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ORIGINAL ARTICLE

The Effectiveness of Sit-To-Stand Exercise In Improving Dynamic Balance In The Elderly

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Abstract:
Background: Indonesia has facing increasing number of elderly since 5 years ago. The elderly has an aging process, which affect to their body structures and fucntions, but also the quality of life (QoA). One of the problem they have is balance. It caused by some factors such as decrease in lower limb muscle strength. Balance problem increase the fall risk in eldetly. Sit to stand exercise is the intervention which safe and easy to do for the elderly. Methods: This research using one group pretest and posttest, it was pre-experimental study design. Four Square Step Test (FSST) is used to assess the dynamic balance. Results: the mean of pretest and posttest scores are 18,34 second and 12,39 second. d value is 1.38, means that the sit to stand exercise has large effect (d > 0.8) of improving balance among elderly. Conclusions: Sit to stand exercise is proved has a large effect on improving dynamic balance in elderly. Sit to stand exercise is a recommended treatment to elderly, as it is easy to follow, safe, and simple exercise.
Keywords: Elderly; Sit to Stand Exercise; Balance.

1. Introduction

Indonesia is experiencing an increase in the number of elderly people (lansia) from 9.93% in 2020 to 11.93% in 2025. According to Law Number 13 of 1998 on the Welfare of the Elderly, an elderly person is someone who is 60 years of age or older (Directorate of People's Welfare Statistics, 2025). In elderly individuals, a degenerative process occurs that can alter the anatomical structure as well as the physiological functions of the body, thereby leading to a decline in physical condition.

Physical decline in the elderly can give rise to various disorders in the body and also affect their quality of life. One of the disorders that occurs in the elderly is balance impairment (Qorib and Laswati Purba, 2020). Balance impairment in the elderly is caused by a decrease in the mass and strength of the lower limb muscles, one of which is the quadriceps femoris muscle, the knee extensor. This muscle plays an important role in maintaining balance (Astari et al., 2021).

One preventive measure that can be taken to address balance impairment in the elderly is sit-to-stand exercise. This exercise focuses on improving lower limb muscle strength, which can also increase the strength of the quadriceps femoris muscle. Sit-to-stand exercise is also easy for the elderly to perform and does not require any special training or equipment. Therefore, this exercise is used as a relevant and safe intervention to improve balance in the elderly (Jeon, Hsiao and Griffin, 2021).

2. Materials and Methods

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Study Design

This research using one group pretest and posttest, it was pre-experimental study design.

Subjects

Inclusion Criteria:

1. Elderly individuals aged 60–74 years
2. Elderly individuals who are able to understand and follow verbal instructions
3. Hemodynamically stable
4. Elderly individuals who are willing to participate as research subjects

Exclusion Criteria:

1. Elderly individuals with hearing impairment
2. Elderly individuals with visual impairment
3. Experiencing weakness in the lower extremities with an MMT score of < 3

Research Instruments

Four Square Step Test (FSST) is used to assess the dynamic balance

Procedure

Pretest conducted one day before exercise program and posttest done after the exercise program complete in 4 weeks, 3 times a week.

Statistical analysis

The data was analysed using Cohen's d Formula to test the effectiveness of the exercise program.

$$d = \frac{M_{pre} - M_{post}}{SD_{pooled}}$$

3. Results

The study results present some data, including subject's characteristics, pre and posttest balance test, and the effectiveness of sit to stand exercise.

Table 1. Subject Characteristics

	N	Min	Max	Mean
Age	18	62	74	68,61 ± 4,18
Height (m)	18	1,30	1,58	1,46 ± 0,08
Weight (kg)	18	37	69	48,96 ± 8,15
BMI	18	18,34	32,82	22,70 ± 3,49

The total subject is 18 people, age 62-74. The mean height and weight are 1,46 meters and 48,96 kilograms. And the mean body mass index (BMI) is 22,70 kg/m^2 which categorized in normal range.

Table 2. Four Square Step Test Results

	N	Min	Max	Mean
Pretest (second)	18	10,16	30,11	18,34 ± 5,14
Posttest (second)	18	7,28	20,9	12,39 ± 3,26

According to data in the table 2, concludes that the mean of pretest and posttest scores are 18,34 second and 12,39 second.

Figure 1. Analysis Test Using Cohen's d Formula

$$d = \frac{M_{pre} - M_{post}}{SD_{pooled}}$$

SD Pooled:

$$SD_{pooled} = \sqrt{\frac{SD_{pre}^2 + SD_{post}^2}{2}} = \sqrt{\frac{5,14^2 + 3,26^2}{2}} = \sqrt{\frac{26,42 + 10,63}{2}} = \sqrt{18,52} \approx 4,30$$

Cohen's d:

$$d = \frac{18,34 - 12,39}{4,30} = \frac{5,95}{4,30} \approx 1,38$$

Based on the analysis calculation using Cohen's d Formula, d value is 1.38, means that the sit to stand exercise has large effect of improving balance among elderly.

4. Discussion

Sit to stand exercise in elderly, can increase the muscle mass and strength of lower limbs, as well as it also affects the neural system which propioceptive function is improved. The information is delivered to the sensory system and it is processed and transferred to the motoric system (Nugraha et al., 2016). The balance control obtained by the synergic function of sensory and motor systems. It stimulates activation of the muscle spindle and golgi tendon organ (GTO) to improve the motor control.

Frequently do this exercise give an impact to the body, as muscle contraction, motor unit recruitment, and coordination improving which be the main factor to increase the muscle mass and strength. Thus, the lower limb muscle strengths improve, the motor control to maintain balance also improve (Swandari, Nurmawan dan Sundari 2016).

Based on this study, sit to stand exercise has large effect to the dynamic balance in elderly, with d value is 1,38 (large effect >0.8). this is in-line with the previous study, that sit to stand exercise give significant effect to lower limb muscles strength, balance, and gait performance (Hyun, Lee Jin & Lee Byoung, 2021).

According to Fujita et.al (2019) sit to stand exercise 3 times a week in 4 weeks period, improves the knee extensor muscles and gets better performance. They measured the muscle strength using Electromyography, in quadriceps femoris, the strength is increased 19,4%. Thus, this exercise has a same effect in the strengthening program with high intensity.

Lower limb muscles, especially quadriceps femoris, has a vital function in maintaining balance. It helps control the stability and the center of gravity (CoG) keep inside the base of support (BoS) (Yılmaz et al., 2023). As its strength is increased, the motor control improved, and the balance is getting better.

Research Limitations

This research focusing in balance and lower limb muscles, without consider other factors that influence the balance, such as physical activity.

Directions for Future Research

Future study should concern with some factors that affecting balance in elderly, includes physical activity and comorbidity to get the comprehensive analysis.

5. Conclusions

1. Sit to stand exercise is proved has a large effect on improving dynamic balance in elderly.
2. Sit to stand exercise is a recommended treatment to elderly, as it is easy to follow, safe, and simple exercise.
   Sit to stand exercise also increasing the lower limb muscles strength and the function.

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Conflict of Interest

The authors declare no conflict of interest.

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