

# Effect of Aquatic and Land Plyometric Training on Selected Physical Fitness Variables in Intercollegiate Male Handball Players

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**Abstract**—The purpose of the study was to find out the effects of Aquatic and Land plyometric training on selected physical variables in intercollegiate male handball players. To achieve this purpose of the study, forty five handball players of Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat were selected as players at random and their age ranged between 18 to 21 years. The selected players were divided into three equal groups of fifteen players each. Group I underwent Aquatic plyometric training, Group II underwent Land plyometric training and Group III Control group for three days per week for twelve weeks. Control Group did not participate in any special training programme apart from their regular activities as per their curriculum. The following physical fitness variables namely speed; leg explosive power and agility were selected as dependent variables. All the players of three groups were tested on selected dependent variables prior to and immediately after the training programme. The analysis of covariance was used to analyze the significant difference, if any among the groups. Since, three groups were compared, whenever the obtained 'F' ratio for adjusted posttest was found to be significant, the Scheffe's test to find out the paired mean differences, if any. The 0.05 level of confidence was fixed as the level of significance to test the 'F' ratio obtained by the analysis of covariance, which was considered as an appropriate. The result of the study indicates due to Aquatic and Land plyometric training on speed, explosive power, and agility has been improved significantly.

**Keywords**—Aquatic training, explosive power, plyometric training, speed.

## I. INTRODUCTION

**A**QUATIC Plyometric Training - Aquatic training are beneficial not only for rehabilitation but also for conditioning because of the unique properties of water, specifically, buoyancy and resistance resulting from its viscosity [1] Land Plyometric Training - Plyometric training is a type of exercise using explosive movement to develop muscular power, bounding, hopping, and jumping; plyometric exercise helps to bridge the gap between strength and speed. It refers to human movement that involves an eccentric movement contraction immediately and rapidly followed by concentric contraction. The main objective in plyometric training is to improve quickness through strength [2]. Plyometric training would be to perform in water, swimming pool or aquatic plyometric training (APT). Water may reduce

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the pressure put on the musculoskeletal system because aquatic environment provides buoyancy that reduces weight bearing stress on the limbs. The viscosity and resistance to movement within the water requires additional muscle activation to overcome the resistance and produce the similarly movement that is more easily produced land or other surfaces. Different studies compared the effects of aquatic and land plyometric training on power, vertical jump (VJ), speed, strength, agility and muscle soreness [3]-[5].

## II. STATEMENT OF THE PROBLEM

The purpose of the study was to find out the effects of Aquatic and Land plyometric training on selected physical fitness variables in intercollegiate male handball players.

## III. METHODOLOGY

### A. Selection of the Subjects

To achieve the purpose of the study, forty five male handball players were randomly selected as a subject from Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat. The age of the subjects ranged between 18 to 21 years. The subject were divided into three equal groups consist of 15 each. The subjects received all the necessary information about the study's procedures in oral and written form.

### B. Experimental Design

Fifteen subjects were randomly assigned to each of the three groups. Experimental Group - I underwent the Aquatic plyometric training (APT), Experimental Group II underwent the Land plyometric training (LPT) and Control Group was not exposed to any training.

### C. Training Programme

The control group was not exposed to any specific training however; they were participating in their regular physical activities. The experimental groups I and II were subjected to twelve week of Aquatic plyometric and Land Plyometric training respectively. Then training was given for three days per week (alternative days). Every training session lasted for 80 to 90 minutes. The training program was scheduled for the morning between 6.00 am and 7.00 am.

### D. Statistical Technique

In this study, analysis of co-variance statistical techniques was used to find out the selected Physical fitness variables in intercollegiate male handball players. When the adjusted

posttest was significant, the Scheffe's post hoc test was used to find out the paired mean significant difference.

