

Research Article

The Effect of Strengthening Ball Roll Exercise on the Static Balance and Flexibility in Children with Flatfoot at 4-6 Years

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Abstract.

Flatfoot is a condition in which part or all of the soles of the feet do not form an arch (longitudinal arch) as normal so that the soles of the feet appear flat and touch the ground. This condition makes the function of the soles of the feet as shock absorbers and as a support for body weight during activities, cannot work properly. This greatly affects the development of body components, including flexibility and balance. Flexibility and balance are needed when a person is active, especially at the age of 2-6 years which is a golden age in determining future growth and development. Pathology in the form of weak extrinsic muscles of the foot which makes the midtarsal joint unstable so that the foot looks pronated, besides that there is tension in the ligaments in the foot. Measurements of the wet footprint test, Clarke's angle, Knee to Wall Test, and stork stand test. Strengthening ball roll exercises increased extrinsic muscle strength, and the application of rolling the ball can relax muscles that are experiencing tension.

Keywords: Flat Foot, Flexibility, Static Balance, Strengthening Ball Roll Exercise

1. INTRODUCTION

In general, the arch of the foot will be formed from the first 5 years of life with an age range of 2-6 years when it begins to enter the walking phase and the anatomy of the foot also begins to develop, where the age of 6 years has entered a critical period in the formation of the foot arch. The presence of weakness of the intrinsic muscles of the foot is one of the causes of the medial longitudinal arch to become flat in the weight-bearing position (1,2)

The loss of the arch of the foot is caused by several factors, such as weakness in the supporting structures of the medial longitudinal arch, namely the intrinsic muscle group of the foot, the plantar ligament, and the anterior and posterior tibial tendons. Whole-body hypermobility may be associated with increased dorsiflexion of the ankle with

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flatfoot (3,4). The relationship between foot pronation and joint flexibility may need to be considered in children with flat foot symptoms. This study from Hawke, Rome, & Evans, found a strong agreement between lower leg and full body flexibility, and moderate strength agreement between ankle flexibility with lower leg flexibility and whole body ankle flexibility and other possible flexibility measures. caused by the functional demands placed on the calf muscles in gait, which differ between children depending on their gait (e.g., increased demand and the likelihood of subsequent calf tension in gait) children with a more pronated foot type exhibit limb flexibility lower and the whole body is larger (5)

In children with flat feet, treatment should be carried out as early as possible so that the arches can still be repaired by handling strengthening exercises which are muscle strengthening exercises, where strengthening exercises for conditions on flat feet are carried out on the feet and also the toes. Ball roll exercise can relieve tension and relax the tight ligaments on the bottom of the foot (6)

Strengthening ball roll exercise is a strengthening exercise that uses a tennis ball on the sole of the foot which functions to relax muscles and ligaments, and can shape the arch of the foot so that it can improve static balance. Based on previous research, it also explained that strengthening ball roll exercise on intrinsic muscles can increase the stability and strength of leg muscles, as well as increase proprioceptive stimulation so that it can maintain a body position in equilibrium (6).

2. MATERIALS AND METHODS

The research instrument used the wet foot print test and Clarke's Angel to determine the condition of the flat foot, and the Stork Stand Test to measure the static balance of the respondents. Flexibility measurement using the knee to wall test and stork stand test to measure static balance in respondents. Test the normality of the data using Shapiro Wilk. The effect test uses a paired t test based on data that is normally distributed.

This study uses a pre-experimental design by comparing the post-test and pretest, the variable is a strengthening ball roll exercise that acts as a variable independence and ankle flexibility as dependent variable.

In this study the sampling technique used was purposive sampling where samples were selected based on predetermined inclusion and exclusion criteria.

1. Inclusion Criteria

- (a) Friends of Ananda Dau KB students aged 4-6 years.

(b) KB Sahabat Ananda Dau students who have flat feet based on the wet foot print test.

(c) Sailors who experience balance disorders based on the Stork Stand Test.

2. Exclusion Criteria

(a) Children who experience leg injuries during the examination.

(b) Children who do not get permission from parents/guardians.

3. Drop Out Criteria

(a) Respondents who did not attend the training session 3 times

(b) Respondents experienced injuries during research.

3. RESULT

3.1. Characteristics By Age

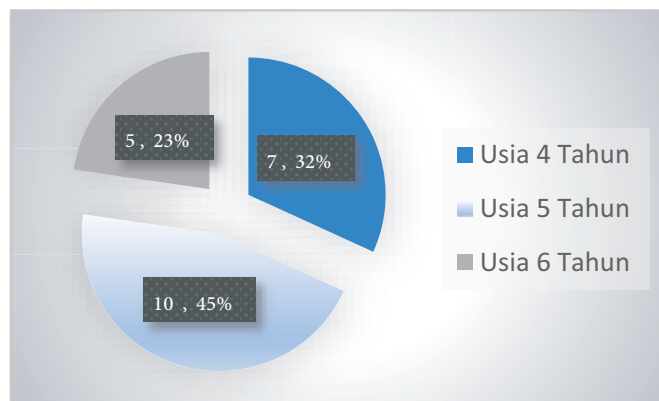


Figure 1

From the first chart, in this study, there were more respondents aged 5 years old than 4 years old and 6 years old.

