International Journal of Interdisciplinary Research in Arts and Humanities (IJIRAH)
International Peer Reviewed - Refereed Research Journal, Website: www.dvpublication.com
Impact Factor: 5.225, ISSN (Online): 2456 - 3145, Volume 11, Issue 1, January - June, 2026

EFFICACY OF GAME SPECIFIC TRAINING IN COMBINATION WITH PLYOMETRIC TRAINING PERFORMED IN DIFFERENT SURFACE CONDITIONS ON SPEED OF YOUNG VOLLEYBALL PLAYERS

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Cite This Article: Ramesh Chintala & S. Alagesan, "Efficacy of Game Specific Training in Combination With Plyometric Training Performed in Different Surface Conditions on Speed of Young Volleyball Players", International Journal of Interdisciplinary Research in Arts and Humanities, Volume 11, Issue 1, January - June, Page Number 108-111, 2026.

Type of Review: Peer Reviewed as per |C|O|P|E| Guidance.

DOI: https://doi.org/10.5281/zenodo.20546926

Abstract:

The purpose of the present study was to investigate the efficacy of game specific training in combination with plyometric training performed in different surface conditions on speed among young volleyball players. To achieve the purpose of the study, forty-five male volleyball players aged between 15 and 18 years were selected as subjects and randomly divided into three equal groups of fifteen each. Group-I underwent combined game specific training with plyometric training on sand surface, Group-II underwent combined game specific training with plyometric training on firm surface, and Group-III served as the control group. The training programme was conducted for a period of twelve weeks. Speed was selected as the dependent variable. The collected data were statistically analyzed using paired 't' test, Analysis of Covariance (ANCOVA), and Scheffe's post hoc test. The results revealed significant improvement in speed among the experimental groups when compared to the control group. The obtained paired 't' ratio values for combined sand surface plyometric and game specific training group and combined firm surface plyometric and game specific training group were 9.20 and 8.40 respectively, which were greater than the required table value of 2.15 at 0.05 level of significance. The percentage of improvement in speed was 18.18% for the combined sand surface plyometric and game specific training group and 9.21% for the combined firm surface plyometric and game specific training group. The ANCOVA analysis revealed a significant adjusted post-test 'F' ratio value of 43.16, which was higher than the required table value of 3.23 at 0.05 level of confidence. Further, Scheffe's post hoc test confirmed significant mean differences among the groups. The findings of the study indicated that both sand surface and firm surface plyometric training combined with game specific training significantly improved speed performance among volleyball players. However, combined sand surface plyometric and game specific training was found to be superior to combined firm surface plyometric and game specific training in improving speed.

Key Words: Plyometric Training, Sand Surface Training, Firm Surface Training, Speed, Volleyball Players and Game Specific Training.

Introduction:

It is widely accepted that sports performance is affected by internal factors such as the age, fitness status and cognitive abilities of the players (Morcillo et al., 2015; Sterzing et al., 2009). In addition, environmental factors, including the playing context, shoes characteristics and playing surface have been identified as important external factors that can influence sports performance (Sterzing et al., 2009). An increasing number of research studies have been conducted to assess the influence of playing surface on various technical and physical components of players.

To date, studies assessing the influence of playing surface type on physical performance abilities have yielded conflicting results. During competitive games, Andersson et al., (2008) observed similar running (e.g., sprint number, high-intensity running and total covered distance) and technical (e.g., standing tackles) patterns on artificial turf (AT) compared to natural grass (NG). Moreover, single sprint (Gains et al., 2010) as well as jumping and agility performances (Hughes et al., 2013; Stone et al., 2014) appear to be similar on AT and NG. On the other hand, the effect of playing surface on repeated sprint ability (RSA) is equivocal (Stone et al., 2014).

Playing surface has been shown to influence some variables, such as the peak and average speed (Rago et al., 2018), the playing style (Andersson et al., 2008), and the change of direction ability (Gains et al., 2010; Hughes et al., 2013), with players also exhibiting better technical skills (e.g., fewer sliding tackles, more short passes and faster turns and direction change abilities) on AT compared to NG. These findings suggest that exercise tasks that require more direction changes might be more likely to observe a beneficial effect on different surfaces. However, the exercise induced alterations in motor fitness, coordinative abilities and game skills in response to plyometric exercise performed in sand and firm surfaces among volleyball players are poorly defined.

