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Effect Of Aquatic Plyometric Training On Measures Of Physical Performance Among College Students

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Abstract

The purpose of the present was to investigate the effects of aquatic plyometric training on measures of physical performance among college students. For the study, a total of 20 male college students were randomly selected of age between 18 to 25 years. The selected subjects were equally randomized into two groups – Experimental Group and Control Group. The experimental group performed six weeks of aquatic plyometric training twice a week while control group was not involved in any sort of training. All the subjects were tested twice i.e. before and after the training for three variables – vertical jump using wall test, agility using modified agility t test, and 30-m speed. For statistical analysis, paired t-test was used to compare the pre and post-test values at 0.05 level of significance. The findings showed that aquatic plyometric training had significant effect on vertical jump, agility, and speed in experimental group as their performance improved after six weeks of aquatic plyometric training.

Keywords: aquatic, plyometric, vertical jump, agility

Introduction

Plyometric training is a widely utilized method to improve physical performance in various sports and activities. It involves quick and explosive movements that aim to enhance power, speed, and agility (Zhao-he, 2011).One area of interest within plyometric training is the use of aquatic environments for plyometric exercises.(Chomani et al., 2021) Aquatic plyometric training refers to the performance of plyometric exercises in water, such as jumping, bounding, and hopping.(Miller et al., 2001) This type of training has gained attention due to its potential benefits, including reduced impact on joints, increased resistance from water, and enhanced

neuromuscular control.(Dapinder et al., 2012) Several studies have investigated the effects of aquatic plyometric training on physical performance measures, such as vertical jump height, muscular strength, and agility.(Slimani et al., 2016)(Chomani et al., 2021)(Dapinder et al., 2012)(Sporri et al., 2018).

One study conducted by Ramirez-Campillo et al.(Ramírez-Campillo et al., 2022) aimed to evaluate the effects of aquatic plyometric training on various physical fitness attributes in basketball players. The researchers conducted a meta-analysis of available studies on this topic and found that aquatic plyometric training demonstrated positive effects on vertical jump height, muscular strength, and agility in basketball players. Another study by Biju Peter and Maniazhagu compared the effects of low and moderate intensities of plyometric training on muscular endurance. The researchers found that both low and moderate intensities of plyometric training had similar positive effects on muscular endurance. Furthermore, Maniazhagu, Sukumar, and Selvaraj conducted a study investigating the effects of strength training on speed, leg explosive power, and muscular endurance. They found that strength training significantly improved speed, leg explosive power, and muscular endurance.

Overall, the research suggests that aquatic plyometric training can be an effective method to improve physical performance in athletes across various sports. However, further research is still needed to determine the optimal protocols, durations, and frequencies of aquatic plyometric training to maximize its benefits.

Aquatic plyometric training has been shown to have numerous benefits for athletes, particularly in improving physical performance measures. In a study by Ashton-Miller et al.(Miller et al., n.d), the researchers found that aquatic plyometric training led to significant improvements in neuromuscular control and proprioception, which are crucial for injury prevention and overall athletic performance. Additionally, a meta-analysis by Gantchev and Dimitrova examined the effects of aquatic plyometric training on sprint performance and found that it resulted in improved sprint times and acceleration in athletes.

Moreover, a study by Barbosa et al. (Barbosa et al., 2009) investigated the impact of aquatic plyometric training on muscle activation patterns and found that it led to greater muscle activation in key lower body muscles, indicating its potential for enhancing strength and power. These findings highlight the diverse range of positive effects that aquatic plyometric training can have on athletes' physical performance across different sports and activities.

In conclusion, the existing body of research strongly supports the efficacy of aquatic plyometric training in improving various physical performance measures in athletes. However, continued research into optimal training protocols and long-term effects is essential to fully understand the impact and potential applications of aquatic plyometric training. So, the present study was conducted with the purpose to investigate the effects of six weeks of aquatic plyometric training on selected measures of physical performance among college students.

Methodology

Selection of Subjects

For the purpose of the present study, a total of 20 male college students were randomly selected of age ranging between 18 to 25 years. All the selected subjects were free from any sort of musculo-skeletal disorder or injury which can limit their ability to perform the tasks of the study. Subjects were informed about the objectives of the study and the consent forms were signed.

The selected subjects were equally randomized into two groups, namely – Experimental Group and Control Group. The experimental group underwent six weeks of aquatic plyometric training with the frequency of two days per week while the control group was not involved any sort of training for those six weeks. Using pre-test post-test randomized group design, the selected subjects were tested for three dependent variables – vertical jump, agility and speed.

