

## Dynamic Stabilization Exercises Leg Press and Single Leg Straight Deadlift with Medicine Ball Can Improve Leg Muscle Strength and Balance

### Ejercicios de estabilización dinámica Prensa de piernas y peso muerto recto de una sola pierna con balón medicinal pueden mejorar la fuerza y el equilibrio de los músculos de las piernas

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**Abstract.** This study aims to analyze the effect of dynamic stabilization exercises single leg press and single leg straight deadlift with the medicine ball on leg muscle strength and balance. This type of research is quasi-experimental with a matching only design. A total of 36 men with an average age of 16 years and an average BMI of 19-20 kg/m<sup>2</sup> participated in this study. The inclusion criteria in this study were being male and willing to take part in the training program provided. The exclusion criteria in this study were subjects who were overweight. Subjects were divided into 2 groups, namely the press leg dynamic stabilization group and single-leg deadlift dynamic stabilization group. The treatment was given for 8 weeks 3 times in 1 week. The results of this study reported that there was a significant difference between the pre-test and post-test in all groups (K1 and K2) ( $p < 0.05$ ). It can be concluded that leg press and single leg straight deadlift exercises with a Medicine Ball can improve strength and balance. We recommend that these exercises be included in the exercise program. Future research suggests combining various training programs with varying ball sizes.

**Keywords:** Exercise, stabilization, leg press, single leg deadlift, medicine ball strength.

**Resumen.** Este estudio tiene como objetivo analizar el efecto de los ejercicios de estabilización dinámica, press con una sola pierna y peso muerto recto con una sola pierna con balón medicinal sobre la fuerza y el equilibrio de los músculos de las piernas. Este tipo de investigación es cuasiexperimental con un diseño de sólo emparejamiento. En este estudio participaron un total de 36 hombres con una edad promedio de 16 años y un IMC promedio de 19-20 kg/m<sup>2</sup>. Los criterios de inclusión en este estudio fueron ser hombre y estar dispuesto a participar en el programa de formación impartido. Los criterios de exclusión en este estudio fueron los sujetos con sobrepeso. Los sujetos se dividieron en 2 grupos, a saber, el grupo de estabilización dinámica de prensa de piernas y el grupo de estabilización dinámica de peso muerto con una sola pierna. El tratamiento se administró durante 8 semanas 3 veces en 1 semana. Los resultados de este estudio informaron que hubo diferencia significativa entre el pretest y postest en todos los grupos (K1 y K2) ( $p < 0,05$ ). Se puede concluir que los ejercicios de prensa de piernas y peso muerto recto con una sola pierna con balón medicinal pueden mejorar la fuerza y el equilibrio. Recomendamos que estos ejercicios se incluyan en el programa de ejercicios. Investigaciones futuras sugieren combinar varios programas de entrenamiento con diferentes tamaños de pelota.

**Palabras clave:** Ejercicio, estabilización, prensa de piernas, peso muerto a una pierna, balón medicinal, fuerza.

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## Introduction

To achieve maximum performance an athlete needs to train optimally. The aspects that are considered to achieve achievement are physical, technical, tactical, and mental conditions (Berduszek et al., 2021). Athletes who have good physical qualities tend to have a better quality movement or motor skills (Komaini et al., 2022). Physical aspects as the basis for achievement in sports such as cardio-respiratory endurance, muscle endurance, muscle strength, flexibility, speed, muscle explosive power, agility, balance, coordination, and accuracy are the elements needed in most sports, including sports athletics (Farley et al., 2020). When exercising, each limb has an important role in the effectiveness of the movements carried out, especially in the speed of time taken according to the distance and number of performances, besides that it is also influenced by the dominant physical component that the athlete must have in accordance with the concept of the problem, namely stabilization and strength (Cronin & Hansen, 2005). Stabilization in all sports is very necessary because if a person does not have low or less stabilization, he will be easily distracted by combinations that come from outside (Colcuc et al., 2022). Strength is one of the basic biomotor components needed in every sport (Mallard et al., 2021). To be able to

achieve optimal performance, strength must be increased as the underlying foundation in the formation of other biomotor components.

Strength as the underlying foundation in the formation of biomotor components requires important physical components in order to achieve optimal performance, one of which is leg muscle strength, because most sports require leg muscles in their movements, for example for the athletics branch in running and jumping, volleyball, basketball, football and so on, leg muscles play a major role in success in various sports (Ishida et al., 2020). One theory has been that the lower extremities are especially important because much greater muscle strength is seen in the lower extremities compared to the upper extremities (Ramari et al., 2020). Several studies have shown that reduced lower extremity muscle strength, especially in the weaker leg, negatively impacts walking, balance and sit-to-stand performance (Abramson et al., 2018; Bowser et al., 2015; Callesen et al., 2019). To improve and develop an athlete's physical condition, regular and structured training is needed to produce maximum results (Rueggsegger & Booth, 2018). In the current phenomenon, we analyze that there are several factors that can hinder when doing sports, to be able to do that requires muscle strength for adolescents and junior athletes to introduce stabilization movements that

lead to loading movements. If an athlete who is still a teenager is given too early a load will inhibit the growth and development of the athlete.

