

Original Research

Sandsack Physical Activity Increasing Balance Score in Children with Down Syndrome

Aniek Puspitosari^{1*}

¹Department of Occupational Therapy Poltekkes Kemenkes Surakarta, Indonesia

ABSTRACT

Background: Down syndrome children have motoric and balance problems. Balance problems cause the child to be unable to maintain posture. Physical activity effective to stimulate development motor skills and balance in children. Sandsack physical activity can be applied to optimizing balance in children with down syndrome. The aim of the study was to investigate the effect of sandsack physical activity on balance in children with Down Syndrome.

Methods: Quantitative research with pre-experimental research design one group pretest-posttest with a sample size of 13 children with Down syndrome in SLBN Surakarta. Eight sandsack physical activity models are provided in each session. Four sandsack physical activity models per sessions. Balance is measured by sixteen balance test before and after 12 section. The data analysis method uses a paired sample t-test of SPSS.

Results: Paired sample t-test results showed that sig. (2-tailed) < 0.05. The increase in the balance score occurred after being given the sandsack physical activity intervention (mean difference of 6.39). Sandsack physical activity intervention have a positive and significant effect on balance in Down Syndrome children ($p = 0.001$). Most of Down Syndrome children in SLBN Surakarta were male (53.8%). Down Syndrome children in SLBN Surakarta is dominated at the age of 8 and 14 years old (23.1%). BMI score of Down syndrome children in SLBN Surakarta was 15.50 (15.4%).

Conclusion: Sandsack physical activity intervention affects the balance in Down Syndrome children. Sandsack physical activity improved balance in children with Down Syndrome and should be applied in conjunction with physical and occupational therapy programs.

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CONTACT

Aniek Puspitosari

✉ aniekpspitosari@gmail.com

Department of Occupational Therapy Poltekkes Kemenkes Surakarta, Jln. Letjen Sutoyo, Mojosongo, Surakarta, Indonesia.

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INTRODUCTION

Data and Information Center for the Ministry of Health of the Republic of Indonesia in 2019 reported that cases of Down Syndrome in Indonesia tend to increase. Results of Basic Health Research (Riskesdas) in 2010, for children 24 to 59 months of Down Syndrome cases of 0.12%, in Riskesdas (2013) increased to 0.13% and in Riskesdas (2018) increased again to 0.21%. SIRS Online data for 2015-2017 shows that

the number of outpatients and inpatients for Down Syndrome has increased every year. The number of new outpatient cases in 2017 reached 4,130 and the number of hospitalized cases reached 1,305 in the same year. World Health Organization (WHO) reports that there is one incidence of Down Syndrome in 1,000 births. Currently, it is estimated that there are four million sufferers worldwide and 300,000 cases occur in Indonesia. This figure makes Down Syndrome the most common symptom of chromosome abnormalities in humans being.

Chromosomal abnormalities have an impact on developmental in Down Syndrome children compared to other children. Chromosome 21 abnormalities cause genetic disorders that interfere with all individual physical, mental and social development, resulting in developmental delays (Anne et al., 2014). Children with Down Syndrome often experience delayed in motor skills, such as; walking, standing, and running caused by the hypotonus. Marchewka (2008), children with Down syndrome are often found to have problems maintaining their balance while standing and walking. Balance problems that cause him to be unable to maintain his posture against the disturbance that comes. If this is allowed, it will certainly cause further motor development problems (Hazmi, 2014).

One of the processes of children's motor skills is gross motor skills related to movements that are influenced by the movement of large muscles. Motoric skills is the development of controlling body movements through coordinated activities between the nervous system, muscles and spinal nerve fibers. This ability is determined by the development of muscle, bone and brain coordination to maintain body balance (Widyastuti and Widyani, 2007). Balance is one of the most important factors for children in carrying out daily activities, playing and other activities (Padafani, 2019).

