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The Effect of Plyometric Exercise on Selected Physical and Physiological Parameters among Female Volleyball Players

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Abstract: *This study was designed to investigate the effect of plyometric exercise on selected physical and physiological parameters among female volleyball players. 30 female volleyball players from Rajiv Gandhi Arts and Science College, Puducherry were randomly selected as subjects and their age were between 18 to 22 years. The study was formulated as a true random group design, consisting of a pre-test and post-test. The subjects (n = 30) were randomly assigned to two equal groups of fifteen female each. The groups were assigned as plyometric exercise group and control group in an equivalent manner. The group I underwent plyometric exercise and group II acted as a control group. The experimental group participated the training for a period of twelve weeks to find out the outcome of the training packages and the control group did not participated in any training programme. The parameter to be used in the present study was collected from all subjects before they have to treat with the respective treatments, it was assumed as pre-test. After completion of treatment they were tested again as it was in the pre-test on all parameters used in the present study. This test was assumed as parameters by the experimental group. The initial and final readings derived from the experimental group and control group underwent a procedure of statistical analysis using with 't' test to find out significant improvement if any at 0.05 level of confidence. These finding suggest that the plyometric exercise program has a statistically significant influence in developing the selected criterion parameters.*

Keywords*: Agility, Breath Holding Time, Plyometric Exercise, Resting Heart Rate and Speed.*

1. INTRODUCTION :

Plyometric training is very popular because it provides exercising the lower extremities mainly by using one's own body weight and in the upper limbs. The very structure of plyometric training is such that it requires the adaptation of the muscle from an eccentric to a concentric contraction. Modalities, elicits numerous positive changes in the neural and musculoskeletal systems muscle function and athletic performance of healthy individuals (**Markovic 2010**).

Plyometric training procedure of high intensity allowing muscles to produce more effective in a short period of time. Jumping performance is determined by a complex interaction among several factors including maximal force capacity, rate of force development, muscle coordination and stretch shortening cycle (**Arabatzi 2010**). The greater the athlete's ability to generate maximal force or strength to begin with, the more of it can be converted into sport-specific power.

Plyometric movements are powerful and high-impact, although the impact should be controlled as much as possible. Plyometric training requires both strength and endurance. Common plyometric training exercises include various jumps hops and steps or cones (**Faigenbaum 2007**). Exercises done in water are designed for the body in an upright position. The primary goal of these activities is to improve physical efficiency, and depth of the water. Shallow water programs are typically performed in water that ranges from mid-rib cage to mid-chest in depth. Plyometric training in aquatic nature has become increasingly popular it provides a safer and less stressful alternative to land based programme.

1.1 Volleyball

Volleyball is a popular game in over 200 countries. It is the most popular participation sport in the world. Volleyball was first invented in the U.S. by William G. Morgan in 1895, who was an athletic director at a YMCA and was looking for a game for older clientele to play. It was originally named Mintonette, but the name was changed to

volleyball because of the game's object. Morgan combined rules from tennis, handball, and basketball to create a team game to be played indoors, with little equipment, and gave all players an equal opportunity to play. Each side could have as many players as they wanted and had as many hits as needed to get the ball over the net. Today volleyball is a highly competitive team sport, found in the Olympics and national teams, and popular in playgrounds.

Along with athleticism, volleyball is a team sport that heavily relies on cooperation and coordination among the players to score points. It is gender-neutral and played equally by men and women. It is an exciting and fast-paced game that is thrilling for spectators to watch as well as the athletes to play. Volleyball is also a popular sport to bet on. It can be adapted and played at all levels encouraging physical fitness, hand-eye coordination, and even injecting joy into the players' lives because of friendship and love of the sport.

1.2 Speed

The rate of change of position of an object in any direction.

1.3 Agility

Agility is the ability rapidly change body direction, accelerate or decelerate. It is influenced by balance strength, coordination and skill level.

1.4 Breath Holding Time

The average person can hold their breath for 30 – 90 seconds. This time can increase or decrease due to various factors, such as smoking, underlying medical conditions, or breathe training. The length of time a person can hold their breath voluntarily typically ranges from 30 to 90 seconds.

1.5 Resting Heart Rate

Resting heart rate, or pulse, is the number of times your heart beats per minute when you are at rest such as when you are relaxed, sitting or lying down. Resting heart rate varies from person to person.

