THE EFFECT OF *SINGLE-TASK EXERCISE* ON DYNAMIC BALANCE IN CHILDREN AGED 7 - 12 YEARS

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ABSTRACT

Background: Lack of physical activity in children leads to decrease in the child's dynamic balance which results in a high risk of falling. Balance is a key element to achieving adequate movement ability. This study aimed to determine the effect of Single-Task exercises on children's balance. Methods: The design of this study was the Pre Experimental - pre and post-test one-group design. Respondents were 14 children aged 7-12 years who were selected by purposive sampling technique in Pulo Gebang Bekasi. The independent variable was a Single-Task Exercise while the dependent variable was dynamic balance as measured by the Balance Y Test. Data analysis included univariate analysis and bivariate analysis using the Paired sample T-Test. Results: After the intervention, there was a change in the average balance from 45.12% to 83.27%, or an increase of 84.44% with a p-value of 0.000 (p ≤ 0.005). Conclusion: Single-Task Exercise had a significant effect on the dynamic balance of children aged 7 -12 years therefore can be a novel approach as a routine school exercise to improving children's dynamic balance

Keywords*: children; dynamic balance;single-task exercise*

INTRODUCTION

The rapid development of science and technology affects convenience in all aspects of life. Teenagers are no no longer required to perform physical labor to meet their needs (Hallal *et al.*, 2012; Ngafifi, 2014). Changes in the function of open land to the public further reduce the availability of facilities and amenities for carrying out physical activities safely (Kusumo, 2010). This has also been exacerbated due to the spread of Corona Virus transmission, with social distancing and restrictions being imposed (Sibarani, 2020). The results of a UNICEF survey showed a lack of physical activity in adolescents at school (United Nations Children's Fund, 2021). According to the resuls of basic health research in Indonesia, lack of physical activity in children and adolescents aged 10-14 reached 64.4% (Kementerian Kesehatan, 2019). Lack of physical activity can result in low physical fitness including balance which is a component of physical fitness. Research conducted by Canli and Samar (2022) found that physical activity affects balance in young people.

Balance is the body's ability to control the position at a certain point from the center of gravity to the base of support either while still or moving. Balance can be achieved based on the vestibular assessment by the central nervous system of visual and somatosensory stimuli that produce an appropriate response in the musculoskeletal system. Balance is related to equilibrium and is a basic ability for humans that is needed to move (Dominguez-Romero *et al.*, 2020; Slovenica, 2022). Balance is an important component in everyday life because it helps maintain a stable posture to carry out daily activities and is a component of falling risk prevention (Patole *et al.*, 2021).

Balance ability development in children is an important part of human balance ability development and determines other abilities in carrying out various daily activities (Li *et al.*, 2022). Children who have not been able to regulate optimal balance will have difficulty adjusting balance when the body moves, will be unable to maintain a sitting, standing, walking, or running position, and will have difficulty carrying out other activities that interfere with functional activities carried out daily, putting children at risk of falls and injuries. If this is not addressed, it can interfere with the children's development process, and the children may choose to isolate their selves from their environment (Fitri and Imansari, 2020).

According to Muehlbauer *et al.* (2013), within 25-35 years there has been a decrease in balance and muscle strength in children which is a risk factor for falls and injuries. In Indonesia, there were around 5.8% of children aged 7-12 years experienced dynamic balance disorders (Wijayanti and Khotimah, 2019). The results of the preliminary survey in this study showed a larger presentation, 12 out of 15 (80%) children aged 7-12 years in Pulo Gebang Bekasi had an average balance score of 51%, where these results showed a high risk of falling in children due to weakness hip abductor and knee flexor muscles and the child's low balance to maintain posture. According to Butler *et al.* (2013), a score of 90% has a 3.5 times greater risk of injury.