Volleyball - An Overview:

Volleyball is played by million of people around the world. In many countries, it has been ranked as top-level competitive sports. It is a fascinating game, which everybody will accept. It is a well-knows fact that volleyball is a thrilling game. It is one of the recreational games with in a small area. It is a game where not only the hands are engaged in receiving and spiking the ball, but the whole body and mind are engaged in this game. Volleyball is probably the leading ball game in the world as far as

action and accuracy are concerned. Regarding the result of this game anything many happen at any time. Volleyball is a team game where six players in the court will play as a unit and not like machine.

Though volleyball was originally invented to be a recreational game; it has now developed into a high competitive sport, requiring a high degree of fitness. The requisite level of fitness will vary depending upon the level of competition. Participation in top-notch competitive volleyball requires that a person should be in a state of optimum fitness.

Need of Specific Conditioning for Volleyball Players:

Fitness and conditioning are important elements to success in the game of volleyball. The player's energy will be drained toward the end of a volleyball match if the fitness level is lacking. In games where two teams are evenly matched, the one with the best overall conditioning often prevails. Fatigue in a volleyball match can lead to mistakes, and mistakes can lead to a loss.

There are different types of training methods for the development of performance abilities of volleyball players. Understanding these training methods and the effectiveness of the training methods to suit a particular game and game situations is a challenging task for any coach or player. This helps coaches and athletes prevent injury and overtraining while trying to maximize their performance variables, and analyze the strengths and weaknesses related to their specific training programs.

Volleyball games typically have short bursts of play that require start and stop action. Cardio exercises to improve endurance should include volleyball drills that mimic the bursts of stamina needed in a volleyball game. The circuit training helps to condition a volleyball player's technique to improve spiking, blocking and serving. Starting a workout routine that includes high intensity integral training with a variety of cardio equipment and strength training will also help to improve endurance and fitness. Volleyball players can use integral training to condition them for quick volleyball maneuvers through bursts of intense exercises and drills (Balakrishnan, 2007).

Importance of Plyometric Training for Volleyball Players:

Volleyball is an intense anaerobic sport that combines explosive movements (i.e., in both vertical and in horizontal directions) with short periods of recovery (Polglaze & Dawson, 1992; Gabbett & Georgieff, 2007; Sheppard, Gabbett & Stanganelli, 2009). Therefore, explosive strength, which is defined as the ability of an individual's neuro-muscular system to manifest strain in the shortest possible time (Verhosanski & Bobot, 1979), is considered a fundamental aspect of successful athletic performance (e.g., (Chu, 1998)). In fact, when speed and agility are combined with maximum strength, power is the outcome (Saeed, 2013). Muscular power enables a given muscle to produce the same amount of work in less time, or a greater magnitude of work in the same time, which is important for sprinting, jumping (Peterson, Alvar & Rhea, 2006) and quick changes of direction (Saeed, 2013). Indeed, studies have shown strong relationships between power measures and vertical jump performance (e.g., (Peterson, Alvar & Rhea, 2006;Stone et al., 2003;Wisloff et al., 2004), suggesting that power influences vertical jumping performance (Sheppard et al., 2008).

A vertical jump is a complex movement that requires the coordination of several muscles in the trunk, arms and legs (Charoenpanicha et al., 2013). Knowing that each player performs more than 250 jumps in a volleyball match of five sets (Martinez, 2017;Vlantes & Readdy, 2017), jumping ability has been identified as one of the key determining factors of high performance in volleyball (Stanganelli et al., 2008). In fact, several studies have shown that vertical jump test results are indicative of the performance level of an athlete (e.g., (Lidor & Ziv, 2010;Ziv & Lidor, 2010; Smith, Roberts & Watson, 1992; Palao, Manzanares & Valadés, 2014)). For example, Ziv and Lidor (2010), in a review concerning vertical jump in female and male volleyball players, noted that better-performing teams were comprised of players with high vertical jumps (Tsoukos et al., 2018).

