DISCUSSION AND FINDINGS

The study's findings demonstrate that the Plyometric training group (PTG) and Weight Training Group (WTG) significantly improved muscular endurance, coordination and flexibility as compared to the control group. As a result, twelve weeks of PTG and WTG significantly improved muscular endurance, coordination and flexibility among inter-collegiate women volleyball players. The results of the study are in conformity with the findings of **Bompa and Buzzichelli (2019)**, **Suchomel, et. al., (2016)** and **Miller, et. al., (2006)**.

#### 5. CONCLUSIONS

The present study found that plyometric training and weight training had a significant influence on the improvement of muscular endurance, coordination and flexibility among inter-collegiate women volleyball players. When compared to weight training, plyometric training demonstrated greater improvement in the selected motor ability variables. In the light of the study, similar research may be conducted by state universities, central universities and autonomous institutions on different training methods and coaching methodologies to further enhance motor abilities and refine performance among players in various sports.

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