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PHYSICAL EDUCATION

ANALYSIS OF AQUATIC AND LAND TRAINING ON SELECTED PHYSICAL FITNESS VARIABLES AMONG VOLLEYBALL PLAYERS

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Abstract

The purpose of this study was to analyse the aquatic and land training on selected physical fitness variables among Volleyball players. To achieve the purpose 30 physically active and interested undergraduate engineering Volleyball players were selected as subjects and their age ranged between 18 and 20 years. The subjects are categorized into two groups randomly viz.; Aquatic Training group (ATG), land Training group (LTG) and each group had 15 subjects. The experimental group underwent the experimental treatment for 12 weeks, 3 days per week and a session on each day with 90 minutes duration. Speed, endurance and explosive power were taken as variables for this investigation. Fifty meters run, cooper 12 minutes run and standing vertical jump were tests used to collect the relevant data. The data were collected prior and after the experimental treatment. The collected data was analyzed using analysis of covariance (ANCOVA). The result reveals that aquatic training group showed significant improvement in all the selected physical fitness variables.

Keywords: Aquatic training, Land training, Speed, Endurance, Explosive power, Volleyball

Introduction

The benefits of aquatic exercise originate from the supportive nature of the water environment, muscular strengthening and toning of muscles which result from the resistive properties of water as a dense liquid. The buoyancy experienced in water reduces body weight and makes many exercises possible while reducing stress on joints. Buoyancy is the force that water applies in an upward direction against gravity. The buoyant force provided by water decreases the player's weight in relation to the degree of submersion and decreases the amount of force and joint compression during landing. The buoyancy effect of water makes aquatic training an optimal exercise environment for the players and individuals, as impact and stress on joints is reduced (Gappmaier et al., 2006).

Water has several properties that make it an ideal environment for exercise. The buoyancy of water supports the submerged body from the downward pull of gravity, Providing up to a 90% reduction in body weight (Darby & Yaekle, 2000; DiPrampero, 1986; Wilder & Brennan, 2004). Benefits of this buoyant effect include less stress and pressure on bone, muscle and connective tissue, while the viscosity and drag force of water provides a resistance proportional to the exerted effort (Wilder & Brennan, 2004).

When the velocity of movement doubles, the drag force produced by water quadruples, providing a resistance training stimulus (Tsourlou, et al., 2006). As the density of water is approximately 800 times that of air (DiPrampero, 1986), the buoyant properties of water reduce forces on the musculoskeletal system, thereby decreasing the risk of overuse injuries such as tendonitis and stress fractures.

Aquatic training resulted in similar training effects as land-based training with a possible reduction in stress due to the reduction of impact afforded by the buoyancy and resistance of the water upon landing.(Stemm & Bert, 2007).Aquatic exercise does not worsen the joint condition or result in injury (Wang, 2006) The resistance of the water promotes strengthening. Water acts as a variable “accommodating” resistance. (Prins, 2009). An aquatic training programme can decrease compression forces, vibration forces and torsional forces that a player may ensure while training on land (Roswell, et al., 2009). The resistance of the water promotes strengthening. In recent years, aquatic training became one of the most important training to improve the physical and physiological variables (Beale et al, 2005). The purpose of this study was to analyse the aquatic and land training on selected physical fitness variables among Volleyball players.

Methods

To achieve these purpose 30 physically active and interested undergraduate Engineering Volleyball players were randomly selected as subjects and their age ranged between 18 and 20 years. The subjects are categorized into two groups randomly viz. Aquatic

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Training group (ATG), Land Training group (CG), and each group had 15 subjects. The selected criterion variables Speed was assessed by fifty meter run, Endurance was assessed by coopers'12 minutes run in metres test and explosive power was assessed by Standing Vertical Jump in centimetres. The aquatic training group and land training group underwent the experimental treatment for 12 weeks, 3 days per week and a session on each day with 90 minutes duration.

Aquatic and land training

Warming-up exercise was performed in ground and water. After that the land training group and aquatic training group performed the following exercises in the respective land and aquatic places. The water level was just above the hip level. 1. Single leg jump (alternative leg), 2. Double leg jump, 3. High knee action, 4. Aerobic exercise. These exercises were performed for 90 minutes in a day and for 3 days per week. Initially apilot work was done by the investigators.

Statistical analysis

Pre and post test data were collected before and after 12 weeks of training. The collected data was analyzed using analysis of covariance (ANCOVA). The means and standard deviations of both aquatic and land training groups were calculated for speed, endurance and explosive power for the pre as well as post tests. ANCOVA was used to examine significance between testing groups (ATG and LTG). Statistical significance was set to a priority at $p< 0.05$. All statistical tests were calculated using the Statistical Package for the Social Science (SPSS) for Windows (Version 15).