In children's world, games that use physical activity are very diverse and varied, one of which is the game of sandsack. This sandsack game can be used to train muscle strength, mental, discipline and body fitness. This activity consists of hitting, kicking, ducking, jumping, dodging, turning, and balancing exercises. All of these movements can optimizing children's motor skills to be stronger, more agile, fast and nimble (Shinta, 2013). Berg et al., (2012) stated that physical activity for children can improve upper leg coordination, manual dexterity, balance, postural stability, and limit stability control.

In this study, the physical activity of sandsack was developed into 8 types of movement, where the goal is to facilitate balance both statically and dynamically when standing, speed and dexterity in walking in a straight line / stepping and when hitting, postural stability, coordination of upper and lower limbs when hitting. and kick alternately in a standing position.

MATERIALS AND METHOD

This research is a pre-experimental quantitative study using a one-group pretest-posttest design. Population was children with Down syndrome in SLBN Surakarta. The sampling technique used by researchers is total sampling with criteria children are able to walk independently and able to follow simple commands. This balance ability is measured by the Sixteen Balance Test instrument, which amounts to 16 sub tests.

Data collection was carried out by means of direct intervention and evaluation during December 2019-February 2020. The intervention was giving sandsack physical activity with 8 types of exercises including hitting the sandsack in an upright position, hitting the sandsack in the front stance, hitting the sandsack in the side stance with a

crossmidline hitting motion, kicking the sandsack with your feet forming a T letter, hitting and kicking. Sandsack by alternating, kicking two sandsacks by changing positions, stepping point to point and hitting 2 sandsacks in turn, walking backwards in a straight line and hitting the sandsack. This activity is carried out with a frequency of 3 times a week with a duration of 60 minutes for 8 weeks and is carried out in the morning during school hours. The normality test used in this study was Shapiro Wilk and the analysis of the research data used the Paired t-test.

RESULTS

The intervention was conducted at SLBN Surakarta during December 2019-February 2020. The distribution of study sample frequencies by gender, age group, and BMI is in table 1

Table 1. Frequency distribution for gender, age, BMI

Characteristics	Frequency	Percentage (%)
Gender		
Male	7	53.8
Female	6	46.2
Total	13	100
Age		
8	3	23.1
9	1	7.7
10	2	15.4
11	2	15.4
12	2	15.4
14	3	23.1
Total	13	100
BMI		
11.6	1	7.7
14.4	1	7.7
15.5	2	15.4
18.0	1	7.7
18.5	1	7.7
18.6	1	7.7
19.6	1	7.7
20.3	1	7.7
22.8	1	7.7
27.4	1	7.7
28.1	1	7.7
29.3	1	7.7
Total	13	100

The majority of sample was male (53.8%), the age group ranged from 8 to 14 years with the majority at the age of 8 and 14 years (23.1%). A BMI score of 11.6 to 29.3 with the majority of the sample at 15.5 (15.4%).

Table 2. Balance score distribution pretest posttest

Pretest			Post test			Δ
Min	Max	Mean	Min	Max	Mean	Mean

60	107	85.15	63	115	91.54	6.39
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Table 2 can be seen in the average difference is 6.39 with an average value of 85.15 and pretest the average posttest score was 91.54. The increase in the balance score occurred after the sandsack physical activity training intervention was given.

Table 3. Data normality test results

	<i>Saphiro wilk</i>		
	Statistic	Df	Sig.
pretest	0.975	13	.943
posttest	0.936	13	.412

Table 3 shows the results of the normality test using Saphiro Wilk. The reference probability value amounting to 0.05, so that in this test a data can be said normally distributed if the significance value obtained is $p > 0.05$. The results of the data normality test show that the significance value Sixteen Balance Tests check before and after the intervention amounting to 0.943, and 0.412, so it can be concluded that the data normally distributed.

Table 4. Data hypothesis test results

	N	Mean	Paired t-test ρ
Sixteen balance test pretest	13	85.15	
Sixteen balance test posttest	13	91.54	0.000

In this hypothesis test if $p < 0.05$ with degrees significance at 95%, then H_0 is rejected and H_a is accepted. After testing Paired t-test on the examination data balance before and after intervention is obtained the result $p = 0.000$ which can be concluded that H_a is accepted. Table 4 shows the results of the t-test p value = .000 (< 0.05), showing the effect of physical activity on sandsack on the balance level of children with Down Syndrome.