TABLE I PART A  
AQUATIC AND LAND PLYOMETRIC TRAINING PROGRAMME

Sr. No.	Details	Duration
1.	Intensity	Moderate/High
2.	Frequency	Three Days
3.	Number of Weeks	12 Weeks
4.	Duration of Each Session	90 minutes
5.	Total number of foot contact	80-300
6.	Rest Interval between Repetition	60 Sec
7.	Rest Interval between Set	2 to 3 minutes
8.	Warm up and Warm down	20 Minutes

TABLE I PART B

AQUATIC AND LAND PLYOMETRIC TRAINING PROGRAMME IN DETAIL					
Weeks	Exercises	Sets	Repetition	Foot Contact	
I & II weeks	1. Squat Jump	1	8	80	
	2. Split squat Jump	1	8		
	3. Two foot ankle Hop	1	8		
	4. Standing long jump	1	8		
	5. Pike Jump	1	8		
III & IV weeks	1. Squat Jump	1	8	80	
	2. Split squat Jump	1	8		
	3. Two foot ankle Hop	1	8		
	4. Standing long jump	1	8		
	5. Pike Jump	1	8		
V & VI weeks	1. Squat Jump	2	8	160	
	2. Split squat Jump	2	8		
	3. Two foot ankle Hop	2	8		
	4. Standing long jump	2	8		
	5. Pike Jump	2	8		
VII & VIII weeks	1. Squat Jump	2	10	200	
	2. Split squat Jump	2	10		
	3. Two foot ankle Hop	2	10		
	4. Standing long jump	2	10		
	5. Pike Jump	2	10		
IX & X weeks	1. Squat Jump	3	8	240	
	2. Split squat Jump	3	8		
	3. Two foot ankle Hop	3	8		
	4. Standing long jump	3	8		
	5. Pike Jump	3	8		
XI & XII weeks	1. Squat Jump	3	10	300	
	2. Split squat Jump	3	10		
	3. Two foot ankle Hop	3	10		
	4. Standing long jump	3	10		
	5. Pike Jump	3	10		

#### IV. RESULT OF THE STUDY

TABLE II  
COMPUTATION OF ANALYSIS OF COVARIANCE OF PRE-TEST, POST-TEST AND ADJUSTED POST TEST ON SPEED OF EXPERIMENTAL GROUP I, EXPERIMENTAL GROUP II AND CONTROL GROUP

Test	Ex Group I	Ex Group II	Control Group	Sources of Variance	Sum of Square	df	Mean of Square	Obtain F ration
Pre Test Mean	7.53	7.53	7.55	Between	0.0040	2	0.0020	0.10
	0.14	0.14	0.13	Within	0.8440	42	0.0201	
Post Test Mean	7.25	7.33	7.52	Between	0.5924	2	0.2962	13.09*
	0.12	0.14	0.17	Within	0.9507	42	0.0226	
Adjusted Post Test Mean	7.25	7.33	7.51	Between	0.5016	2	0.2508	85.73*
				Within	0.1199	41	0.0029	

(Scores in Seconds)

TABLE III  
SCHEFFE'S POST HOC TEST MEAN DIFFERENCES ON SPEED AMONG THREE GROUPS

Experimental Group I	Experimental Group II	Control Group	Mean Difference	Confidence Interval Value
7.25	7.33	-	0.08*	0.049
7.25	-	7.51	0.26*	0.049
-	7.33	7.51	0.18*	0.049

TABLE IV  
COMPUTATION OF ANALYSIS OF COVARIANCE OF PRE-TEST, POST-TEST AND ADJUSTED POST TEST ON LEG EXPLOSIVE POWER OF EXPERIMENTAL GROUP I, EXPERIMENTAL GROUP II AND CONTROL GROUP