Table-1: Analysis of covariance for speed of aquatic and land training groups

Test	Aquatic Training Group (ATG)	Land Training Group (LTG	Sources of Variance	Sum of the Squares	df	Means Squares	F-ratio
Pre test Mean	7.47	7.45	BG	0.003	1	0.003	0.038
	0.26	0.29	WG	2.20	28	0.07	
Post test Mean SD (±)	7.07	7.30	BG	0.38	1	0.38	3.76
	0.25	0.37	WG	2.86	28	0.10	
Adjusted post test Mean	7.06	7.31	BG	0.45	1	0.45	23.08*
			WG	0.53	27	0.02	

* Significant at 0.05 level

Results

Table 1 shows that the pre and post test means and standard deviation of aquatic and land training groups on speed. The obtained 'F' value of pre and post test means on speed was 0.038 and 3.76 respectively, which was lesser than table value of 4.19 for degree of freedom 1 and 28 at 0.05 level of confidence; hence there was no significant difference in pre and post test data of aquatic and land training groups. The analysis of adjusted post test mean data reveals that obtained 'F' value of 23.08 was greater than table of 4.21 for degree of freedom 1 and 27 at 0.05 level of confidence; hence there exist difference in speed among the ATG and LTG groups.

Fig.1: Line Diagram showing the pre, post and adjusted post test means on speed

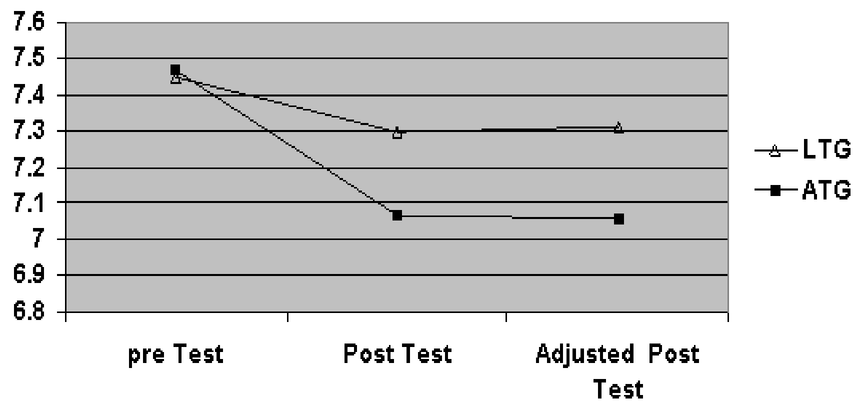


Table 2: Analysis of covariance for endurance of aquatic and land training groups

Test	Aquatic Training Group (ATG)	Land Training Group (LTG)	Sources of Variance	Sum of the Squares	df	Means Squares	F-ratio
Pre test Mean	2239.33	2152.66	BG	56333.33	1	56333.33	0.96
SD (±)	204.43	274.13	WG	1637186.66	28	58470.95	
Post test Mean	2298.66	2165.33	BG	133333.33	1	133333.33	2.39
SD (±)	209.04	259.99	WG	1558146.66	28	55648.095	
Adjusted post test Mean	2256.51	2207.48	BG	17436.16	1	17436.16	50.29*
			WG	9360.02	27	346.66	

* Significant at 0.05 level

The table 2 reveals that the pre and post test means and standard deviation of aquatic and land training groups on endurance. The obtained 'F' value of pre and post test means on endurance was 0.96 and 2.39 respectively, which was lesser than table value of 4.19 for degree of freedom 1 and 28 at 0.05 level of confidence; hence there was no significant difference in pre and post test data of aquatic and land training groups. The analysis of adjusted post test mean data reveals that obtained 'F' value of 50.29 was greater than table value of 4.21 for degree of freedom 1 and 27 at 0.05 level of confidence; hence there exist difference in endurance among the ATG and LTG groups.