DISCUSSION

Sandsack physical activity training affects the balance of children with Down Syndrome. This balance consists of static balance (body in a stationary position) and dynamic balance (body in a moving position). Components that are always related to balance are COG (Center of Gravity), BOS (Base of Support), Core Stability, Visual (Beam, 2018).

Sandsack physical activity carried out by the researcher began with static movements and was followed by several dynamic movements. Where the change from static to dynamic motion requires a good balance component. These movements include; hitting the sandsack in an upright position, hitting the sandsack in the front stance, hitting the sandsack in the side stance with a crossmidline hitting motion, kicking the sandsack with the feet forming a T letter, hitting and kicking the sandsack in alternating ways, kicking two sandsacks by changing positions, stepping point to point and hitting 2 sandsacks alternately, walking backwards in a straight line and hitting the sandsack.

The change from static and dynamic motion requires the ability of the balance component to be traversed when the center of gravity (COG) of the body is maintained above the base of support (BOS) when hitting in an upright position and the forward and side stances, sandsack hitting and kicking movements. The function of COG is to

distribute the mass of objects evenly. In humans, if the weight of the body is always supported by this point, the body is in a state of balance. But if there is a change in posture, such as the movement of the kicking legs alternately right and left, then the movement of changing positions from right to left or vice versa, stepping forward with alternating legs and jumping then the center of gravity changes, usually it will result in a balance disorder (unstable). However, given the physical sandsack activity, it is hoped that DS children can learn to balance automatically because the center of gravity will always move automatically according to the direction or weight changes, if the COG is located in and right in the middle, the body will be balanced. If it is outside the body, there will be an unstable state (Beerse, 2018).

The base of support (BOS) is the base on which the body rests or rests, whether on the floor, ground, beams, tables, chairs, ropes or other places. The wider the area of support, the more stable the body position will be (Nala, 2015). Like the static movement at the beginning, the researcher uses an upright position and opens both feet shoulder width apart either parallel or the position of the stance when hitting the sandsack so that children can do it easily and smoothly. Then when walking backward (Heel-to-toe walking), like the movement performed by the researcher, walking backwards, this movement is an exercise that is done by narrowing the area of the fulcrum (BOS). How to walk in a straight line with the heel of the foot touching the toes of the other, according to Tarkowski (2008), this exercise serves to improve postural balance dynamically. Exercises by doing heel-to-toe walking according to research conducted by Algazali (2016) also greatly affect human dynamic balance.

Sandsack physical activity with static movements, namely hitting the sandsack with straight legs parallel, and bent as a side, front and kick stance. This movement is often called static legs exercises with a straight posture. Exercises that improve posture are the Core Stability Exercise which functions to strengthen and balance the performance of core muscles such as the Gluteus Muscle Group (buttocks, middle hips and hamstrings or muscles behind the thighs), Hip Muscle Group (upper hips and pelvis), Abdominal Muscle Group (front and side abdominal muscles, oblique or waist area muscles), Spine Muscle Group (muscles located in the spine area) (Yuliana, 2014). Within this muscle group helps as a stabilizer of the spine, pelvis, and kinetic chain mechanism during motion (Alsakhawi et al., 2019). Core stability exercise is an exercise that uses the ability of the trunk, lumbar spine, hips, small muscles along the spine that work together to form strength which aims to maintain the spine in accordance with a symmetrical body line and become more stable. When the spine is strong and stable, it makes it easier for the body to move effectively and efficiently (Yuliana, 2014). Besides increasing balance directly, sandsack physical activity can also be used as a core stability exercise where good core stability will improve balance. The Core Stability Exercise will help maintain good posture for movement and provide the basis for all movements in the arms and legs. This shows that only the stability of posture is optimal, then mobility in the extremities can be carried out efficiently and in a balanced manner.