It is necessary to find alternative solutions to overcome these problems. In this case, a stabilization training method is needed because the stabilization method can increase movements that resemble loading movements. One type of exercise that can be used is the leg press and single leg deadlift (Corrales et al., 2006; Migliaccio et al., 2018). The leg press is a movement pushing a weight or obstacle using the legs (Migliaccio et al., 2018). Previous research has reported that the leg press can be used to evaluate lower body strength from the gluteus maximus to the gastrocnemius muscles. (Gentil et al., 2020). Meanwhile, the leg deadlift is a movement that aims to strengthen the strength of the hip and leg muscles (Coratella et al., 2022). Furthermore, in this regard, medicine balls can be used as additional media to support training programs (Faigenbaum et al., 2018). Several studies have reported that weight training in the form of leg press and deadlift exercises has been widely used to increase hypertrophy and muscle strength (Schoenfeld et al., 2021). However, until now it has not been reported that single leg deadlift dynamic stabilization exercises with a medicine ball can increase leg muscle strength and balance.

This study aims to analyze the effect of dynamic stabilization exercises single leg press and single leg straight deadlift with the medicine ball on leg muscle strength and balance.

## Materials and Methods

### Study Design

This type of research is quasi-experimental with a matching-only design. Subjects were divided into 2 groups, namely group (K1) with dynamic stabilization of the pressing leg with medicine ball and group (K2) with dynamic stabilization of single-leg deadlift with medicine ball

### Subjects

A total of 36 men with an average age of 16 years and an average BMI of 19-20 kg/m<sup>2</sup> participated in this study. The inclusion criteria in this study were being male and willing to take part in the training program provided. The exclusion criteria in this study were subjects who were overweight.

### Procedure

Before the research began, the researcher gave an explanation of the purpose and intent of the research as well as filled out and submitted an informed consent form by the research sample. Subjects were divided into 2 groups, namely group (K1) with dynamic stabilization of the pressing leg and group (K2) with dynamic stabilization of single-leg deadlift. The treatment was given for 8 weeks 3 times in 1 week. Before being given treatment, pre-test data were collected for leg muscle strength and balance, after being given

treatment for 8 weeks, post-test data were collected for leg muscle strength and balance. Measurement of muscle strength was carried out using a leg dynamometer and measurement of balance using a balanced one.

## Exercise Program

Table 1.  
Exercise Program.

Exercise	Stage	Activity	Repetition	Set	Recovery between Sets (Second)
Stabilization exercises Leg Press with medicine ball	Stretching	Stretching			
	Exercise	Stabilization exercises Leg Press with medicine ball with medicine ball	10	4	60
	Colling Down	Walk			
Single leg straight deadlift with medicine ball	Stretching	Stretching			
	Exercise	Single leg straight deadlift with medicine ball	10	4	60
	Colling Down	Walk			



Figure 1. Stabilization exercises Leg Press with medicine ball.



Figure 2. Single leg straight deadlift with medicine ball.

## Statistical analysis

Statistical analysis in this study used the IBM SPSS version 27 application, a descriptive test was performed to obtain the mean dan standard deviation. Furthermore, the normality test was carried out using the Shapiro-Wilk method, if the data were normally distributed the different test was carried out using the paired t-test, but if the data was not normally distributed, the difference was carried out using the Wilcoxon signed rank test.

## Ethics

Declared to be ethically appropriate in accordance to 7 (seven) WHO 2011 Standards, 1) Social Values, 2)

Scientific Values, 3) Equitable Assessment and Benefits, 4) Risks, 5) Persuasion/Exploitation, 6) Confidentiality and Privacy, and 7) Informed Consent, referring to the 2016 CIOMS Guidelines. This is as indicated by the fulfillment of the indicators of each standard. Declaration of ethics was approved by the Health Research Ethics Committee of the Politeknik Kesehatan Kemenkes Malang with registration number (No.DP.04.03/F.XXI.31/0086/2024).

## Results

Data on the characteristics of the research subjects are shown in Table 1. The results of the leg muscle strength test are presented in table 1 and Figure 3.

