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Evaluation of Explosiveness of Strength and Power among College Volleyball Players in Ondo, Nigeria

Évaluation de l'explosivité de la force et de la puissance chez les joueurs de volleyball de l'équipe universitaire d'Ondo, au Nigéria

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Abstract

The coaches' contribution to the effectiveness of a team's performance is highly influential and players must be well equipped to execute a variety of skills during play. This study, therefore, evaluated the explosiveness of leg strength and leg power of volleyball players at preseason and post season training. Principle of Specificity provided the framework for this study. Thirty college volleyball players (15males and 15 females) participated in the study. Each player performed on the court season training specifically with squat and vertical jump test. Pretest and posttest measurement were taken. Paired groups type of t-test was used to analyse the data. There was significant difference in the players' scores for leg strength (LS) ($\bar{x}$ = 24.80±4.83), conditions (t = -21.78; df=29; p<.05). There was a significant difference in the scores for leg power (LP) (t=-27.38; df=29; p <.05). The results indicated that there were significant differences in LS between males and females (t = 3.557; df = 28; p < .05). The results also indicated that there were significant differences in LP between males and females (t= 8.311; df = 28; p < .05). It was revealed that the training improved their leg strength and leg power. Therefore, coaches should engage volleyball players with exercise drills that would develop the lower body strength and power because they need explosiveness to be more effective to get off the floor quickly and reaching up above the net.

Keywords: Volleyball Players, Leg Strength, Leg Power, Bodyweight Squats, Standing Long-Jump

Résumé

La contribution des entraîneurs à l'efficacité de la performance d'une équipe est très influente et les joueurs doivent être bien équipés pour exécuter diverses habiletés pendant le jeu. Cette étude a donc évalué l'explosivité de la force des jambes et de la puissance des jambes des joueurs de volleyball lors des

entraînements présaison et post-saison. Le principe de spécificité a fourni le cadre de cette étude. Trente joueurs universitaires de volleyball (15 hommes et 15 femmes) ont participé à l'étude. Chaque joueur s'est entraîné sur la saison du court spécifiquement avec un test de squat et de saut vertical. Des mesures prétest et post-test ont été prises. Un test t de type groupes appariés a été utilisé pour analyser les données. Il y avait une différence significative dans les scores des joueurs pour la force des jambes ($\bar{x}$ = 24,80 ± 4,83), les conditions (t = -21,78; df = 29; p <0,05). Il y avait une différence significative dans les scores pour la puissance des jambes (t = -27,38; df = 29; p <0,05). Les résultats ont indiqué qu'il y avait des différences significatives de la force des jambes entre les hommes et les femmes (t = 3,557; df = 28; p <0,05). Les résultats ont également indiqué qu'il y avait des différences significatives de puissance des jambes entre les hommes et les femmes (t = 8,311; df = 28; p <0,05). Il a été révélé que l'entraînement améliorait la force de leurs jambes et leur puissance. Par conséquent, les entraîneurs devraient occuper les joueurs de volleyball avec des exercices d'exercices qui développeraient la force et la puissance du bas du corps, car ils ont besoin d'explosivité pour être plus efficaces pour descendre rapidement du sol et atteindre le dessus du filet.

Mots-clés : Joueurs de volleyball, force des jambes, puissance des jambes, squats au poids corporel, saut en longueur debout

Introduction

Explosiveness is important in many sports and for a successful performance in ball games, such as volleyball and basketball. Ball games generally require well developed skills in agility, strength and power. Explosive strength refers to individuals' ability to exercise the greatest amount of force within the shortest possible timeframe (Giminiani & Visca, 2017). It is important to build speed strength and raise absolute strength in other to develop explosive strength. More so, in a bid to improve explosive strength, the movement must change from eccentric to a concentric action (Osunriande & Oladipo, 2014). Volleyball players need to be explosive to be more effective. Whether in the process of getting higher to become a better hitter or being able to jump quickly in order to provide an effective block, the ability to get off the floor quickly and reach above the net is critical for volleyball players.

Volleyball players need stronger leg power to get high in the air and explosive strength to display skills such as digging, spiking and blocking. The amount of muscle strength which can be achieved usually depends on gender, age and inherited physical attributes per individual (Ojo, 2019). Increase in muscle fiber can be stimulated by weightlifting, as muscle fiber is needed to produce more strength and speed. Therefore, as players become stronger, so does the

explosive power on the pitch. Strengthening certain muscles in volleyball allows athletes to perform at their best. Most often, players required strength for stability as it permits effective transmission of power from the lower body to the upper body. Strength training increases muscle fibers allows the athlete to lift better and to develop higher jumping power and greater power to serve (Ojo, 2019).