2. STATEMENT OF THE PROBLEM :

The intention of the exploration was the effect of plyometric exercise on selected physical and physiological parameters among female volleyball players.

3. METHODOLOGY :

To accomplish the purpose of the study was 30 female volleyball players from Rajiv Gandhi Arts and Science College, Puducherry at age ranged between 18 to 22 years. The selected subject was assigned into two equal groups with fifteen subjects with each group. The experimental group (plyometric exercise) and control group. The plyometric exercise underwent training for a period of twelve weeks. The training session were conducted three days a week. Measurement of speed, agility, breath holding time and resting heart rate parameters was taken for the both groups.

3.1 Selection of Parameters and Criterion Measures

S.No	Criterion Variables	Test Items	Units of Measurement
1	Speed	50 mts Dash	In Meters
2	Agility	T - Test	In Meters
3	Breath Holding Time	Stop Watch	In Seconds
4	Resting Heart Rate	Manual	In Minutes

3.2 Training Protocol

The effect of plyometric exercise were selected as training protocol. The plyometric exercise was provided in the morning time.

Training Week	Plyometric Exercise	Sets & Repetition	Intensity
I and II	Single Leg Bending	3 × 6	65%
	Side to Side Ankle Hops		
	Lateral Cone Hops		
	Split Jumps		
	Double Leg Hops		
III and IV	Double Leg Hops	4 × 8	70%
	Split Jumps		
	Lateral Cone Hops		

	Side to Side Ankle Hops		
	Single Leg Bending		
V and VI	Lateral Cone Hops	3 × 8	75%
	Side to Side Ankle Hops		
	Split Jumps		
	Double Leg Hops		
	Single Leg Bending		
VII and VIII	Double Leg Hops	4× 9	80%
	Single Leg Bending		
	Side to Side Ankle Hops		
	Lateral Cone Hops		
	Split Jumps		
IX and X	Lateral Cone Hops	5× 8	85%
	Split Jumps		
	Single Leg Bending		
	Double Leg Hops		
	Side to Side Ankle Hops		
XI and XII	Split Jumps	4 × 10	90%
	Double Leg Hops		
	Lateral Cone Hops		
	Side to Side Ankle Hops		
	Single Leg Bending		

3.3 Training Program

The training program was conducted for 45 minutes for session in day, three days in a week for a period of twelve weeks duration. These 45 minutes included 10 minutes warm up, 25 minutes plyometric exercise and 10 minutes warm down. Every week's 5 % of intensity of load was increased from 65 % to 90 % of work load. The volume of plyometric exercise prescribed based on the number of sets and repetition.

4. STATISTICAL ANALYSIS

The initial and final readings derived from the experimental group and the control group. The results of the study dependent 't' test was used for the interpretation of the pre and post-test date of experimental group as well as control group. The confidence level is maintained at 0.05 level.

5. RESULTS AND DISCUSSION

The collected data were analysed using dependent 't' test and the results were given below.

Table. 1

Table Showing the Mean, Mean Difference, Standard Deviation and 't' value of Experimental and Control Groups on Speed

Group	No of Subjects	Test	Mean	Standard Deviation	Std. Error Mean	Obtained 't'
Experimental	15	Pre Test	5.18	0.27	0.09	2.402*
		Post Test	4.97	0.40		
Control	15	Pre Test	5.15	0.21	0.10	0.136
		Post Test	5.14	0.42		

Significant

The required table value for significance at 0.05 level of confidence for df 1 and 14 is 2.15.

An examination of table 1 indicates that the obtained 't' ratios were 2.402 and 0.136 for experimental and control groups respectively. The obtained 't' ratio of speed were found to be greater than the required table value of

2.15 at 0.05 level of significance for 14 degrees of freedom. So it was found to be significant. The results of the study showed statistically significant and explained its effects positively.

