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Plyometric Training on Grass Surfaces on Women's Vertical Jump in Volleyball

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Abstract

This study aim for know impact exercise plyometric on the surface grass to volleyball vertical jump daughter. Research This use method quantitative with design One-Group Pretest-Posttest Design. Sample consists of of 20 athletes Allexis club princess aged 14-16 years, with using total sampling. Subject done with One group experiment accept exercise plyometric on the surface grass. The instrument used For measure vertical jump is slapstick test/ Vertec . Data analysis in study This using SPSS 26 test. Hypothesis test results show that there is difference significant ($p<0.05$) between pre-test and post-test scores, which indicate that hypothesis study accepted. In descriptive, average score vertical jump increase from 32.15 cm in the pre-test to 35.35 cm in the post-test after undergo 12 sessions exercise plyometric during One month. This average increase show existence change positive that describes the influence of the training program provided. Therefore that, can concluded that there is significant impact exercise plyometric on the surface grass to volleyball vertical jump daughter.

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INTRODUCTION

Volleyball is an intense anaerobic sport that combines explosive movements (vertical and horizontal) with short recovery periods (T Polglaze, 1992). A volleyball match alternates between short periods (3-9 seconds) of maximal intensity and relatively long recovery periods (10-12 seconds) (T Polglaze, 1992). Therefore, physical fitness variables such as frequent sprinting, change- of-direction speed (CODS) , and anaerobic power can influence volleyball player performance (Pereira et al., 2015). In addition, cardiorespiratory endurance helps reduce recovery time after maximal intensity efforts during a total match time of approximately 60-120 minutes (T Gabbett, 2007). The vertical jump is the athlete's ability to jump as high as possible from a standing position (Bobbert, 1988). Achieving optimal performance is the goal of athletes and team coaches, but achieving it is not easy. (Kusdinar et al., 2019).

In volleyball, vertical jump is a fundamental skill that is crucial for various types of activities such as spiking, blocking and serving. (Sheppard et al., 2009). Among the physical fitness traits, the vertical jump ability of volleyball players is crucial for scoring and defending points due to the characteristics of the game (Gjinovci et al., 2017). Based on the principle of specificity training, plyometric jump training (PJT) is an essential element in a volleyball player's regular training schedule (Ramirez-Campillo et al., 2021). A systematic review showed that plyometric jump training improves the strength, agility/speed, and vertical jump performance of volleyball players (Ahmadi et al., 2021), which has the potential to assist players during match-deciding actions (serving, spiking, and blocking). (Ramirez, 2020).

Several PJT variables can be manipulated to improve the effectiveness of PJT , such as volume, intensity, and type of jumps (Sanchez-Sanchez et al., 2022). However, environmental variables, such as surface type (e.g., hard surface, sand, natural and artificial grass), should also be considered during PJT programming. (Sanchez-Sanchez et al., 2022). Among team sport athletes, the optimal surface type for PJT has not been identified. To date, few well-controlled studies have examined the potential effects of various PJT surfaces on physical fitness components and explosive performance in athletes. One study addressed the effects of surface type during PJT in volleyball players. Study This study showed the same increase in vertical jump in male volleyball players after PJT was performed on wooden and synthetic surfaces (Çımenlı et al., 2016). Another study on male volleyball players Young people observed greater vertical jump gains after 2 weeks of PJT on sand compared to hard surfaces (Silva et al., 2019). However, none of the aforementioned studies involved women. This is because the effects of PJT can be moderated by participant gender, particularly for jump-related outcomes (Suresh, 2017).

Vertical jump is a complex movement that requires coordination of several muscles of the body, arms, and legs (Charoenpanicha, 2013). It is known that each player performs more than 250 jumps in a volleyball match during five sets (Martinez, 2017). Jumping ability has been defined as one of the main factors of high performance in volleyball (Sheppard et al., 2009) . Leg muscle strength, especially for vertical jump performance , is an important element to advance the success of athletes (T. Polglaze, 1992). Volleyball requires offensive and defensive skills such as spikes, blocks, and serves that require great jumping performance (Stanganelli et al., 2008) . Players who have good jumping ability can be more effective in attacking and defending, thereby increasing the team's chances of winning (Stanganelli et al., 2008).