It is known that while vertical jumping is an important task in volleyball, the test of performance in jumping has been subjected to validity and reliability (Sattler, et al, 2012). The assessment of the explosiveness of strength and the assessment of power were considered in volleyball due to the characteristics of the nature of explosive movements that are associated with performance in the ability to jump. Tests with vertical jumps were suggested to estimate the explosive capacity among players of volleyball in their performance of repetitive movements (Hoffman & Kang, 2002). The vertical jump tests lasting fifteen seconds or sixty seconds proved to measure explosive strength in volleyball players.

Additionally, it is important to examine how fatigue affects the production of strength and muscular power in volleyball game. This sport is characterized by actions of a short period in in a prolonged time; therefore, explosive strength and endurance are exhibited consistently. While playing a game, repetitive movements lead to fatigue as the seriously interfere with volleyball players' performance (Scates & Linn, 2003). The consequences of fatigue during training are based on temporary results as a result of decrease in the athletes' functional capabilities, as this demonstrates a weakness in the performance of strength, speed and power (Abass, 2009). Though, it is worth noting that continuous and intense exercise with stretching and shortening cycle (SSC) are means applied in training as sports modality.

The need to improve the physical fitness of players has prompted the improvement of the players' specific and relevant skilful abilities inherent in their sport (Ojo & Oladipo, 2018). Therefore, to develop physical performance of the players, there would be need to increase strength and power trainings and thereby improve sports specific skills. Prior studies have shown there is correlation between ball throwing velocity and upper extremities strength performance (Forthomme et al. 2005). Literature revealed that improvements in neuromuscular characteristics could likewise improve endurance performance, which includes motor unit recruitment and shorter ground contact time (Hoff, Gran & Helgerud, 2002).

This study therefore, evaluated the explosiveness of leg strength and leg power of volleyball players between the preseason training and before a competition

using the squat and vertical jump tests.

Research Question

Is the data on leg strength and leg power of the volleyball players normally distributed?

Hypotheses

1. The difference in the leg strength of the volleyball players before preseason training and before competition is not a significant one.
2. The difference in the leg power of the volleyball players before preseason training and before competition is not a significant one.
3. Gender influence on the leg strength of the volleyball players is not significant.
4. Gender influence on the leg power of the volleyball players is not significant.

Research Design

The randomized pretest, posttest, quasi-experimental design was used for this study. There were pretest and posttest measurements at preseason training and before competition respectively for all the participants.

Sample

Thirty college volleyball players (15 males and 15 females) participated in the study. Each player performed bodyweight squat test and vertical jump test.

Testing Procedure

The following data were collected:

1. Weight: This was measured in kilogramme.
2. Height: This was measured with the use of the metre.

Prior to the study, the players were examined and cleared of any known ailment that might hinder their commitment and activeness in the training by consulting a doctor who ascertained health status. Each participant signed a consent form before the study. This study was accomplished during twelve week sessions of competitive training. During the season, the players had series of matches per week combined with the drills as well as the tests. The players familiarized themselves with all the testing and training exercises since at preseason training routine, participants' performed leg strength and leg power test which were measured at pretraining and posttraining via squat test and vertical jump test in other to evaluate the iso-inertial and isometric of leg

strength and leg power.

a. **Leg Strength Test (Squat)**: To measure muscular strength of lower extremity.

Equipment: Open space.
Procedure: Each participant stood with their feet wide apart, with their weights in their heels and knees in line with their ankles. Each participant performed bodyweight squats as they could until they are fatigued.

b. **Vertical jump test:** For the measurement of leg power.
Procedure: Athletes stand to a wall and stretch up. The feet must be flat with the ground and the points of the fingertips were marked. The participant projects their body upwards using both arms and legs touching the wall at the highest point of the jump. The distance between the standing height and the jump height is the score for leg power.

Statistical Analyses
A Shapiro-Wilks normality test determined the data normality in the distribution of the data. In tandem with the specifications of Akinsola and Ogunleye (2004) and Ogunleye (2008), the paired groups' t-test was also used to analyse the data at .05 level of significance.
Results
Rq1: Is the data on leg strength and leg power of the volleyball players normally distributed?

Table 1: Shapiro-Wilks Normal Distribution Test

Measure	Statistic	df	Sig.
Pre strength	.973	30	.634
Post strength	.936	30	.070
Pre power	.983	30	.907
Post power	.938	30	.078

In Table 1, results indicated that the data were normally distributed for pre strength, post strength, pre power and post power (P >.05). This implies that the data were not significantly skewed either positively or negatively.

Ho1: The difference in the leg strength of the volleyball players before preseason training and before competition is not a significant one.

Table 2: Paired Samples t-test for Leg Strength

Leg strength	Mean	Std. Dev.	Std. Error	df	t	Sig.
Pre	24.80	4.831	.882	29	-21.78	.000*
Post	41.30	4.801	.876			

*Significant

The result in Table 2 shows a significant difference in the pre ($\bar{x}$ =24.80) and post ($\bar{x}$ =41.30) preseason leg strength of the volleyball players, conditions (t = -21.78; df=29; p<.05). Hence, the hypothesis became rejected.