Test	Ex Group I	Ex Group II	Control Group	Sources Of Variance	Sum Of Square	df	Mean of Square	Obtain F ratio
Pre Test Mean	1.87	1.87	1.87	Between	0.0002	2	0.0001	0.31
	0.02	0.02	0.01	within	0.0109	42	0.0003	
Post Test Mean	1.93	1.90	1.87	Between	0.0249	2	0.0124	28.74
	0.03	0.02	0.01	within	0.0182	42	0.0004	
Adjusted Post Test	1.93	1.90	1.87	Between	0.0282	2	0.0141	93.95
				within	0.0061	41	0.0001	

(Scores in Meter)

TABLE V  
SCHEFFE'S POST HOC TEST MEAN DIFFERENCES ON LEG EXPLOSIVE POWER AMONG THREE GROUPS

Experimental Group I	Experimental Group II	Control Group	Mean Difference	Confidence Interval Value
1.93	1.90	-	0.03	0.009
1.93	-	1.87	0.06	0.009
-	1.90	1.87	0.03	0.009

(Scores in Meters)

TABLE VI

COMPUTATION OF ANALYSIS OF COVARIANCE OF PRE-TEST, POST-TEST AND ADJUSTED POST TEST ON AGILITY OF EXPERIMENTAL GROUP I, EXPERIMENTAL GROUP II AND CONTROL GROUP

Test	Ex Group I	Ex Group II	Control Group	Sources of Variance	Sum of Square	df	Mean of Square	Obtain F ration
Pre Test Mean	9.41	9.43	9.42	Between	0.0031	2	0.0016	0.20
	0.08	0.09	0.09	Within	0.3227	42	0.0077	
Post Test Mean	9.19	9.23	9.41	Between	0.4120	2	0.2060	29.23
	0.08	0.09	0.08	Within	0.0960	42	0.0070	
Adjusted Post Test Mean	9.20	9.22	9.40	Between	0.3915	2	0.1958	212.61
				Within	0.0378	41	0.0009	

(Scores in Seconds)

### V. GRAPHICAL VIEW

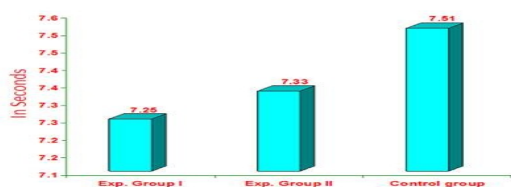


Fig. 1 Computation of analysis of covariance of pre-test and adjusted post-test on speed of experimental group I, experimental group II and control group

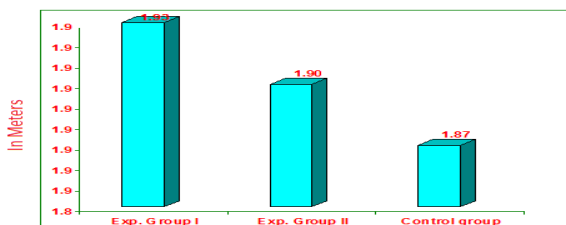


Fig. 2 Computation of analysis of covariance of pre-test, post-test and adjusted post-test on leg explosive power of experimental group I, experimental group II and control group

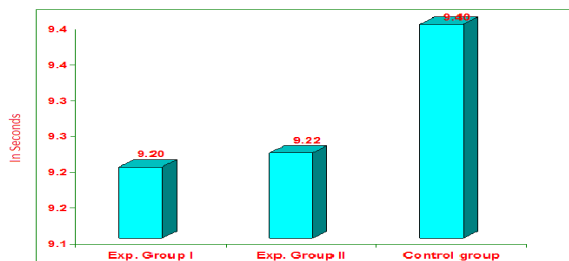


Fig. 3 Computation of analysis of covariance of pre-test, post-test and adjusted posttest on agility of experimental group I, experimental group II and control group

### VI. CONCLUSION

The Aquatic plyometric training significantly improved on Speed, Leg explosive power greater than that of Land plyometric and Control group. There was no significant difference between Aquatic plyometric and Land plyometric training groups on agility. The Land plyometric training significantly improved on Speed, Leg explosive power and Agility greater than that of Control group.

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