There are several ways to overcome a child's balance problems, such as single-task exercises. Previous studies have found that Single-Task Exercise was effective in improving children's balance (Lüder, Kiss and Granacher, 2018; Jahanbakhsh *et al.*, 2020). For this study, it seeks to address balance problems in children with Single-Task Exercise to strengthen the muscles of the child's lower limbs to maintain balance in their posture

METHOD

The type of research used in this study was experiment with a pre-experimental-pretest and post-test one-group design. There was no comparison group in this study and only two measurements were taken in the treatment group, pre-intervention (pre-test) and post-intervention (post-test). This research was conducted to determine the effect of the balance of the Single-Task Exercise intervention on children's dynamic balance.

The sample size in this study was 14 children who were determined using the Lemeshow formula (Lemeshow and Lwanga, 1991) and selected by purposive sampling according to the inclusion and exclusion criteria. The inclusion criteria in this study included: respondents aged 3-6 years, able to communicate well, had a dynamic balance score using the balance y test below 70%, and were willing to participate in this study to the end. Meanwhile, the exclusion criteria in this study were respondents who used walking aids, had a history of heart and lung disease (CHD and Asthma), and were currently involved in other studies.

The data collection process started with screening, in which parents were asked about their child's current health status and dynamic balance was measured using the balance-y test. Following that, 14 children who met the inclusion and exclusion criteria were given a single-task exercise intervention three times per week for eight weeks. The exercise lasted 45 minutes and included a 10-minute warm-up, 30 minutes of core exercises, and a 5-minute cool-down. This exercise consists of four movements: standing on two legs, standing on one leg, walking straight, and jumping. Each movement had four difficulty levels, ranging from level 1 to level 4 and repeated eight times, taking a 30-second break between sets.

Balance measurement was performed once more after all interventions have been administered. The collected data was then processed and analyzed using SPSS software, which included univariate and bivariate analysis with paired sample t-tests. The paired sample t-test was used after the data normality test using the Shapiro-Wilk Test revealed that the data were normally distributed, with a p-value of 0.191 for the balance data before the intervention and 0.145 for the data after the intervention.

RESULTS AND DISCUSSION

The average age of respondents was around 9.75 years and the majority were 8 years old. Most of the respondents were girls, which reached 58% and only 43 were boys. More details can be seen in the following Table 1:

Table 1. Characteristics of Respondents

Respondents Characteristics	Frequency	%	Mean ± SD
Age			
7 years	2	14	9,57± 1.910
8 years	4	29	
9 years	1	7	
10 years	1	7	
11 years	2	21	
12 years	3	22	
Gender			
Girl	8	57%	
Boy	6	43%	

The mean dynamic balance was 45.12% before intervention and increased to 83.27% after intervention. Paired-samples-test results showed that statistically 95% believed there was a change of 38.10% or an increase of 84.55% (p-value 0.0001), as shown in Table 2**.** It can be concluded that there was a significant effect of single-task exercise related to dynamic balance in children.

Table 2. Results of the Paired Sample T=Test
On Dynamic Balance Before and After the Intervention

Dynamic Balance	Mean ± SD	Δ Mean ± SD	T	p
Before the Intervention	45,12±6,766	38,10±8,46	7,198	0,0001
After the Intervention	83,27±7,53			

Participants in the study were 14 children aged 7 to 12 who had decline their balance, with a mean of 45.12%. When children spend more time using gadgets to play on the internet and less physical activity, their sense of balance may be compromised (Ngafifi, 2014). Decline physical activity in children results in increased protein catabolism, leading to decreased muscle strength (Wijayanti and Khotimah, 2019). This muscle weakness contributes to the child's lack of dynamic

balance and may increase the risk of falls (Cech and Martin, 2012; Fitri and Imansari, 2020; Arovah, 2021).