Ho2: The difference in the leg power of the volleyball players before preseason training and before competition is not a significant one.

Table 3: Paired Samples t-test for Leg Power

Leg power	Mean	Std. Dev.	Std. Error	df	t	Sig.
Pre	29.413	4.5964	.8392	29	-27.38	.000*
Post	51.780	5.7658	1.0527			

*Significant

In Table 3, there was a difference which was significant in the pre ($\bar{x}$ =29.413) and post ($\bar{x}$ =51.780) of the volleyball players leg power, conditions (t = -27.38; df = 29; p <.05). Ho2, therefore, was rejected.

Ho3: Gender will not have significant difference in the leg strength of the volleyball players.

Table 4: Gender Differences in Leg Strength of Volleyball Players

Gender	Mean	Std. Dev.	Std. Error	df	t	Sig.
Male	43.93	3.56	.918	28	3.557	.001*
Female	38.67	4.49	1.162			

Table 4 shows significance in the difference between LS of males ($\bar{x}$ =43.93±3.56) and females ($\bar{x}$ =38.67±4.49); conditions (t = 3.557; df = 28; p < .05). The hypothesis on gender influence was therefore, rejected.

Ho 4: Gender will not have significant difference in the leg power of the volleyball player.

Table 5: Gender Differences in Leg Power of Volleyball Players

Gender	Mean	Std. Dev.	Std. Error	df	t	Sig.
Male	242.87	15.137	3.908	28	8.311	.000*
Female	193.13	17.549	4.531			

Table 5 shows that gender had significant difference in the leg power of the volleyball players with males ($\bar{x}$ =242.87±15.137) and females ($\bar{x}$ =193.13±17.548) in favour of males (t= 8.311; df = 28; p < .05). The hypothesis was then rejected.

Discussion

Transition of power from the lower body to the upper body requires strength which is also vital for a player's stability. As a result of the strength development, the growth of the muscle fibers can usually be stimulated through strength training pressure. There was improvement in leg strength among the volleyball players. Millic, Nejic and Kostic (2008) reported marginal increase in the explosive strength recorded against the two-foot and single-foot takeoff jumps of selected volleyball players exposed to six weeks of plyometric training. This also validated the views of Akinsola and Ogunleye (2003) that there was prospect for improvement of performance in the course of implementation of a course of instruction or set of activities. Indeed, Ogunleye (2009) had reported that students' involvement in practical activities led to significant improvement in their task performance. Furthermore, in this study, the leg strength of the males improved significantly than that of the females. Babalola and Ojo (2015) had reported that females produced lower amount of testosterone (muscle building hormones) than males which makes male counterpart LS improves better. It is also generally thought that males could do better because males have greater muscle bulk (Ojo, 2019). Although, if strength is expressed relative to muscle cross-sectional area, the gender differences in strength disappears. It was also reported that the participants developed lower lean muscle mass compared to those training under similar relative intensity.

This study reported a better improvement in the leg power of the players. Jumping high is important during spiking and defending spikes during play in the game of volleyball. Physical One exercise approach to help has been acclaimed as very important for the health of people most especially players as it could help them stay in the best frame of mind for maximum benefits from training (Ogunleye & Ojo, 2019). The results from the study validated information that there was an increase in the jump height of the players comparing the pretest and posttest leg power. Previous studies have revealed the effectiveness of plyometric training for the purpose of improving power most especially as increased vertical jump high (Radua, Făgăraş & Graurc, 2015). There was greater improvement in the leg power of the males than that of the females. There is no doubt that males generally have a greater proportion of fast-twitch to slow-twitch fiber than in females (Ojo & Oladipo, 2019). More so, it has been established that muscular strength and power development improves better with fast-twitch fibers while the ratio of fibers as well as their sizes are important factors that can limit strength (Paulo, James. Maria, Rafael, Castanheira, Antonio & Martim, 2016).

The main result which this study yielded was that it is required to consider the frequency, training volume and specificity of exercises alongside the preseason training which came up thrice per week for improving strength and power among volleyball players. Training activities which include squatting and jumping were implemented in addition to regular training. The team was in their competitive season and the group consists of players from first 15 males and females. It was revealed that the leg strength and leg power of the players improved significantly on both male and female.

Conclusion

In conclusion, there was significant improvement found when comparing pre and post-test leg strength and leg power due to the influence of specific volleyball drills on the players. Also, the male players LS and LP improve better than their females' counterpart. The players who participated and were consistent at training sessions made significantly gains on the fitness tests of squat and vertical jump tests.

Recommendations

Coaches and trainers should always endeavour to equip players with exercises that would build the leg strength and leg power of the players. At the same time, volleyball players need to take maximum advantage of training activities that could help improve explosiveness in their leg strength and power.

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