Jump training is commonly associated with plyometric training and, in particular, with drills that stress the musculotendinous unit (Wilson & Flanagan, 2008; Taube, Leukel & Gollhofer, 2012; Ives, 2013). In fact, de Villarreal et al., (2009) found that a combination of bodyweight plyometrics, including countermovement jumps, depth jumps and squat jumps, resulted in a 4.7% to 15% increase in vertical jump height. Nevertheless, this type of training increases neuromuscular coordination through training the nervous system (Davies, Riemann & Manske, 2015), thus allowing the stretch-shortening cycle (SSC) which is a lengthening movement (i.e., eccentric) quickly followed by a shortening movement (i.e., concentric) ((Wilson & Flanagan, 2008;Davies, Riemann & Manske, 2015) to react faster (Behm et al., 2017). Additionally, because this training includes muscle lengthening, it may also improve flexibility, increase the amount of stored elastic energy in the muscles (Kubo et al., 2017), stimulate more muscle units (McLaughlin, 2001), result in higher (neural) firing frequency (McLaughlin, 2001; Pienaar & Coetzee, 2013) and improve joint proprioception (Swanik et al., 2002; Swanik et al., 2016).

Methodology:

Selection of the Subjects:

To achieve the purpose of the study, forty-five male volleyball players aged between 15 and 18 years were selected as subjects. The selected subjects were randomly divided into three equal groups of fifteen subjects each. Group-I underwent combined game specific training with plyometric training on sand surface, Group-II underwent combined game specific training with plyometric training on firm surface, and Group-III served as the control group.

Before the training programme, all subjects underwent a minimum strength requirement test which included five push-ups, five squat thrusts, standing long jump, and jumping rope for 30 seconds as recommended by Voight and Draovitch (1991). The selected subjects were medically examined by a qualified physician and confirmed to be physically fit to participate in the training programme.

Selection of Variables:

Independent Variables:

- Combined game specific training with plyometric training in Sand surface
- Combined game specific training with plyometric training in Firm surface

Dependent Variables:

- Speed

Experimental Design:

The experimental design used in this study was random group design involving 45 subjects, who were divided at random in to three equal groups of fifteen subjects each. All the three groups were selected from the same population. No effort was made to equate the groups prior to the commencement of the experimental treatment. The data collected from the three experimental groups on selected dependent variables was statistically analyzed by paired 't' test to find out the significant differences if any between the pre and post test on speed percentage of changes was calculated to find out the chances in selected dependent variables due to the impact of experimental treatment.

The data collected from the three groups prior to and post experimentation on selected dependent variables were statistically analyzed to find out the significant difference, if any, by applying the analysis of covariance (ANCOVA). The pre test means of the selected dependent variables was used as a covariate. Since three groups were involved, whenever they obtained 'F' ratio value was found to be significant for adjusted post test means, the Scheffe's test was applied as post hoc test to determine the paired mean differences, if any. In all the cases, the level of confidence was fixed at 0.05 level.

Analysis of Speed:

The results of various statistical techniques applied to know the impact of plyometric exercise performed in sand and firm surface conditions on speed of volleyball players is displayed in table 1.

Table 1: Percentage (%) of Improvement and 't' Test (Paired) Results on Speed of Sand and Firm Surface Plyometric Training as well as Control Group

Group	Tests	N	Group's Mean	SD	M. Diff	Obtained 't' - ratio	%
Combined Sand Surface Plyometric and Game Specific Training	Pre	15	5.21	0.33	1.17	9.20*	18.18
	Final		4.04	0.38			
Combined Firm Surface Plyometric and Game Specific Training	Pre	15	5.32	0.32	0.86	8.40*	9.21
	Final		4.45	0.14			
Control (CG)	Pre	15	5.14	0.40	0.02	0.18	0.24
	Final		5.12	0.38			

Table value for df 14 is 2.15(*significant)

The calculated mean values of initial (pre) and final test data on speed of volleyball players belongs to plyometric exercise performed in sand and firm surface condition group's differ clearly, as combined sand surface plyometric and game specific training and combined firm surface plyometric and game specific training group's resultant 't' ratio values (9.20 &8.40) are more than table(df14=2.15) value needed. Due to combined sand surface plyometric and game specific training and combined firm surface plyometric and game specific training, 18.18% and 9.21% of improvement in speed was observed.

In the below given table 2, the applied ANCOVA statistics results on speed performance of sand and firm surface plyometric training groups and control group participants are put on view.