Philosophy plyometric exercises on the surface grass For volleyball athlete daughter ages 14-16 years focus on improvement explosion strength through cycle stretch-shortening (SSC), which mimics movement leaps and changes direction fast in volleyball , while reduce risk injury blessing absorption impact experience grass (Impellizzeri et al., 2008). Exercise This utilise characteristic more grass gentle compared to floor hard , so that reduce painful muscles and allows adaptation optimal neuromuscular function in adolescents woman who is experience growth (Silva et al., 2019). Exercise The plyometrics used include : single leg stride jump, double leg butt kick, double leg hop progression (James C. Raddliffe, 1999). Form exercise single leg stride jump This own objective For form long step which spike start can determine amount steps in the spike movement (Articulos et al., 2004). Exercise This very Good For sport whatever is needed projection good hips from movement one leg at a time take turns . Practice This For put hips with one leg so that can increase step without change posture and with correct technique (James C. Raddliffe, 1999). Then form exercise furthermore that is double leg butt kick that is Women's volleyball teams require frequent and repeated jumping, which if performed with incorrect biomechanics can put athletes at high

risk of injury. (Taylor, J.B., 2022). The athletes use exercise This as movement First with use style extension followed flexion during jump with bend joints knee For allows leg lift to on using the foot part lower (James C. Raddliffe, 1999). Form exercise final that is double leg hop progression is component important in the training program especially For strength , and height leap in sport (Gustavsson, A., 2006). For do exercise with right , step beginning use exercise gradually . Develop moreover formerly mechanism off proper and consistent takeoff and landing during practice . Then use goal or obstacle small For help develop technique stage beginning (James C. Raddliffe, 1999).

Adaptation training begins by applying physical load to the athlete's body through controlled exercise (Nurjaya, 2009). Even though training is an individual matter, it can also be done in groups so that it is more economical and encourages participants' emotions to improve their performance. (Nurjaya, 2009). It is hoped that the results of this study can provide insight and guidance for coaches and players in designing effective and efficient training programs. It is important for coaches and players to understand and implement appropriate plyometric training in training programs (Stanganelli et al., 2008). Although plyometric training has been widely used in volleyball, little scientific information is available to determine its possible benefits on various components of performance (Villarreal, 2010). With this background, this study aims to explore various plyometric training methods on grass surfaces that can be applied to improve vertical jump ability in female volleyball players. With this background, this study presents a novel approach by focusing on plyometric jump training performed on grass surfaces in adolescent female volleyball players aged 14–16 years, a population and training surface combination that has rarely been examined in previous research. This study aims to explore various plyometric training methods on grass surfaces that can be applied to improve vertical jump ability in female volleyball players.

METHOD

This study is an experimental study with a one-group pretest–posttest design that aims to analyze the effect of plyometric training on the vertical jump ability of female volleyball players. The research sample consisted of 20 people selected using a total sampling technique. Measurement of vertical jump ability was carried out using the slapstick test or Vertec (Yingling et al., 2018). Treatment in the form of plyometric training was given for 12 meetings over a period of 4 weeks (James C. Raddliffe, 1999). And data analysis using SPSS.

RESULTS AND DISCUSSION

Table 1. Descriptive Test

	N	Min	Max	Sum	Mean	Standard Deviation	Variance
pretest	20	28	36	643	32.15	2,390	5,713
posttest	20	31	40	707	35.35	2,621	6,871

Table 1. The results of the descriptive analysis showed that the vertical jump value in the pretest had an average of 32.15 cm with a range of 28–36 cm. After being given plyometric training , the posttest value increased with an average of 35.35 cm and a range of 31–40 cm. The increase in the average score indicates a positive change after treatment, thus illustrating that the training program provided has an effect on the athlete's vertical jump skills .

Table 2. Normality Test Shapiro-Wilk

	Statistics	df	Sig.	information
pretest	.961	20	.55	Normality
posttest	.963	20	.59	Normality

Table 2. The results of the Shapiro–Wilk normality test showed a significance value of 0.556 for the pretest and 0.598 for the posttest. Both values are greater than 0.05, thus concluding that the data are normally distributed. Therefore, the assumption of normality is met, and the analysis can proceed with parametric tests.

Table 3. Homogeneity test

		Levene Statistics	df1	df2	Sig.	information
pretest_ posttest	Based on Mean	.277	1	38	.602	Homogeneity
	Based on Median	.207	1	38	.652	
	Based on Median and with adjusted df	.207	1	37,598	.652	
	Based on trimmed mean	.269	1	38	.607	

Table 3. The results of the homogeneity test using Levene's Test showed that the significance values for all approaches were above 0.05, namely 0.602 based on the mean, 0.652 based on the median, and 0.607 based on the trimmed mean. Therefore, it can be concluded that the variance between the pretest and posttest data is homogeneous. This indicates that the assumption of homogeneity of variance is met, allowing the

analysis to proceed using parametric tests.

Table 4. Hypothesis testing Paired Samples Test

		Paired Differences					t	df	Sig. 2-tailed	Information
		Mean	Standard Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	pre-test - post-test	-3,200	.410	.092	-3,392	-3,008	-34,871	19	.000	significant

Table 4. The results of the hypothesis test were conducted using the Paired Sample t-Test. The analysis showed a significant difference between the pretest and posttest scores with a significance value of $p < 0.05$. Thus, the research hypothesis was accepted, namely that plyometric training on grass surfaces has a significant impact on improving vertical jump ability in female volleyball athletes.