Balance is the ability to react quickly and efficiently to maintain postural stability before, during, and after movement and in response to external changes (Wijianto, Dewangga and Batubara, 2019). Balance is required to maintain position and stability when moving from one position to another lain (Supriyono, 2015). Balance is achieved when we can adjust the equilibrium from the center of gravity (COG) to the base of support (BOS) (Dominguez-Romero *et al.*, 2020). Several factors contribute to balance, including the effective functioning of the nervous system, musculoskeletal system, and sensory system (Cech and Martin, 2012). The balance reaction can be attained by a complex process involving the sensory system, central nervous system, and musculoskeletal system. The sensory systems (visual, vestibular, and somatosensory) provide the information needed to maintain posture. This sensory input is integrated by the central nervous system which will find an adequate neuromuscular response in the musculoskeletal system to carry out the required movement response (Dominguez-Romero *et al.*, 2020). Balance is an important element for individuals to move. Balance development in children is a critical stage in the formation of balance abilities in adulthood and is crucial in mastering complex movement skills required in daily activities (Li *et al.*, 2022).

To overcome the lack of balance in children, practical and interesting exercises can be given so that children will be more enthusiastic in carrying out the exercises and not feel burdened. Single-Task Exercise is an effective and practical balance exercise. One of the movements in this exercise is jumping on one leg so that it can be a substitute for traditional children's games such as *engklek* and jump rope (Dominguez-Romero *et al.*, 2020; Fitri and Imansari, 2020). Unlike most other traditional games, this intervention does not require a lot of tools, making it easier for children to do exercises indoors and outdoors, with friends or individually. Each movement in this Single-Task Exercise also has a different level of difficulty, which encourages children to be creative in order to maintain balance. Furthermore, the variety of movements can help children avoid becoming bored while doing it. This exercise can be done with peers or even parents to get children excited about doing routine and focused exercises to improve significant dynamic balance. Parents play an important role in this exercise by setting

a good example and contributing while the children do the exercises. (Pagliarulo, 2012; Jahanbakhsh *et al.*, 2020).

The single-task exercise performed in this study proved effective in improving dynamic balance from 45.12% to 83.27%. Alternatively, we can say that the achieved balance improvement amounted to 84.55% (multiplied by 100%the average difference in dynamic balance before and after the procedure). The results of this study were consistent with those of Lüder, Kiss and Granacher (2018), who found that single-task exercise enhances dynamic balance in children and adolescents and was an adequate exercise capacity to maintain the body's center of gravity. This research was also supported by the work of Jahanbakhsh *et al.* (2020) who found a significant increase in the static and dynamic balance after performing single-task exercises.

To stimulate balance responses, single-task exercises combine the fundamentals of balance exercises. The respondent's handling is minimized in this intervention so that the respondent makes active movements to maintain his balance (Pagliarulo, 2012). The movements in the Single-Task exercise intervention use a dynamic system approach and coordination by focusing on direct learning and the task to be learned, combining motor control and motor learning principles with progressive physical activity to produce optimal balance results (Jahanbakhsh *et al.*, 2020). Furthermore, the intervention used in this study emphasized lower leg muscle strengthening. Lower leg muscle activation is beneficial for maintaining balance so that the plantar muscles, large muscle groups such as the quadriceps and hamstrings, and gluteals strengthened through repetitive and controlled movements. Thus, when performing dynamic activities, the lower limbs can support the body optimally and achieve optimal body balance (Wardhani and Jumahira, 2020).

CONCLUSION

Performing a 45-min single-task interventional exercises three times a week for eight weeks significantly improves dynamic balance by 84.55%, from an average of 45.12% to 83.27%. Children should perform single-task exercises regularly to maintain and improve their dynamic balance. In addition, single-task exercises can also be used as part of school sports training to help children develop their balance skills in the best possible way. Furthermore, we recommend adding comparison groups and adding more respondents to improve the quality of research on similar topics in the future.

Researchers were unable to account for other risk factors for decreased balance, such as posture, leg length differences, valgus/varus, flatfoot, and arch abnormalities, as well as other physical activity factors that influence children's balance improvement.

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