International Journal of Health Sciences and Research
Volume 14; Issue: 10; October 2024
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Comparison of Rubberised Floor Vs Aquatic based Plyometric Training on Physical Fitness Variables of Collegiate Players

Dr. Manoj Kumar Jadiya[1], Dr. Virendra Singh Rajpurohit[2], Dr. Maliram Sharma[3], Dr. Swati Sharma[4], Dr. Dhruv Taneja[5]

[1]Associate Professor, Department of Physiotherapy, Pruthuviraj Deshmukh College of Physiotherapy, Yavatmal, Maharashtra
[2]Professor, Maharaj Vinayak Global University, Jaipur Physiotherapy College of Physiotherapy, Jaipur Rajasthan
[3]Principal, Maharaj Vinayak Global University, Jaipur Physiotherapy College of Physiotherapy, Jaipur Rajasthan
[4]Associate Professor, Maharaj Vinayak Global University, Jaipur Physiotherapy College of Physiotherapy, Jaipur Rajasthan
[5]Professor, Maharaj Vinayak Global University, Jaipur Physiotherapy College of Physiotherapy, Jaipur Rajasthan

Corresponding Author: Dr. Manoj Kumar Jadiya

DOI: https://doi.org/10.52403/ijhsr.20241005

ABSTRACT

The purpose of this study was to compare the effects of 6-week plyometric training on two different surfaces, aquatic and rubberised floor on selected physical fitness variables namely; agility, cardiovascular endurance, explosive power, speed and muscle soreness in collegiate level players. These physical fitness variables are essential for athletes which can be enhanced by plyometric training. The plyometric training are exercises that are designed to enhance neuromuscular performance. Due to the powerful eccentric forces during the decelerating/landing phases, and rapid transition to the concentric propulsive phase, plyometric training can also constitute an effective training stimulus to reduce lower-extremity injuries in team sports. The plyometric exercises can be performed on different surfaces and each surface may prove different training stimulus as resistance of each surface is different.

Methodology: This comparative and experimental study included sample of 40 male collegiate players aged 18 to 25 years, which were randomly divided into two groups- aquatic training group (n=20) and rubberised floor training group (n=20). After the baseline measurements of variables plyometric training was given for 6-weeks, three sessions per week for both the groups.

Results: Data when compared after plyometric training revealed there was significant changes in performance of the players in both the groups ($p \leq 0.05$). Moreover, on comparing both the groups, aquatic group as well as rubberised floor showed more improvement in agility, CV and speed. While there were no significant changes seen in explosive power. The study also revealed that athletes showed less muscle soreness as compared to rubberised surface.

Conclusion: This study concluded that both the surfaces are able to enhance the performance of athlete. While comparing the groups aquatic surface plyometric training was found more effective than rubberised floor surface training in context with muscle soreness.

Keywords: Plyometric Training, aquatic surface, rubberised floor surface, muscle soreness.

INTRODUCTION

Worldwide sports are played by millions of people of all ages in many countries. Now a day's sport conjuncture oriented in success and competitiveness. In order to be successful, players should be engaged in hard trainings with commitment and as a result they can gain fast, strong durable and excellent technique and enhance variety of physical fitness qualities such as agility, endurance, power, strength, sports specific drills, speed etc. Plyometric jump is a training method widely spread among athletes of many fields, which has been thoroughly studied throughout the last few decades (Markovic and Mikulic, 2010). Plyometric contains an eccentric and concentric movement of the muscle, which displays the stretch shortening cycle (SSC). Plyometric exercises are characterized by a high intensity stretch shortening cycle and jumps with drops from heights between twenty and eighty cms, usually performed on a rigid or flat surface. Due to the great impact and stress exerted on musculo-tendinous structures, PT must be applied with caution, adapting the load to the characteristics of the individual in all cases intensity of the jumps is found to be beneficial for the improvement of explosive strength, these training methods have been criticized for their potential to raise the appearance of injuries (Blattner et al., 1979). Due to the great impact and stress exerted on musculo-tendinous structures, Plyometric Training must be applied with caution, adapting the load to the features of the individual in all cases. All these physical fitness variables are prerequisites for a successful player at the time of game. Agility is well-defined as one's ability to change the body position and direction quickly and accurately. A football player changes direction every 2–4 seconds and makes 1,200–1,400 changes of direction during a game (Sohnlein *et al.*, 2014). Cardiovascular endurance is defined as ability of heart and lung to take in and to transport adequate amount of oxygen to the working muscles for activities. Speed denotes to one's ability to perform successive movements of the same pattern at the fast rate (Kansal, 2008). The explosive power of lower legs is compulsory in the athletes. The more will be the muscular force in shortest time more competent will be the player. The phenomenon that is often reported in the days after resistance training or unacclimatized and unaccustomed muscular effort and eccentric muscular actions is DOMS (delayed-onset muscle soreness). Symptoms of Delayed Onset Muscle soreness include – a dull, aching sensation mild discomfort or pain, mainly when the muscle is stretched or palpated. Now a day's plyometric exercises are performed on different surfaces by coaches and physiotherapist and each surface have different impact on the physical fitness variables of the athletes. As the resistance offered by different surfaces are different, the training outcomes in both the given surfaces will also be different. In the study four different surfaces i.e. sand, grass, aquatic and rubberised floor was used to train the collegiate players in order to investigate and compare the efficacy of these surfaces on different on physical fitness variable of the players.