In addition to static movements in the physical activity of the sandsack, there is dynamic movement of the ability to maintain body position in changing COG, dynamic balance causes automatic postural adjustment to maintain posture and stability in various conditions and movements (Volkan-Yazici et al., 2018). As is done in the physical activity of this sandsack, the movement of shifting and kicking positions, walking from point to point and jumping and walking backward is done sequentially

with dynamic movements, visuals also play a role in improving the balance where the visual system (vision) has the task important for human life, namely providing information to the brain about the position of the body to the environment based on the angle and distance from the surrounding objects. With visual input, the human body can adapt to changes that occur in the environment. The visual system provides information to the brain and then the brain provides information so that the musculoskeletal system (muscles and bones) can work synergistically to maintain body balance (Watson & Black, 2008).

Repeated hitting and kicking movements in sandsack physical activity can increase muscle tone in addition to training the balance itself so that there will also be an increase in muscle tension. Where muscle strength is generally required in carrying out activities. All the resulting movements are the result of an increase in muscle tension as a motor response. Muscle strength can be described as the ability of the muscles to withstand loads, either in the form of external loads (external force) or internal force (internal force). Muscle strength is closely related to the neuromuscular system, namely how much the ability of the nervous system to activate muscles to contract. So that the more activated muscle fibers, the greater the strength produced by the muscle. The muscle strength of the legs, knees and hips must be adequate to maintain balance in the body under external forces. Muscle strength is directly related to the ability of muscles to resist gravity and other external loads that continuously affect body position.

The punching and kicking movements in sandsack physical activity besides giving an effect to increase muscle strength also provide cross-midline hand movements and coordination of movements between right and left such as hitting and kicking the sandsack alternately so as to further improve sensory integration ability and increase visual response. This movement affects more broad brain functions such as the frontal lobes, occipital, limbic system, cerebral cortex and brainstem. Brain activation will make the brain respond quickly to situations that require balance. Rochman (2015) that movements that use right and left coordination will improve sensomotor and sensory integration so that the brain's ability to organize sensory information from the environment and from within the body will be better. Sensory integration will make it easier to cross the center line of the body so that the balance response is better. The results of this study are reinforced by research "Brain gym improves dynamic balance more than exercise for physical fitness for 7-8 year olds at Simpang Tertib West Bangka" by Siamy et al., (2015) which states that activities that involve the coordination of both right and left hands or brain exercise are more effective at improving body balance.

From the whole series of physical activity of this sandsack, from static to dynamic movement. The results of this study are also in accordance with the research "Effect of Strength and Balance Training in Children with Down's Syndrome: A Randomized Controlled Trial" conducted by Gupta (2010) that physical activity training can also improve strength and balance in children with Down Syndrome. Then the research "Effects of whole-body vibration on muscle strength, bone mineral content and density, and balance and body composition of children and adolescents with Down Syndrome: a systematic review" conducted by Saquetto (2018) showed that jumping activity can generate postural control automatically, and muscle strength in the limbs, so that when doing jumping exercises the balance of children is significantly improved. As in the results of other studies "Effect of Core Stability Exercise on Postural Stability in Children with Down Syndrome" conducted by Aly & Abanour (2016), core stability

training is very effective in increasing postural stability and balance in children with Down syndrome.

CONCLUSION

The balance of the research sample after intervention in the form of physical activity sand sack training tends to experience an increase in the balance score before and after the intervention is given with an average pretest score of 85.15 and an average post-test score of 91.54. The results of checking the Sixteen Balance Tests before and After the intervention was carried out in the form of sand sack physical activity training which had been carried out by statistical tests using Paired T-Test, the results were obtained, namely $P = 0.000$ which means balance of children with Down Syndrome in SLBN Surakarta. The physical activity of the sand sack that is given consists of 8 training activities with the movement of hitting, kicking the sand sack, kicking two sand sacks by moving from point to point and hitting 2 sand sacks, walking backwards in a straight line and hitting the sand sack. The activity starts from static to dynamic balance and in that balance there are components of COG (Center of Gravity), BOS (Base of Support), Core Stability, Visual always related to balance.

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