This study aim for analyze influence plyometric exercises on the surface grass to improvement ability jump vertical volleyball athlete (Sari, 2022). This research can be a reference for coaches and athletes in designing effective training programs to improve basic technical skills in volleyball such as smash , block , and jump serve. (Abidin et al., 2024). Test results hypothesis show existence significant difference between pre-test and post-test values ($p < 0.05$), which indicates that the exercises given capable increase Power explosion muscle athletes. In general descriptively , the average vertical jump experienced improvement from 32.15 cm to 35.35 cm after 12 session training exercise in period One month (AC Fry, WJ Kraemer, 1991). Improvement This show occurrence condition neuromuscular related with utilization stretch-shortening cycle , which plays a role important in produce movement explosive on the branch volleyball , especially in spike and block techniques (Chauk, A. , & Shah, 2024). Exercise plyometric optimize ability muscle For produce strength explosive through improvement intermuscular and intramuscular coordination (Ramirez-campillo et al., 2021). Research the latest also shows that training plyometric for 4-8 weeks can increase efficiency of neural activity contraction muscles in volleyball athletes (Isanto et al., 2021).

Election surface grass as a training medium exercise give profit significant from aspect biomechanics and safety (Ahmadi et al., 2021). Other studies also show that exercise plyometric on the surface grass produce decline ground reaction force and reduce risk injury to the extremities lower compared to with surface hard like concrete (Sanchez-ottado et al., 2025). This very important For athlete daughter who has risk more ACL injuries tall (Hewett, 2017). 12- session training program in period One month used study This in line with recommendation literature stating that adaptation optimal neuromuscular can achieved in 4-6 weeks exercise plyometric with frequency exercise 2-3 times per week (Salehzadeh, K., & Ghorbanzadeh, 2015). Research latest show that minimum duration of 4 weeks required For produce significant adaptation to capabilities vertical jump volleyball athlete (Cherni et al., 2021) . Frequency consistent practice allows occurrence supercompensation effect, Where body adapt with training stimulus and produce improvement ability physique (Mukhopadhyay, 2021). Progressiveness burden proper exercise also plays a role important in prevent occurrence overtraining syndrome (Kreher & Schwartz, 2012).

Improvement vertical jump achieved in study This own high transfer effect to performance techniques volleyball specific (Young, 2006). Ability increased vertical jump will impact directly at the height contact of the ball at the time performing spikes, block effectiveness , and jump serve quality (Al., 2005). Focus research on athletes daughter give contribution important remember characteristics different physiology and biomechanics compared to athlete son (Frank, 2016) . Athlete daughter generally own difference in matter composition muscles , flexibility , and patterns activity neuromuscular that affects response to exercise plyometric (Mohamed et al., 2014) . Positive results were obtained show that training program plyometric can adapted in a way effective For athlete daughter with consider characteristics special they . Although results study show significant effectiveness , some limitation methodological need considered in interpretation results (Shah, 2012).

Limitations study this , especially No existence group control need considered in interpretation research result furthermore recommended use group more control strict For get greater efficiency strong . Research furthermore need done in term long For evaluate effect from adaptation achieved . Research furthermore more rigorous is needed for strengthen evidence effectiveness exercise plyometric on the surface grass.

CONCLUSION

Based on results research that has been performed , plyometric exercises on the surface grass for 12 sessions in 4 week period give very influential meaningful to improvement vertical jump

ability of volleyball athletes daughter from club Allexis aged 14-16 years. The training program consists of from single leg stride jump, double leg butt kick, and double leg hop progression not only succeed optimize stretch-shortening cycle for increase Power explosion leg muscles through adaptation neuromuscular and inter/ intramuscular coordination , but also utilizes superiority biomechanics surface grass that reduces ground reaction force as well reduce risk ACL injury of the extremities lower greater risk height in athletes daughter compared to son . Improvement This has a high transfer effect to performance technique volleyball specific such as spike, block, and jump serve, where the ability jump vertical become factor crucial For print points and defend , as supported by literature latest about effectiveness of plyometric jump training (PJT) in athletes team.

In a way practical , findings This give guide concrete for coach For integrate plyometric training on grass as element main fitness program , with frequency 2-3 times per week , structured warm-up-strengthening-cool-down , and progressiveness burden gradually use achieving optimal supercompensation without overtraining. Approach This proven economical For exercise group , push motivation emotional athletes , and more safe compared to surface hard like wood or concrete , in line with recommendation from review systematic latest . Although One-Group Pretest-Posttest design show strong effectiveness with normal and homogeneous data , researchers recommend study advanced with randomized controlled trial design , period observation term long (8-12 weeks), and variables addition like spike speed or block efficiency for strengthen generalization and evidence-based practice in development volleyball athlete Indonesian princess.

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