METHODOLOGY

The study was experimental and comparative in nature in which 40 male collegiate players (aged 18-25) of Maharaj Vinayak Global University were included. They were equally divided into two groups: Aquatic plyometric group (n=20) and Rubberised floor plyometric group (n=20). The Mean Age, Weight, Height and BMI for Aquatic plyometric group was 21.6±1.36, 71.35±5.0082, 1.72±0.0629, 24.17±1.0551 and for Rubberised floor plyometric group was, 22.5±1.57, 71.35± 5.0082, 1.72± 0.0629, 24.17± 1.0551 respectively. Figure 1 presents the demographic characteristics of interventional groups.

Tools for Data Collection

1. Dodging Run test – For assessing agility of football players.
2. Queens College step test- For assessing cardiovascular endurance of the players.

3. Vertical Jump test- For assessing explosive power of lower limbs.
4. 50-meter Sprint test- For assessing speed of football players.
5. Muscle soreness- Muscle soreness was assessed at the end of each training session on an Italian version of 7-point Likert scale of muscle soreness (Vicker et al., 2001). It consisted of 7 points ranging from 0-6, where 0 means complete absence of soreness and 6 indicates severe pain, restricting the ability to move.

Likert scale of muscle soreness from Vickers

0- A complete absence of soreness
1 -A light pain felt only when touched/a vague ache
2 -A moderate pain felt only when touched/a slight persistent pain
3- A light pain when walking up or down stairs
4 -A light pain when walking on a flat surface/painful
5 -A moderate pain, stiffness, or weakness when walking/very painful
6- A severe pain that limits my ability to move

After taking pre-training data from subjects of both the groups, they were given sand and grass plyometric training protocol for 3 sessions per week for 6 weeks. Post training data was obtained from all the subjects after completion of 18 sessions of plyometric training protocol. The protocol consisted of Side to side ankle hops, Standing jump and reach, Front cone hops, standing long jump, Lateral jump over barrier, Double leg hops, Diagonal cone hops, standing long jump with lateral sprint, Single leg bounding, Lateral jump single leg, Hexagon drill, Cone hops with change of direction sprint (Sozbir, 2016).

Demographic Data of Aquatic Plyometric Training Group and Rubberised Floor Plyometric Training Group

Table 1: Demographic characteristics of interventional groups.

Parameters	**Aquatic Plyometric Group**	**Rubberised Floor Plyometric Group**
	Mean ±S.D	
Age(years)	21.6±1.36	22.5±1.57
Weight(kg)	71.35±5.0082	71.35± 5.0082
Height(meter)	1.72±0.0629	1.72± 0.0629
BMI(Kg/m2)	24.17±1.0551	24.17± 1.0551

Table 1 presents the demographic characteristics of interventional groups. The groups comprise of 40 subjects (20 each). The Mean ±S. D. for Age, Weight, Height and BMI for aquatic group was 21.6±1.36, 71.35±5.0082, 1.72±0.0629, 24.17±1.0551 and for Rubberised floor plyometric group was, 22.5±1.57, 71.35± 5.0082, 1.72± 0.0629, 24.17± 1.0551 respectively. Figure 1 shows the demographic characteristics of both groups.

