

ORIGINAL RESEARCH

Plyometrics tuck jump and single leg tuck jump exercises increase the leg power of handball athletes

Duaji Rahadyan Nursantiko¹, Djoko Pekik Irianto¹, Fitri Agung Nanda¹

¹ Postgraduate Program in Sports Science, Yogyakarta State University, Indonesia. ² Faculty of Sports Science, Yogyakarta State University, Indonesia. ³ Department of Physical Health and Recreation Education. Universitas Lampung, Indonesia.

Abstract

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In handball, good leg strength is one of the important factors that support the success of handball athletes. The purpose of this study was to determine whether plyometric exercises use the tuck jump and single leg tuck jump models to increase the leg power ability of handball athletes in Banyumas Regency. The sample in this study were 28 handball athletes in Banyumas Regency who had participated in a national scale handball competition. This study uses attribute variables to help maximize the results of leg strength training using plyometrics, namely the variable attribute strength. In this study, the measuring instrument used to measure the ability of leg strength was using a Jump MD, while the attribute variables were strength using a strength measuring instrument using a back and leg dynamometer. The results showed that there was a significant difference between plyometric tuck jump training and single leg tuck jump training on the leg power ability of athletes in Banyumas Regency. Then the strength component possessed by handball athletes produces a significant difference in influence between cross-country athletes in Banyumas Regency who have high and low strength on leg strength.

Keywords. Handball, leg power, one-foot tuck jump, plyometric, tuck jump.

Introduction

Handball is a mixed sport played by 7 against 7 people. Handball is one part of the big ball game in that the one in the field will bring together two groups, each group consisting of 7 people, one of whom is a goalkeeper. This game is done by entering the ball as much as possible into the goal. This game has similarities to the game of football but in the application of the game using hands (Dogra, 2015). Handball is a dynamic sport that is fun to play and interesting to watch. This sport uses natural athletic skills such as running, throwing, and jumping (Clanton & Dwight, 2013). Hermassi et al. (2018) Handball is an intensive form of intermittent physical activity and includes a high-intensity defense and offense that includes the complex movements and repetitions of the explosive muscle

needed to run, jump, spin, change seed, and throw the ball.

The game of handball sports requires good motor skills for it. Biomotor abilities such as leg power are important in the success of handball. In line with that, Ardian & Sifaq (2017) explained that in doing flying shoots on handball athletes, the ability of leg power and arm muscles plays an important role in the success of the movement. Leg power is one of the components that handball athletes should have. Furthermore, the ability of leg power will affect how the flying shoot ability in handball games will be (Rohman & Puriana, 2020). The ability of tungai power possessed by professional handball athletes affects how they perform in the field (Murugavel & Balaji, 2020).

Leg power is needed by handball athletes to block and score points by jumping as high as possible to get the ball into the goal. In line with that statement

✉ F. A. Nanda, e-mail: fitriagungnanda16@gmail.com

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(Firdaus et al., 2020) explain if the athlete's physical condition affects how successful the field is. Furthermore, the components of physical condition such as leg power are important factors that must be considered in handball athletes. Afif & Nasrullah, (2016) explained that leg power in handball athletes is very necessary due to jump-shoot to get the ball into the goal. Power when doing the jump-shoot technique is very important because if the athlete lacks leg power, the athlete is less able to compete when jumping.

Talking about leg power which is one of the components that handball athletes must have. There is an exercise program that includes these components, namely plyometric exercises. Plyometrics training is a specific training program to increase the correlation between maximum strength and power, which is an important component of athlete performance. Dogra, (2015) stated that plyometrics and core training are widely used as methods of developing explosive power with additional agility in sports activities. Wertheimer et al., (2018) Plyometric training is an important part of athletic conditioning with many significant benefits, including improvement in motor ability and performance, but it can also increase serum muscle index.

The plyometric exercise that is considered the best in developing both components is the tuck jump, (Khalid & Rustiawan, 2020) explained that doing the tuck jump exercise was able to provide a good increase in leg power ability. The athlete's leg power ability can improve well if plyometric exercises are carried out with the tuck jump method. Furthermore, there is an increase in the ability of leg power among athletes who are trained using tuck jumps (Jaya & Rohmat, 2019). Pembayun et al., (2018) revealed that the single leg tuck jump exercise was able to increase the ability of leg power. Thoiban & Tohidin, (2019) explained that in order to improve the ability of leg power, it is expected to involve a plyometric exercise program using a single leg tuck jump. Furthermore, it was explained that the exercise method gave different results between those who were given treatment and those who were not given treatment on the ability of leg power.