Fig. 1 - Bar Diagram Showing the Pre and Post-test Mean Value of Experimental and Control Groups on Speed

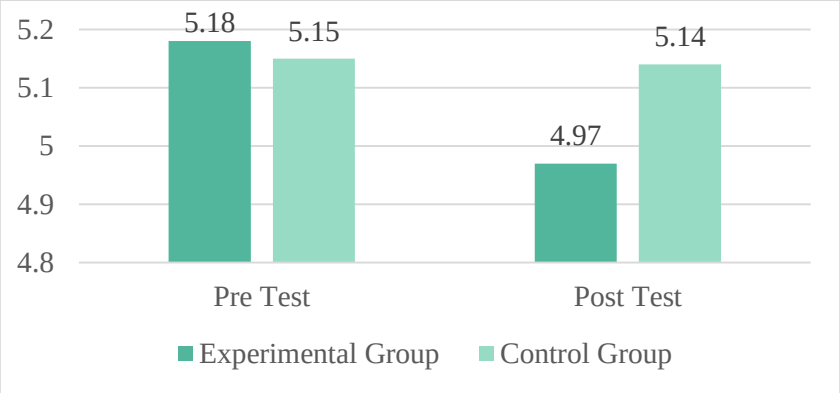


Table. 2

Table Showing the Mean, Mean Difference, Standard Deviation and‘t’ value of Experimental and Control Groups on Agility

Group	No of Subjects	Test	Mean	Standard Deviation	Std. Error Mean	Obtained ‘t’
Experimental	15	Pre Test	21.61	0.91	0.09	2.323*
		Post Test	21.41	0.91		
Control	15	Pre Test	21.59	1.08	0.17	0.561
		Post Test	21.49	1.00		

Significant
The required table value for significance at 0.05 level of confidence for df 1 and 14 is 2.15.

An examination of table 2 indicates that the obtained‘t’ ratios were 2.323 and 0.561 for experimental and control groups respectively. The obtained‘t’ ratio of agility were found to be greater than the required table value of 2.15 at 0.05 level of significance for 14 degrees of freedom. So it was found to be significant. The results of the study showed statistically significant and explained its effects positively.

Fig. 2 - Bar Diagram Showing the Pre and Post-test Mean Value of Experimental and Control Groups on Agility

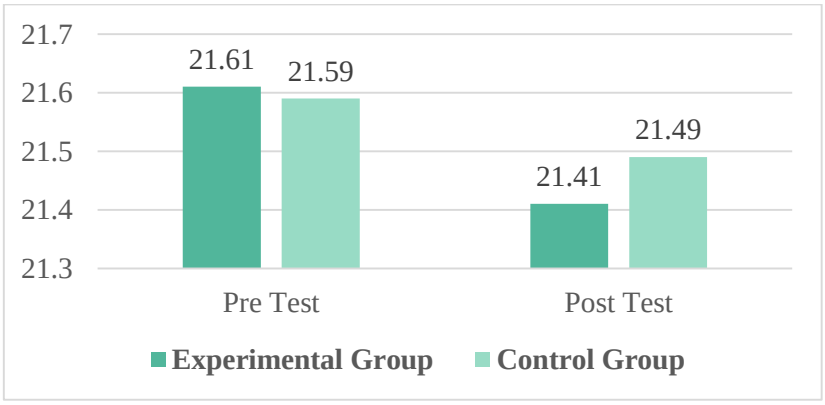


Table. 3

Table Showing the Mean, Mean Difference, Standard Deviation and‘t’ value of Experimental and Control Groups on Breath Holding Time

Group	No of Subjects	Test	Mean	Standard Deviation	Std. Error Mean	Obtained ‘t’
Experimental	15	Pre Test	25.07	3.51	0.19	3.57*
		Post Test	27.87	3.24		
Control	15	Pre Test	25.2	3.38	0.23	0.29
		Post Test	26.47	3.26		

Significant

The required table value for significance at 0.05 level of confidence for df 1 and 14 is 2.15.

An examination of table 3 indicates that the obtained‘t’ ratios were 3.57 and 0.29 for experimental and control groups respectively. The obtained‘t’ ratio of breath holding time were found to be greater than the required table value of 2.15 at 0.05 level of significance for 14 degrees of freedom. So it was found to be significant. The results of the study showed statistically significant and explained its effects positively.