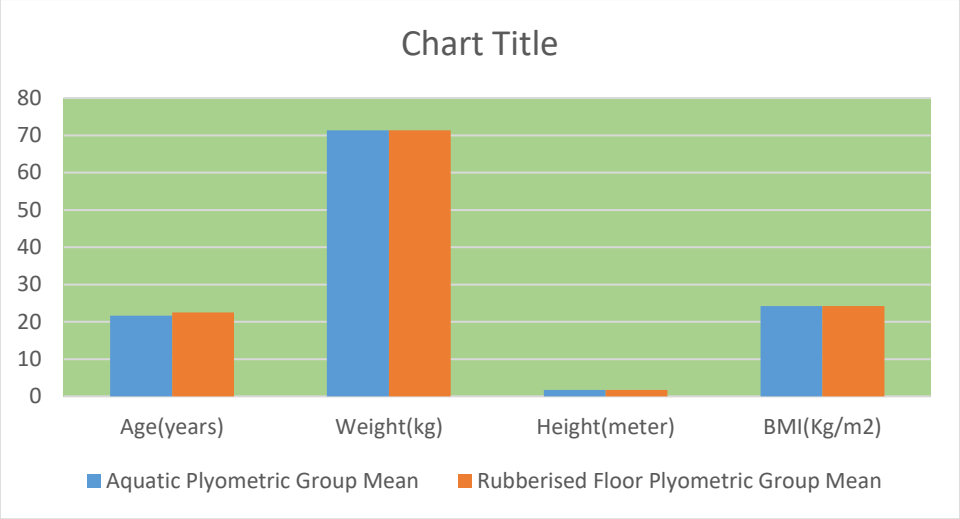

Figure 1 -Demographic characteristics of both groups.

RESULTS

The data was analysed with the help of Microsoft excel software. Paired t test was used to find the comparison of aquatic and rubberised floor plyometric groups for agility, cardiovascular endurance, explosive power and speed at Significance level ≤0.05. Pairwise Comparisons (Durbin-Conover) of muscle soreness was done to compare muscle soreness of both the surfaces.

Table 2 presents comparison of mean score of Pre-Training and Post Training observations of physical fitness variables in Aquatic Plyometric Group. t value suggests that there is statistically significant improvement in Cardiovascular Endurance (t=2.36), Explosive Power (t=3.43) and Speed (t=2.02) of athletes.

Parameter	Phase	Aquatic Plyometric Group Mean ± SD	t value	P value
Agility (seconds)	Pre	17.02±1.26	1.003	0.15
	Post	16.82±1.18		
Cardiovascular Endurance	Pre	59.48±4.11	2.36	.01*
	Post	62.99±3.60		
Explosive Power (inches)	Pre	17.80±2.80	3.43	.001*
	Post	18.16±2.08		
Speed (seconds)	Pre	7.45±0.47	2.02	0.02*
	Post	6.95±0.45		

*** Statistical significance at p≤0.05, df= 19**

Table-2. Comparison of Pre and Post Training observations of Physical Fitness variables in Aquatic Plyometric Group.