Talking about leg power which is one of the components that must be owned by handball athletes, the problems found by researchers when conducting a survey are that they are not maximized or are still included in the low category of leg power abilities of handball athletes in Banyumas Regency. So, the author wants to do research on the

plyometric tuck jump and single leg tuck jump exercises that are considered the best to increase leg power abilities. Researchers also want to combine the two training methods regarding the tuck jump and single leg tuck jump training methods together to increase the leg power of athletes in Banyumas Regency. This research is a novelty in plyometric research, this is because the previous research only focused on one exercise on the results of leg power.

This research is considered important because there are still limited research results that reveal how the plyometric tuck jump and single leg tuck jump exercises when applied simultaneously in increasing leg power. The aim of this research is to see the exercise of both of the leg power abilities of handball athletes in Banyumas Regency. The selection of Banyumas Regency was based on not being maximized so that there was a need for renewal and the application of additional training methods so as to be able to provide maximum results for the success of Banyumas Regency handball sports.

Methods

Types of Research

The type of research used in this research is quasi-experimental. This quasi-experimental study uses factorial which will be tested based on the results carried out twice including the results of the pretest and posttest.

Research Sample

The research population was all Handball athletes in Banyumas Regency. However, those who met the criteria for being sampled were 28 handball athletes from Banyumas Regency. Sample selection was done through purposive sampling. One of the requirements included in the sample selection is the Banyumas Regency athlete in the handball sport who has competed at the National level.

Research Procedure

This study uses one manipulative independent variable, namely the plyometrics tuck jump exercise and the single leg tuck jump plyometrics exercise which were trained in 16 sessions. In the distribution given 3 times a week there is an increase in repetitions and sets for each type of

exercise in the second and fourth weeks to increase the number of foot contacts and experience a decrease in repetitions and sets in the sixth week as listed in Table 1 and Table 2.

While the dependent variables (dependent) in this study were leg power and agility of handball athletes in Banyumas Regency. This study also used the strength attribute as a measure of how the plyometric exercise affects leg power. The strength attribute was used to determine whether the strength score possessed by the athlete affects the leg power trained using the plyometric model.

Research Instruments

In its implementation, the research uses a test instrument for measuring leg power using Jump MD

while the attribute variable, namely strength, uses a strength test instrument using a back and leg dynamometer.

Results

Based on the results of statistical analysis regarding the tuck jump and single leg tuck jump training methods to improve leg power ability using two-way analysis calculations ANOVA reveal 3 things obtained in the field, namely, the influence of the two training methods on leg power, is there any influence of high and low strength possessed by athletes on leg power and lastly is the interaction of the strength trained using these two methods on leg power.

Table 1
Pre-test and post-test.

Weeks	Latihan Plyometric Tuck Jump					
	Intens	Rep	Recv	Interval	Vol	Frek
PRETEST						
1	Intens	Rep	Recv	Interval	Vol	Frek
	Maxs	3x / set	1 : 5	2 Sec	2 Set	3x / mgg
2	Maxs	4x / set	1 : 5	2 Sec	3 Set	3x / mgg
3	Maxs	4x / set	1 : 4	2 Sec	3 Set	3x / mgg
4	Maxs	5x / set	1 : 4	2 Sec	4 Set	3x / mgg
5	Maxs	5x / set	1 : 4	2 Sec	4 Set	3x / mgg
6	Maxs	3x / set	1 : 4	2 Sec	3 Set	3x / mgg
POSTTEST						

Table 2
Pre-test and post-test.