Fig. 3 - Bar Diagram Showing the Pre and Post-test Mean Value of Experimental and Control Groups on Breath Holding Time

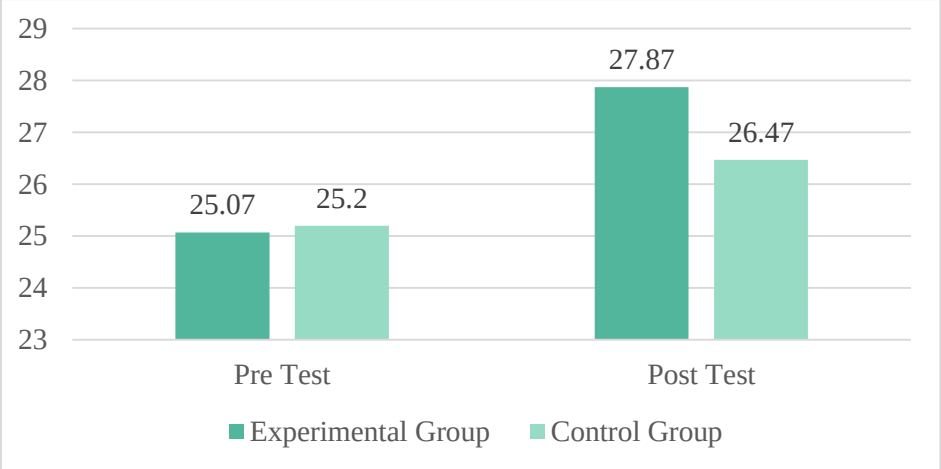


Table. 4

Table Showing the Mean, Mean Difference, Standard Deviation and‘t’ value of Experimental and Control Groups on Resting Heart Rate

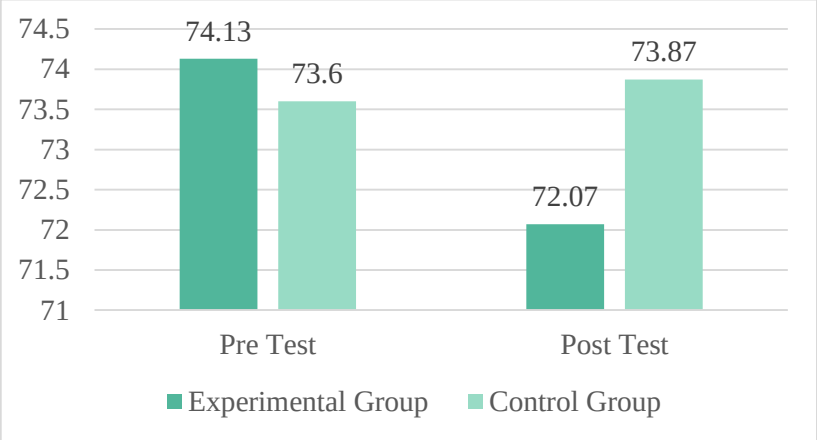
Group	No of Subjects	Test	Mean	Standard Deviation	Std. Error Mean	Obtained ‘t’
Experimental	15	Pre Test	74.13	1.36	0.38	5.39*
		Post Test	72.07	1.44		
Control	15	Pre Test	73.60	1.18	0.45	0.59
		Post Test	73.87	1.19		

Significant

The required table value for significance at 0.05 level of confidence for df 1 and 14 is 2.15.

An examination of table 4 indicates that the obtained‘t’ ratios were 5.39 and 0.59 for experimental and control groups respectively. The obtained‘t’ ratio of resting heart rate were found to be greater than the required table value of 2.15 at 0.05 level of significance for 14 degrees of freedom. So it was found to be significant. The results of the study showed statistically significant and explained its effects positively.

Fig. 4 - Bar Diagram Showing the Pre and Post-test Mean Value of Experimental and Control Groups on Resting Heart Rate



6. DISCUSSION ON FINDINGS :

The findings of the present study strongly indicates that plyometric exercise of twelve weeks have shown significant improvement in selected physical and physiological parameters namely speed, agility, breath holding time and resting heart rate among female volleyball players. The results of this investigation are also supported by the following studies of Karuppasamy, G (2018), R. Anand, M., et.al, (2019) Saran, K. S., et.al, (2019), Dr.S.Varalakshmy**,** et.al and R.Manoranjith., et.al (2020).

7. CONCLUSION :

In the light of the study undertaken certain limitations imposed by the experimental conditions, the following conclusions were arrived that speed, agility, breath holding time and resting heart rate were significantly improved due to the influence of plyometric exercise in experimental group.

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