3.2. Characteristics By Gender

From the second chart, it can be seen in this study that there are more girl respondents than boys

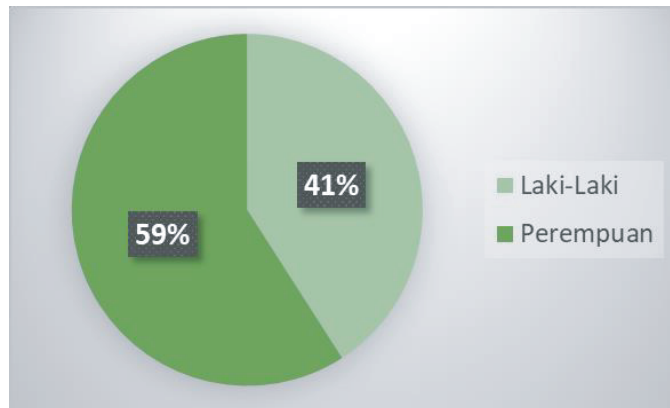


Figure 2

TABLE 1

Variabel	Mean	Median	Modus	Difference before after
Pre test	5.41	5.50	6	0,82
Posttest	6.23	6.00	6	

3.3. Result Of Flexibility

From the results of the above flexibility measurement using the Knee to Wall Test. Where the measurement procedure is carried out by measuring the flexibility of the ankle with the knee touching the wall alternately. An increase in ankle flexibility was found after strengthening the ball roll exercise for 1 month.

3.4. Result Of Static Balance

TABLE 2

Group	N	Mean	The difference between the right and left feet
Right Foot PreTest	22	12,40	7,65
Right Foot PostTest	22	20,05	
Left Foot PreTest	22	12,77	7,08
Left Foot PostTest	22	19,85	

From the results of the above static balance measurements using the stock balance test. Where the measurement procedure is carried out in a stable standing position on one leg and the time is measured for how long it can last. There was an increase in static balance on the right and left legs after strengthening ball roll exercise for 1 month.



Figure 3

3.5. Result Normality Test

TABLE 3

	Kelompok	n	p	\bar{x}
Knee To Wall Test	Pre test	22	0,051	0,05
	Post test	22	0,372	0,05

The results of the normality table using the Shapirowilk test on 22 respondents showed significant pre-test-post results were normally distributed

3.6. Result Comparasion Test

TABLE 4

Group	n	df	P (Sig)	α	t_{value}	t_{table}
Flexibility	22	21	0,000	0,05	7.483	1.72074
Static Balance	Right Foot		0,003		3.405	
	Left Foot		0,010		2.832	

The results of the data table of the effect of strengthening ball roll exercise using the paired sample t-test on 22 respondents obtained a significant pre-test-post-test value on flexibility of 0.00, and 0.003 and 0.010 on static balance. It can be concluded that strengthening ball roll exercise is effective in improving flexibility and balance in children aged 4-6 years with flatfoot

4. DISCUSSION

4.1. Analysis Based On The Flexibility

Analysis of the Effect of Flexibility Before and After Giving Strengthening Ball Roll Exercise in this study had a positive effect on increasing muscle strength and also flexibility in the legs. Strengthening Exercise can refer to the contractile tissue in the muscles to be able to produce tension and resultant force in the muscles which have an impact on arc changes and biomechanical changes (7).

In this study using strengthening of the leg muscles, especially the intrinsic muscles of the foot and the movement in the Strengthening ball roll exercise by rolling a tennis ball on the sole of the foot, a very simple and easy movement to do so it can be done anywhere. The movement in the strengthening ball roll exercise can cause a blood supply in the body so that it can increase so that it will bring nutrients to the feet and also the soles of the feet and the pressure generated when rolling a tennis ball on the soles of the feet repeatedly can relax muscles that experience tension and stiffness. which can increase flexibility in the feet and can also form arches in the soles of the feet (6)

4.2. Analysis Based On Static Balance

Intrinsic foot muscle weakness that occurs in flatfoot children results in overpronation of the ankle when supporting body weight. Changes that arise from foot alignment experiencing excessive pronation place a burden on the muscle groups in the knee and leg areas that have to work harder to keep the body in a stable position. Then the femur and tibia will undergo internal rotation which triggers the alignment of the hip to shift anteriorly by about 10° . If there is a change in these body components, the COG (Center of Gravity) will also change so that it can cause static balance to be disturbed. This COG has a function that will evenly distribute body mass to the Base of Support so that the body is in a balanced state (8,9).

In overcoming muscle weakness to improve body balance, stimulation is given to the components controlling the balance, such as giving strengthening exercises to muscles that experience weakness, one of which is the strengthening ball roll exercise. Strengthening ball roll exercise is a form of leg strengthening exercise that uses a tennis ball as the training medium. The tennis ball is placed under the sole of the foot which is then pressed and rolled for 2 minutes, and alternated on the other side. The pressure

generated when rolling the ball repeatedly will help relax muscles and ligaments that are experiencing stiffness, and can form arches in the feet (6). In addition, repeated training and contractions will also cause muscle fibers to enlarge, so muscle strength increases so that they are able to maintain balance (7).

5. CONCLUSION

The results of this study are increased flexibility and dynamic balance after being given strengthening ball roll exercise for 1 month in children aged 4-6 years with suspect flat foot. This study was conducted at the age of 4-6 years because at that age is a critical period for the formation of the arch of the foot. Early detection is carried out so that early intervention is carried out, so that the bad risk of flatfoot disorders can be suppressed.

Strengthening ball roll exercise is a form of leg strengthening exercise that uses tennis balls as a training medium. The tennis ball is placed under the sole of the foot which is then pressed and rolled for 2 minutes, and is carried out alternately on the other side.

The pressure generated when rolling the ball over and over again will help relax the muscles and ligaments that are experiencing stiffness, and can form the arch of the foot.

The movement of the strengthening ball roll exercise can increase the blood supply in the body so that it will bring nutrients to the feet and also the soles of the feet and the pressure generated when rolling a tennis ball on the soles of the feet repeatedly can relax muscles that experience tension or stiffness. which can increase the flexibility of the feet and can also form an arch in the sole of the foot. In addition, repeated exercises and contractions will also cause muscle fibers to enlarge, so that muscle strength increases so that they are able to maintain balance.

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