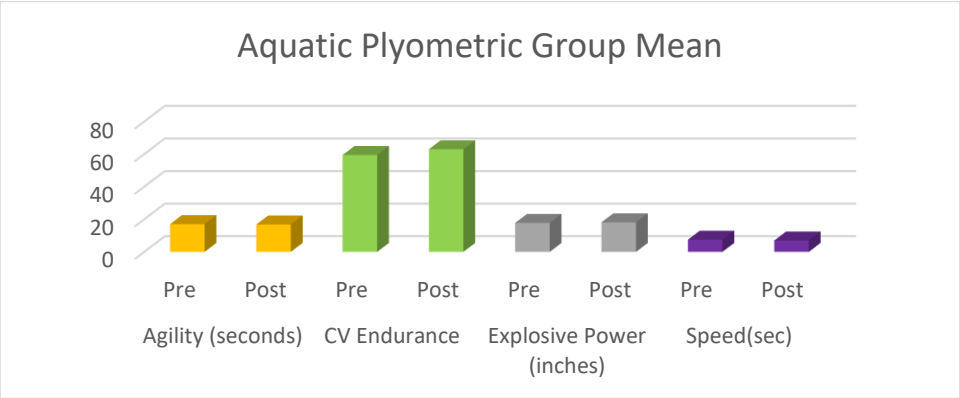

Figure-2. Level of Improvement Aquatic Plyometric Group

Table 3 presents comparison of mean score of pre training and post training observations of physical fitness variables in Rubberised floor Plyometric Group. t value suggests that there is statistically significant improvement only in Explosive Power (t=1.75) of athletes.

Parameter	Phase	Rubberised floor Plyometric Group Mean ± SD	t value	P value
Agility (seconds)	Pre	17.22± 0.9	0.97	0.16
	Post	16.92±0.99		
Cardiovascular Endurance	Pre	59.02±5.58	0.52	0.30
	Post	61.58±5.91		
Explosive Power (inches)	Pre	18.61± 1.60	1.75	0.04*
	Post	18.91±2		
Speed (seconds)	Pre	7.53± 0.64	0.52	0.30
	Post	7.21± 0.59		

*** Statistical significance at p≤0.05, df= 19**

Table-3. Comparison of Pre and Post Training observations of Physical Fitness variables in Rubberised floor Plyometric Group

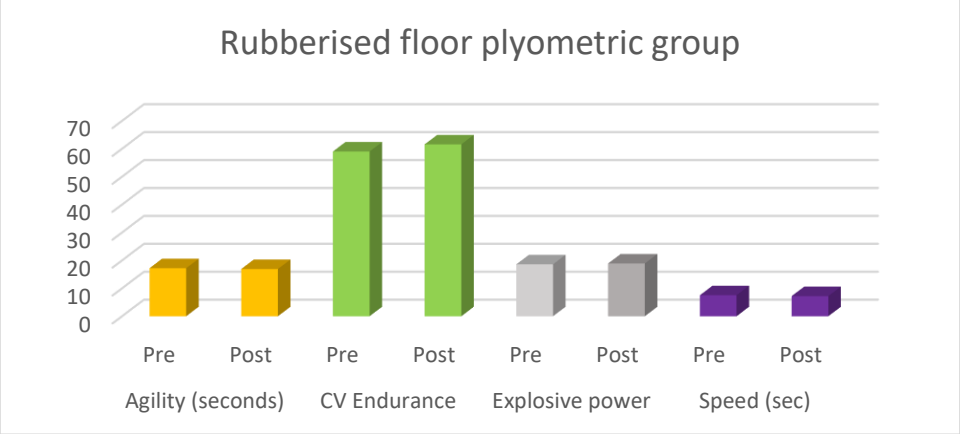

Figure -3. Level of Improvement Aquatic Plyometric Group

Parameter	Mean grading of muscle soreness in aquatic group	Mean grading of muscle soreness in Rubberised floor Plyometric Group
Week 1	4.8	4.45
Week 2	3.15	4.30
Week 3	2.3	4.00
Week 4	1.15	3.05

Table-4. Week wise mean of muscle soreness on Aquatic Plyometric Group and Rubberised Floor Plyometric Group

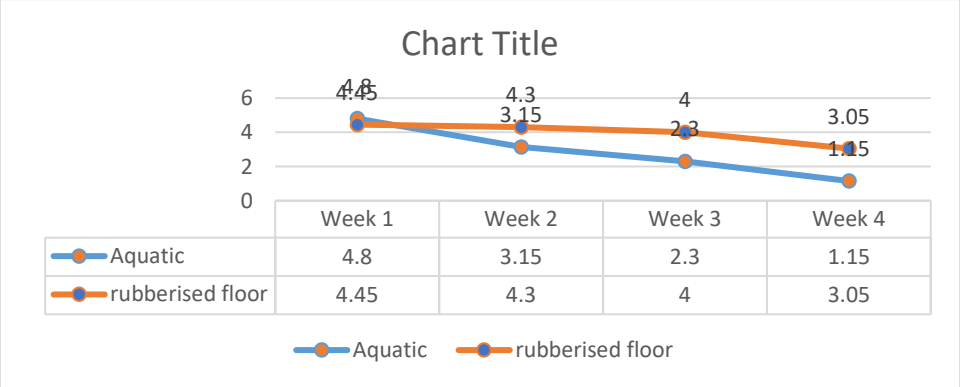

Figure -4. 4-week comparison of muscle soreness between Aquatic and Rubberised Floor group