Weeks	Latihan Plyometric Single Leg Tuck Jump					
	Intens	Rep	Recv	Interval	Vol	Frek
PRETEST						
1	Intens	Rep	Recv	Interval	Vol	Frek
	Maxs	3x / set	1 : 5	2 sec	2 Set	3x / mgg
2	Maxs	4x / set	1 : 5	2 sec	3 Set	3x / mgg
3	Maxs	4x / set	1 : 4	2 sec	3 Set	3x / mgg
4	Maxs	5x / set	1 : 4	2 sec	4 Set	3x / mgg
5	Maxs	5x / set	1 : 4	2 sec	4 Set	3x / mgg
6	Maxs	3x / set	1 : 4	2 sec	3 Set	3x / mgg
POSTTEST						

A. Plyometrics tuck jump and single leg tuck jump practice on leg power ability

According to analyses, it was found that there was a significant effect of both exercises on leg power ($F=70.213$; $p=0.013$). Based on the results of the analysis, it turns out that the single leg tuck jump exercise and also the single leg tuck jump simultaneously can provide an increase in the leg power ability of handball athletes in Banyumas Regency with a posttest difference of 2.21 cm.

Table 3

ANOVA results of plyometrics tuck jump and single leg tuck jump exercise groups on leg power ability.

	Sum of Squares	df	Mean Square	F	p
Plyometric Exercises	10.745	1	10.745	70.213	0.013*

* $p<0.05$

B. There is an influence between athlete strength variables on pulling power

The results regarding the plyometric tuck jump and single tuck jump exercises affect leg power skills, further analyzed is the strength possessed by high or low athletes affects leg power. This means that strength as an attribute variable conveys whether the varied strength possessed by athletes if trained using this method affects the leg power ability of handball athletes in Banyumas Regency. The results of the calculations are presented in Table 4. Based on the results of the analysis carried out in table 2 above, it is known that the p value was 0.000 and the F is 83.627. It means that there was a significant difference between handball athletes in Banyumas Regency who had strength attribute variables on leg power. Athletes who had high strength produce better leg power than low strength athletes.

Table 4

Results of ANOVA differences in high strength and low strength on leg power.

	Sum of Squares	df	Mean Square	F	p
Strength	430.475	1	430.475	83.627	0.000*

* $p<0.05$

C. Interaction between plyometrics tuck jump and single leg tuck jump exercises with high and low strength on leg power

After obtaining the results which revealed that there were differences in the results of the leg power of athletes who had low and high strength when trained using plyometrics with the tuck jump and single leg tuck jump training models. Furthermore, it will be seen how the interaction of the two on the athlete's leg power ability. The results are presented in Table 5. It is known that the p value was 0.000 and the F value was 19.066. There was a significant interaction between plyometrics tuck jump and single leg tuck jump exercises with high and low strength associated with high and low strength athlete's leg power on the handball athlete's leg power in Banyumas Regency. The graph of the interaction results between the plyometrics tuck jump and single leg tuck jump exercises with low and high strength was presented in Figure 1.

Table 5

Results of ANOVA interaction between plyometrics tuck jump and single leg tuck jump exercises with high and low strength against limb power.

Variable	Sum of Squares	df	Mean Square	F	p
Exersice	30.752	1	30.752	19.066	0.001*

* $p<0.05$

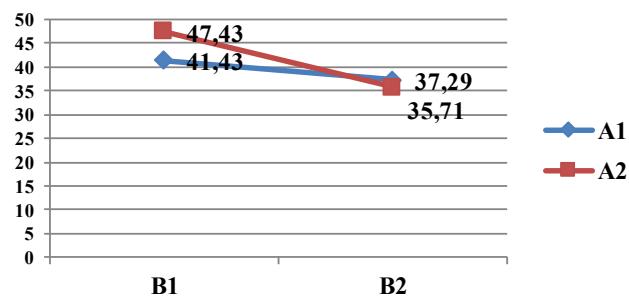


Figure 1. The leg power values.

The results of the analysis revealed that there was an interaction produced by the plyometrics tuck jump and single leg tuck jump exercises with low and high strength on leg power. The next step is to carry out the Tukey Test, the exposure of the test results is presented in Table 6.

Table 6

Summary of Post Hoc test results.

Group	Interaction	Mean Difference	p
A1B1	A2B1	-6.0000*	0.000
	A1B2	4.1429*	0.012
	A2B2	5.7143*	0.001
A2B1	A1B1	6.0000*	0.000
	A1B2	10.1429*	0.000
	A2B2	11.7143*	0.000
A1B2	A1B1	-4.1429*	0.012
	A2B1	-10.1429*	0.000
	A2B2	1.5714	0.583
A2B2	A1B1	-5.7143*	0.001
	A2B1	-11.7143*	0.000
	A1B2	-1.5714	0.583

The results of the analysis through the Tukey test have an asterisk sign (*) revealing that there were pairs that have significantly different interactions or pairs, namely: (1) A1B1-A2B1, (2) A1B1-A1B2, (3) A1B1-A2B2, (4) A2B1 -A1B2, and (5) A2B1-A2B2, while the other pairs stated to have no difference in influence are: (1) A1B2-A2B2.