Table 2. Characteristics of research subjects

Data	Group	N	$\bar{x} \pm SD$	Shapiro-Wilk	p-value
Age	K1	18	16.94±0.80	0.002	0.499
	K2	18	16.77±0.80	0.001	
Height	K1	18	164.83±3.12	0.012	0.426
	K2	18	165.16±2.77	0.049	
Weight	K1	18	54.72±5.53	0.472	0.901
	K2	18	54.50±4.47	0.734	
Body Mass Index (BMI)	K1	18	20.13±1.94	0.833	0.756
	K2	18	19.95±1.51	0.637	

Table 3. Mean Data and Standard Error of Muscle Strength

Data	Group	N	$\bar{x} \pm Std Error$
Muscle Strength	K1 (Pre-test)	18	97,90±0.45
	K1 (Post-test)	18	104,17±0.33
	K2 (Pre-test)	18	97,83±0.23
	K2 (Post-test)	18	104,09±0.24

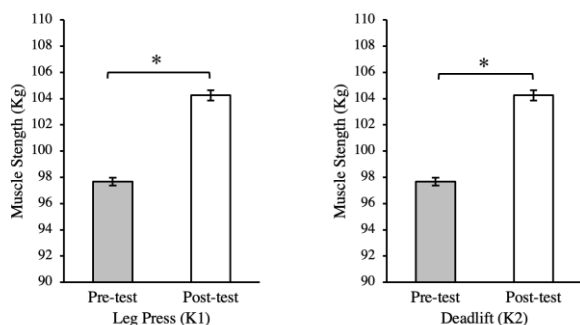


Figure 3. Group (K1) with stabilization exercises Leg Press and group (K2) with single leg straight deadlift were able to significantly increase muscle strength (\* $p < 0.05$ ). Data are presented as Mean and Std Error. P values were obtained using paired t-tests to compare the pre-test and post-test of each group.

The results of the Balance test are presented in Table 1 and Figure 4.

Table 4. Data Mean and Standard Error Balance

Data	Group	N	$\bar{x} \pm Std Error$
Balance	K1 (Pre-test)	18	36,25±0.22
	K1 (Post-test)	18	41,17±0.25
	K2 (Pre-test)	18	36,10±0.18
	K2 (Post-test)	18	41,12±0.16

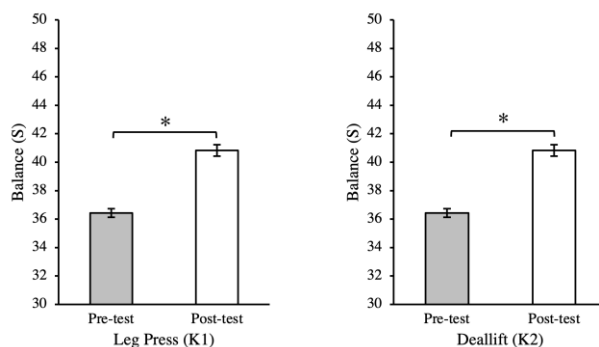


Figure 4. Group (K1) with stabilization exercises Leg Press and group (K2) with single leg straight deadlift were able to significantly increase balance (\* $p < 0.05$ ). Data is presented as Mean and Std Error. P values were obtained using paired t-tests to compare the pre-test and post-test of each group.

## Discussion

Based on the research results, it was reported that leg press stabilization and single straight leg deadlift stabilization had a significant effect on increasing leg muscle strength and balance. However, in this case we did not find any significant differences between each group. The results of this study reported that the leg press training group and single-straight leg deadlift stabilization using a medicine ball and the control group had a significant difference in effect on increasing leg muscle strength and balance ( $p < 0.05$ ).

Leg press and single-straight leg deadlift stabilization exercises are types of exercise that aim to increase strength, especially in the leg muscles (Orssatto et al., 2018). Strength, as the underlying basis for the formation of biomotor components, requires important physical components in order to achieve optimal performance (Ramari et al., 2020). The leg press and single-straight leg deadlift stabilization exercises are training methods that use weights (Martín-Fuentes et al., 2022). Physiologically, a theory reports that the more muscle fibers that work, the more the body's nervous system and biochemistry will develop, so that the greater the muscle strength exerted, the more physical elements will increase (Plotkin et al., 2021). In this regard, the single straight deadlift movement with a medicine ball will cause a heavier load because of the external load and your own body weight so that the single leg straight deadlift exercise is more difficult because of the squatting process, while the leg press exercise focuses on the middle part of the load given. Furthermore, the results of this study are supported by a study which reported that medicine ball exercise for 6 weeks was effective for improving balance (Yu et al., 2017). In this regard, because this exercise uses weights and affects muscle strength, this exercise is considered effective for dynamic balance abilities.

In short, this research reports that leg press and single straight leg deadlift stabilization exercises are types of weight training that can improve strength and balance. Strength as the underlying basis for the formation of biomotor components requires important physical components to achieve optimal performance. In this study there were limitations even though it consisted of several

exercise programs to improve strength and balance. Therefore, further research is recommended to carry out a combination of various training programs with varying ball sizes.

## Conclusion

Leg press and single leg straight deadlift exercises with a Medicine Ball can improve strength and balance. We recommend that these exercises be included in the exercise program. Future research suggests combining various training programs with varying ball sizes.

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