DISCUSSION

This study was an attempt to compare plyometric training on two different training surfaces, aquatic and rubberised floor on physical fitness variables of football players. The outcome measures were namely; Agility, Cardiovascular endurance, Explosive power, and Speed, of collegiate players who participated in the study. On finding the efficacy of aquatic plyometric training on above mentioned variables it was observed that the comparison of pre- and post- training observations, in aquatic plyometric training group, showed statistically significant improvement in all the four physical fitness variables There was a statistically significant decline in mean time taken to perform 50-meter sprint test, suggesting that speed of players was improved by 0.6 seconds, as a result of aquatic plyometric training. This improvement in sprint performance could be due to changes in stride length and stride frequency followed by plyometric training (Rimmer, 2000). Similar results were found in context with agility of participants which exhibited a statistically significant increase of 0.19 seconds when assessed by dodging run test. These findings are well in line with the observation made by Asadi and Arazi (2012). Increase in vertical jump performance can be explained on the basis that plyometric training increases force and tension to the muscle cords, enhances motor unit recruitment and consequently improves leg extensor muscle activity and increases the counter moment jump (Ali and Khan, 2013). Cardiovascular endurance of the participants showed significant improvement, when compared from pre to post plyometric training of 6 weeks. Suggesting that the magnitude of this training in terms of duration, intensity and frequency was sufficient to cause physiological adaptations that could lead to an enhancement in the uptake of oxygen by the exercising muscles.

Binnie *et al.* (2013), agrees with the results of current study showing a positive effect of aquatic plyometric training on speed of players. According to them increase in speed of players may be due to increased cadence, a greater forward trunk lean and hip range of motion, and an increased plantar flexion. Thomas *et al.* (2009), suggested that agility improvement requires rapid force development and high power output in addition to rapid switch from eccentric to concentric muscle action in leg extensor muscles and plyometric technique can increase responses to these requirements. Mirzaei and his associates (2014) also observed ~14% increase in jumping ability on completion of six weeks of sand specific jump training. Neuromuscular adaptations such as increased motor unit functioning, increased inhibition of antagonist muscles as well as activation and co-contraction of synergistic muscle may account for the improvement in jumping abilities, as observed in present study (Potteiger *et al.*, 1999; Marcovic *et al.*, 2010). Cardiovascular endurance, which exhibited statistically significant enhancement from its pre-training level (59.48) to post-training level (62.98). The results are in favour of study by Kumar (2015), in which he founded that there is increase in cardiovascular endurance fitness level of participants when trained in sand surface for ten weeks.

aquatic plyometric training though registered better records when compared with rubber surface plyometric training for agility, no statistically significant difference found between the two groups in context with speed, suggesting that both the surfaces are equally effective to improve the agility in football players. The study done by Singh *et al.* (2013), on grass and sand based surface disagrees with this findings of present study regarding agility. Senthil (2015), found out that cardio-respiratory endurance was improved by plyometric training. However, the study done by him was not surface specific. The reason for improved cardiovascular endurance in aquatic plyometric group could be because of the resistance offered by water training which requires more energy than training on stable surfaces. This increased resistance helps improve quickness and build explosive strength because the muscles experience a

greater workload during training exercises thereby improving the overall cardiovascular endurance (Kumar, 2015). In context with muscle soreness, that was asses by likert scale, there was less muscles soreness in aquatic plyometric training as compared to rubberised floor, as there was a continuous decline in the level of soreness every week in both the surfaces, but aquatic group showed more improvements in terms of soreness every consecutive week.