Table 2: Derived ANCOVA Results on Speed of Sand and Firm Surface Plyometric Training as well as Control Group

Mean Score	Combined Sand Surface Plyometric and Game specific Training	Combined Firm Surface Plyometric and Game specific Training	Control (CG)	SoV	SS	df	MS	Derived 'F' Ratio
Adjusted	4.04	4.43	5.13	B	9.06	2	4.53	43.16*
				W	4.30	41	0.10	

(Table value for df 2 &41=3.23) * Significant (.05 level)

The adjusted (posttest) speed performance mean values, derived through ANCOVA statistics for sand surface plyometric training (SSPT=4.04) and firm surface plyometric training (FSPT =4.43) as well as control groups (CG=5.13) participants are resulted in 'f' ratio value of 43.16. It proved that the combined sand surface plyometric and game specific training and combined firm surface plyometric and game specific training as well as control group's (CG) adjusted(posttest) mean values on speed vary noticeably, as the 'F' ratio value (43.16) for df2 & 41(3.23) is found significant.

In the below given table 3, the applied Scheffe's Test statistics results on speed performance of sand and firm surface plyometric training groups and control group participants are put on view.

Table 3: Derived **Scheffe's Test** Results on Speed of Sand and Firm Surface Plyometric Training as well as Control Group

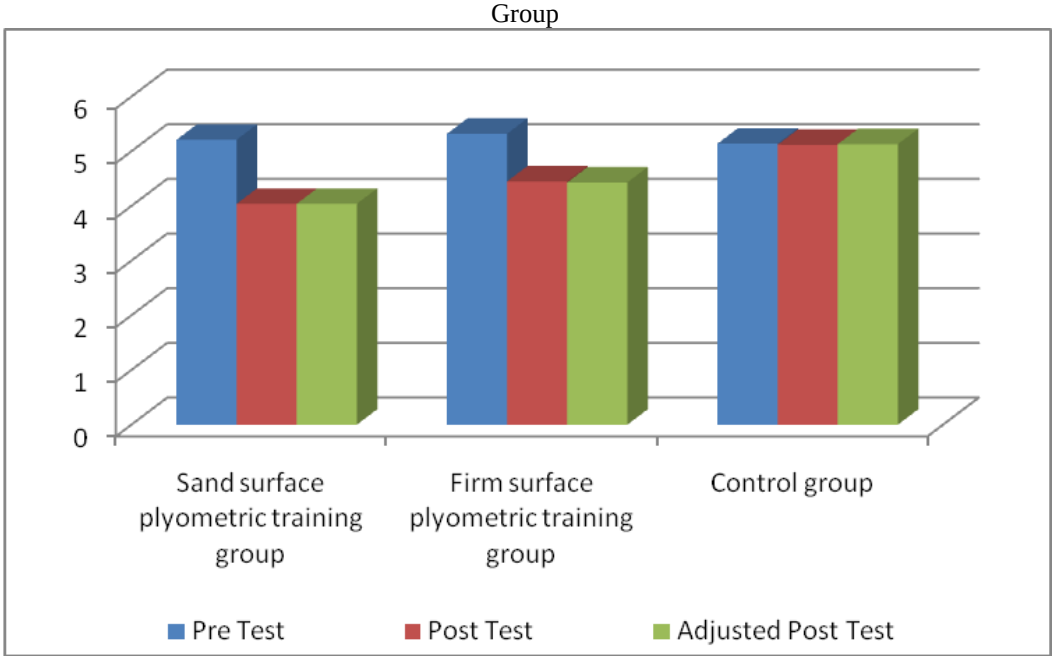
Variable	Combined Sand Surface Plyometric and Game Specific Training	Combined Firm Surface Plyometric and Game Specific Training	Control (CG)	MD	CI
Speed	4.04	4.43		0.39*	0.32
	4.04		5.13	1.09*	0.32
		4.43	5.13	0.70*	0.32

*Significant (.05)

The post hoc (Scheffe's) analysis make obvious that due to sand surface plyometric training (SSPT= 1.09) and firm surface plyometric training (FSPT=0.70) training the participant's speed performance was improved remarkably. Though, combined sand surface plyometric and game specific training was superior to combined firm surface plyometric and game specific training since the difference between these means (MD) (0.39) are above the calculated CI (0.32) value.

The below screening figure (1), shows the speed performance mean scores of chosen sand surface plyometric training (SSPT) and firm surface plyometric training (FSPT) as well as control groups (CG) participants.

Figure 1: Figure Screening Shows the Mean Scores on Speed of Sand and Firm Surface Plyometric Training as well as Control Group



Conclusion:

Due to combined sand surface plyometric and game specific training and combined firm surface plyometric and game specific training, 18.18% and 9.21% of improvement in speed was observed. Though, sand surface plyometric training (FSPT) was superior to firm surface plyometric training (SSPT).

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