Training Program

Table 1. Training schedule of Experimental group for six weeks

Week	Exercises	Set	Repetitions	Foot Contact per session	Total Foot contact per session
1st & 2nd	Squat jump , Double leg lateral hop, Split Squat jump, Tuck Jump, Lunge jump	1	12	60	120
3rd & 4th	Squat jump , Double leg lateral hop, Split Squat jump, Tuck Jump, Lunge jump	2	12	120	240
5th & 6th	Squat jump , Double leg lateral hop, Split Squat jump, Tuck Jump, Lunge jump	3	12	180	360

Collection of Data

The data was collected before the start of the intervention period i.e. baseline testing and after the completion of six weeks of training i.e. post-test. The data was collected for vertical jump using Wall test, agility using Modified agility T-test, and speed using 30-m sprint test.

Wall test procedure: The athlete stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The athlete then stands away from the wall, and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded.

Modified agility T-test procedure: On the signal of the tester, each subject sprinted forward to cone B and touch the base of it with the right hand. Facing forward and without crossing feet, they shuffled to the left to cone C and touch its base with the left hand. Subjects then shuffled to the right to cone D and touch its base with the right hand. They shuffled back to the left to cone B and touch its base. Finally, subjects ran backward as quickly as possible and return to line A. Three trails were given and the best was recorded for the score. (Sassi et al 2009)

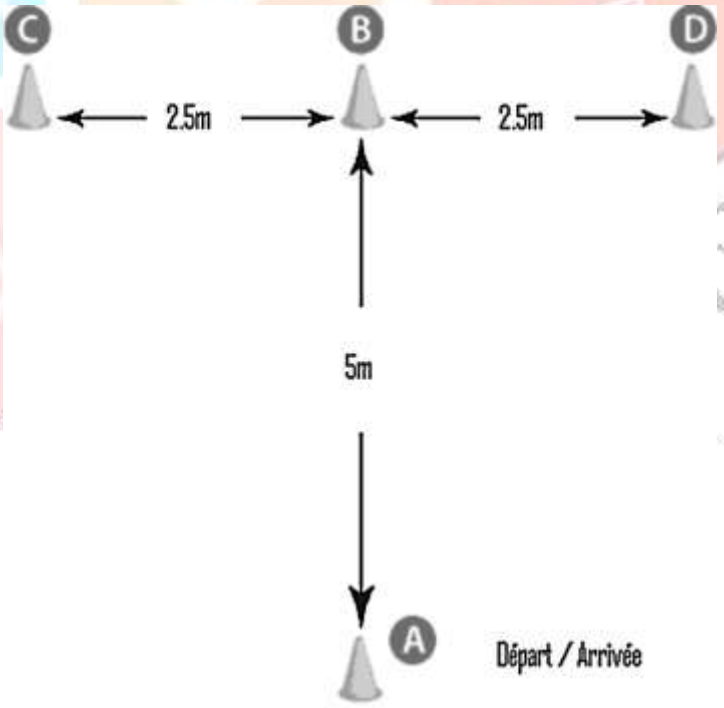

Figure: Illustration of Modified Agility T-test

30-m Sprint procedure: A starting line and a finish line has to draw, after a small warm up the subject has to stand behind the starting line, the investigator has to give signal in ‘ready’ and ‘go’ by using whistle or a gun or a clapper. The subject has to get the signal and then he has to run as much as speed to reach the finish line. The examiner has to take the time he took to cover the distance. Three trials for each subject and the best timing was considered for score.

Statistical Techniques

The collected data was first tested for normality using Shapiro-Wilk test and the data was found to be normal. Then the descriptive statistics (mean, standard deviation, and standard error of mean) was calculated as shown in Table 2 (for Control Group) and Table 4 (for Experimental Group). Finally, the pre-test and post-test were compared for the effect of training by using paired t-test and shown in Table 3 (for Control Group) and Table 5 (for Experimental Group) for all the selected measures of physical performance at 0.05 level of significance.

Results

The findings after the statistical analysis are shown in the tables here.

Table 2. Descriptive Statistics for selected Measures of Physical Performance of Experimental Group

Variable	Test	Mean	Standard Deviation	Std. Error Mean
Vertical Jump	Pre	44.04	3.22	1.02
	Post	49.41	3.72	1.17
Agility	Pre	5.86	0.45	0.14
	Post	5.62	0.39	0.12
Speed	Pre	4.94	0.33	0.11
	Post	4.81	0.36	0.11

Table 3. Paired t-test analysis for selected Measures of Physical Performance of Experimental Group

		Paired Differences					
		Mean	Std Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	VJ_Pre – VJ_Post	-5.370	1.573	0.497	-10.793	9	0.000
Pair 2	Agility_Pre – Agility_Post	0.243	0.106	0.033	7.218	9	0.000
Pair 3	Speed_Pre – Speed_Post	0.131	0.051	0.016	8.007	9	0.000

As shown in the table, the aquatic plyometric training has significant effect on vertical jump, agility and speed of the experimental group as the associated p-value is less than 0.05 for all the dependent variables.