CONCLUSION

The plyometric training in both, aquatic as well as rubberised floor surfaces are effective in improving the studied physical fitness variable in collegiate players and both the surfaces can be used as an alternative to each other for improving speed by using plyometric training. Plyometric on aquatic shows significant improvement on comparing with that on rubberised surface, with reference to cardiovascular endurance, explosive power and in players. While rubberised floor plyometric exercise and aquatic surface both was able to significantly improve speed. the study concluded that Aquatic plyometric training can be adopted by coaches and trainers as an effective training mode to enhance the performance of players with less muscle soreness.

Limitations

The result of the study was based on small sample size, so the findings cannot be generalized and care should be taken before drawing any concrete decision from the study. The factors such as socio-economic status and dietary habits, which may have effect on the players were not taken into consideration. The study was carried out only on male players. Furthermore, the study can be carried out in different age groups as well as different gender.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: The cooperation was received from authorities of Maharaj Vinayak Global University, Jaipur for permitting to carry out this study. The study was conducted as a part of academic programme and no financial support was received from any agency for this work.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Amiri-Khorasani, M., Sahebozamani, M., Tabrizi, K.G. and Yusof, A.B., (2010). Acute effect of different stretching methods on Illinois agility test in soccer players. *The Journal of Strength & Conditioning Research*, *24*(10), pp.2698-2704.
2. Arazi, H., Coetzee, B. and Asadi, A., (2012). Comparative effect of land-and aquatic-based plyometric training on jumping ability and agility of young basketball players. *South African Journal for Research in Sport, Physical Education and Recreation*, *34*(2), pp.1-14.
3. Arazi, H., Coetzee, B. and Asadi, A., (2012). Comparative effect of land-and aquatic-based plyometric training on jumping ability and agility of young basketball players. *South African Journal for Research in Sport, Physical Education and Recreation*, *34*(2), pp.1-14.
4. Binnie, M.J., Peeling, P., Pinnington, H., Landers, G. and Dawson, B., (2013). Effect of surface-specific training on 20-m sprint performance on sand and grass surfaces. *The Journal of Strength & Conditioning Research*, *27*(12), pp.3515-3520.
5. Devinder K. Kansal (2008), Textbook of applied measurement evaluation and sports selection.
6. Kumar, P., (2015). Impact of Sand Training for Endurance Development among Athletes. *International Journal of Applied Research*, *1*(7), pp.503-506.
7. Markovic, G. and Mikulic, P., (2010). Neuro-musculoskeletal and performance adaptations to lower-extremity plyometric training. *Sports medicine*, *40*(10), pp.859-895.
8. Milenković, D., (2013). Explosiveness in Training Process of Football Players. *Sport Science*, *6*(2).
9. Rimmer, E. and Sleivert, G., (2000). Effects of a Plyometric Intervention Program on Sprint Performance. *The Journal of Strength*

& Conditioning Research, *14*(3), pp.295-301.
10. Senthil, P., (2015). Effects of Plyometric Training on Physical and Physiological Parameters.
11. Singh, A., Sakshi, G. and Jaspal Singh, S., (2014). Effect of plyometric training on sand versus grass on muscle soreness and selected sport specific performance variables in hockey players. *Journal of Human Sport and Exercise*, *9*(1).
12. Söhnlein, Q., Müller, E. and Stöggl, T.L., (2014). The effect of 16-week plyometric training on explosive actions in early to mid-puberty elite soccer players. *The Journal of Strength & Conditioning Research*, *28*(8), pp.2105-2114.
13. Sporis, G., Jukic, I., Milanovic, L. and Vucetic, V., 2010. Reliability and factorial validity of agility tests for soccer players. *The Journal of Strength & Conditioning Research*, *24*(3), pp.679-686.
14. Taheri, E., Nikseresht, A. and Khoshnam, E., (2014). The effect of 8 weeks of plyometric and resistance training on agility, speed and explosive power in soccer players. *European Journal of Experimental Biology*, *4*(1), pp.383-386.

How to cite this article: Manoj Kumar Jadiya, Virendra Singh Rajpurohit, Maliram Sharma, Swati Sharma, Dhruv Taneja. Comparison of rubberised floor vs aquatic based plyometric training on physical fitness variables of collegiate players. *Int J Health Sci Res.* 2024; 14(10):37-44. DOI: *https://doi.org/10.52403/ijhsr.20241005*

******