Discussion

Based on the results of the analysis carried out, it was found that the leg power of handball athletes in Banyumas Regency experienced a good increase by being given training using the plyometric tuk jum and single leg tuk jump models. Furthermore, it was also revealed that the strength attribute variables possessed by athletes affect the maximum in getting maximum results in doing leg power with plyometric training models. These results are expected to be able to make a reference or theoretical basis to find out how the leg power ability of each handball athlete can then be carried out by plyometric training models in implementing or making training programs.

The results obtained when associated with several previous literature studies have similar results which reveal that the plyometric training model of the tuk jump and single leg tuck jump affects the ability of leg power. Anwar et al. (2020) explained if the knee tuck jump exercise affects the results of the exercise using a strength barrier against the leg power of futsal players at SMAN 3 Banjarmasin. It was further explained if there were

results of leg power between futsal players who were trained using the plyometric tuck jump model and those who did not. Saputra et al. (2019) revealed that there is a significant effect caused by box jump, burpee and tuck jump exercises to increase leg muscle power and speed as seen from the paired t-test sample and there is a significant difference in the effect between exercise and box jump, burpee and tuck jump increase leg muscle strength and speed.

Indrayana (2018) revealed that the tuck jump exercise was able to improve smash in volleyball games related to jumping ability and leg power. Lindblom et al. (2021) explained that training using tuck jumps can improve the athlete's ability to perform leg power. It was further revealed that the tuck jump exercise was able to relieve knee injuries experienced by athletes even though they were still carried out in different portions and were still under supervision. Exercise using the tuck jump is well applied in an exercise program. 12 weeks of core stability training provided marked improvement in tuck jump kinematics in young soccer players with dysfunction (Saber et al., 2021).

Mcghie et al. (2018) revealed that jumping ability is an important thing that greatly affects handball athletes when attacking, tuck jump training is able to increase leg power in handball athletes. There is an increase in the ability of handball athletes due to the effect of plyometric and jumping exercises on physical performance in young male handball players (Mazurek et al., 2018). Saparia (2020) revealed that plyometric exercises which include the tuck jump model are able to increase the leg power of volleyball athletes which have an effect on the good results of volleyball athletes' smashes compared to plyometric exercises that have not been applied. The jumping ability possessed by basketball and handball athletes affects how they perform in the field, this is very good if training is needed to strengthen leg power (Barrera-Domínguez et al., 2021).

Singh et al. (2019) explained that if plyometric exercises using the single tuck jump model were applied together with sprint training, they could have a good effect on the appearance of handball athletes. It is further explained that these two components affect the performance of athletes. Arunsankar et al. (2020) explained that if the exercise to improve jumping ability was better using the plyometric model of the tuck jump, it significantly affected how the athlete's leg power results in the field. Plyometric training and stationary training programs have a statistically

significant effect in developing the selected criterion variables, namely the ability of power and speed in athletes (Joseph & Praveen, 2019). Plyometric exercises are good for large ball sports such as volleyball, basketball and handball. Big ball games require strength to make jumps. Therefore, volleyball and basketball games require both horizontal and vertical components (Dharani et al., 2020).

Conclusion

The conclusion that can be drawn based on the results of the analysis carried out is that there is a significant difference between the plyometrics tuck jump and single leg tuck jump exercises on the leg power ability of handball athletes in Banyumas Regency. Then the strength component possessed by soccer athletes affects the results of leg power for handball athletes in Banyumas Regency. Strength athletes who have strength in the high category have better leg power than athletes who have strength in the low category. Then the resulting interaction has a significant effect between plyometrics tuck jump and single leg tuck jump exercises with high and low strength on the leg power of handball athletes in Banyumas Regency. The results of the study are expected to be able to make references or references for trainers to include plyometric training models in improving leg power abilities. This study has limitations, namely the sample is only in Banyumas Regency, it is hoped that further research can cover a more diverse sample and include other plyometric exercise models.

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