Fig. 2: Line Diagram showing the pre, post and adjusted post test means on Endurance

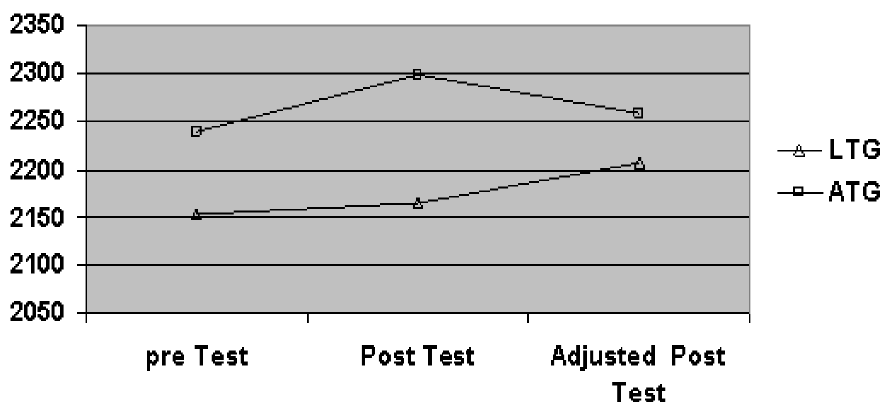


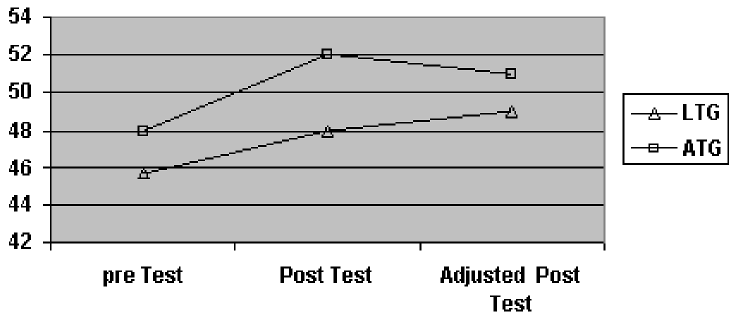
Table-3: Analysis of covariance for explosive power of aquatic and land training groups

Test	Aquatic Training Group (ATG)	Land Training Group (LTG)	Sources of Variance	Sum of the Squares	df	Means Squares	F-ratio
Pre test Mean	48.00	45.73	BG	38.53	1	38.53	1.28
SD (±)	4.50	6.31	WG	842.93	28	30.10	
Post test Mean	52.06	47.93	BG	128.13	1	128.13	4.54*
SD (±)	4.58	5.94	WG	789.86	28	28.21	
Adjusted post test Mean	50.99	49.00	BG	28.19	1	28.19	24.46*
			WG	31.11	27	1.15	

* Significant at 0.05 level

The table 3 indicates that the pre and post test means and standard deviation of aquatic and land training groups on explosive power. The obtained 'F' value of pre test means on explosive power was 1.28 which was lesser than the table value 4.19 for degree of freedom 1 and 28 at 0.05 level of confidence; hence there was no significant difference in pre test data of aquatic and land training groups. The obtained 'F' value of post test means on explosive power was 4.54, which was greater than the table value 4.19 for degree of freedom 1 and 28 at 0.05 level of confidence; hence there was significant difference in post test data of aquatic and land training groups. The analysis of adjusted post test mean data reveals that obtained 'F' value of 24.46 was greater than table value of 4.21 for degree of freedom 1 and 27 at 0.05 level of confidence, hence there exist difference in explosive power among the ATG and LTG groups.

Fig. 3: Line diagram showing the pre, post and adjusted post test means on explosive power



Discussions

The result of the study reveals that there exists significant difference among the groups on all the selected physical fitness variables. The aquatic training group showed significant improvement in all the selected physical fitness variables. Aquatic-based exercise intervention, the resistive properties of water provided a resistive stimulus regardless of whether specific resistance training exercises are prescribed. An aquatic-based exercise demonstrated positive alterations in lower body strength. The majority of these studies suggest that adding deep-water running to an athlete's training regimen has the potential to increase fitness and ultimately improve performance (Burns & Lauder, 2001). The aquatic environment may be used to provide a workload sufficient to create fatigue and produce strength gains in both de-conditioned adults and trained athletes (Tsourlou, et.al, 2006). According to Evans and colleagues (1978), the dual effects of buoyancy and resistance make possible high levels of energy expenditure with relatively little movement or strain on lower-joint extremities. Additionally, enhanced temperature regulation during water exercise makes this an ideal environment for obese individuals who have an increased risk of heat intolerance (Wallace, 2003). Martel and co-workers (2005) demonstrated the ability to increase vertical jump in female Volleyball players using specific aquatic plyometric training and these improvements could be accomplished with less muscle pain as well.

Conclusions

Aquatic training group (ATG) showed significant improvement in all selected physical fitness variables namely speed, endurance and explosive power among Volleyball players after aquatic based exercise training intervention.

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