Table 4. Descriptive Statistics for selected Measures of Physical Performance of Control Group

Variable	Test	Mean	Standard Deviation	Std. Error Mean
Vertical Jump	Pre	44.87	3.29	1.04
	Post	42.71	1.89	0.59
Agility	Pre	5.51	0.69	0.21
	Post	5.68	0.55	0.17
Speed	Pre	4.66	0.19	0.06
	Post	4.75	0.17	0.05

Table 5. Paired t-test analysis for selected Measures of Physical Performance of Control Group

		Paired Differences					
		Mean	Std Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pair 1	VJ_Pre – VJ_Post	2.160	2.426	0.767	2.815	9	0.020
Pair 2	Agility_Pre – Agility_Post	-0.168	0.208	0.065	-2.554	9	0.031
Pair 3	Speed_Pre – Speed_Post	-0.090	0.165	0.052	-1.719	9	0.120

In the above table, paired t-test analysis of control group showed that the vertical jump and agility performance of subjects of control group significantly decreased as their p-value is less than 0.05 while no effect was observed on speed performance as its p-value is higher than 0.05.

Discussion

The present study was conducted with the purpose to investigate the effects of aquatic plyometric training on selected measures of physical performance namely – vertical jump, agility, and speed. The findings of the study showed that aquatic plyometric training significantly improved the performance of experimental group for all the three dependent variables. The control group's performance declined for vertical jump and agility while the speed performance remained unchanged as this group was not undergoing any sort of training during the intervention period, so these results are absolute.

In order to enable the muscle to store energy during the deceleration phase and release it during the acceleration phase, plyometric exercises stimulate the elastic properties of the muscle fibres and connective tissue (Asmussen, 1974; Bosco et al., 1982; Kaneko et al., 1983; Stone & O'Bryant, 1986). Improved measurements of muscular strength and power explosive (Bobbert, 1990; Matavulj et al., 2001; Wilson et al., 1996), joint function and stability (Hewett et al., 1996), a decreased risk of serious knee injuries (Hewett et al., 1996), and running economy (Turner et al., 2003) are among the advantages of plyometric training.

Because of the viscosity of the water, athletes experience more resistance during concentric movements during aquatic plyometric exercise, even while buoyancy lessens the stretch reflex and amount of eccentric loading. Therefore, compared to land-based plyometrics, aquatic plyometric training may offer a slightly different stimulus for progress.

Using isokinetic strength testing, Robinson et al. (2004) investigated the impact of an 8-week aquatic and land plyometric training programme on peak torque production. Thirty-one women at college, aged 20.5 and with 5.5 years of sports experience, were the subjects. The subjects completed the exercise three times a week for eight weeks at a depth of four to five feet in a swimming pool. The lowest number of repetitions was 360, and the highest was 630. Both groups increased their peak torque production, according to their report. APT and volleyball training were compared with standard volleyball training by Martel et al. (2005). Nineteen female volleyball players who were at least two years old and 15 years of age were the subjects. After the 6-week research, both the APT and CON groups showed notable gains; however, the APT group's increase in torque generation during the maximum knee-extension exercise was substantially greater than that of the CON group.

In conclusion, aquatic plyometric training has been shown to have positive effects on various physical performance measures, including vertical jump height, muscular strength, agility, and muscular endurance. The use of aquatic plyometric training can lead to improved physical performance, particularly in vertical jump height, muscular strength, agility, and muscular endurance. Therefore, incorporating aquatic plyometric training into athletic training programs may be beneficial for athletes aiming to improve their physical performance. Aquatic plyometric training has been found to have positive effects on physical performance, including improvements in vertical jump height, muscular strength, agility, and muscular endurance. Aquatic plyometric training has the potential to enhance physical performance in multiple dimensions including vertical jump height, muscular strength, agility, and muscular endurance. The combination of aquatic plyometric training and traditional resistance training has been found to have significant positive effects on physical performance measures such as vertical jump height, muscular endurance, and shooting accuracy in basketball players. In summary, the available literature suggests that aquatic plyometric training can have positive effects on physical performance, particularly in areas such as vertical jump height, muscular strength, agility, and muscular endurance. The effects of aquatic plyometric training on physical performance have been extensively studied. Researchers have found that aquatic plyometric training can significantly improve speed, leg explosive power, and muscular endurance. Aquatic plyometric training has been shown to be an effective method for improving physical performance in athletes across a variety of sports. Further research is still needed to determine the optimal protocols, durations, and frequencies of aquatic plyometric training to maximize its

However, there is still a need for further research to determine the optimal protocols and training parameters for maximizing the benefits of aquatic plyometric training.

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