The Difference between Square Step Exercise and Balance Strategy Exercise Effects On The Change of Limb Muscle Strength and Balance in Elderly People

Sulfitra¹, Irfan Idris², Djohan Aras³
¹Student of Master Program at Hasanuddin University / Makassar City / South Sulawesi / Indonesia
²,³Physiologi, Medical Faculty, Hasanuddin University, Makassar, South Sulawesi, Indonesia.
¹,²,³Street Perintis Kemerdekaan KM. 10, Kota Makassar, Sulawesi Selatan, 90245
¹zulfitra85@gmail.com, ²irfanfaal@gmail.com, ³djo hanarasda@gmail.com

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ABSTRACT
The aging process is something that will be experienced by every individual which will be accompanied by a decrease in various functions of the body including a decrease in balance and muscle strength it can increase the risk of falling in the elderly which can cause injury, fracture, and even death. This study aims to compare the effects of the Square step exercise to the Balance exercise strategy on changes in limb muscle strength and balance in the elderly. The design of this study is comparative analytic with a sample of 40 elderly people experiencing balance disorders and decreased limb muscle strength. The respondents were grouped into two. Each group consists of 20 respondents. The first group is that of respondents who were given Square step exercise treatment and the second group includes the respondents given the Balance exercise strategy. Based on the results of the paired t-test analysis, there was a significant effect on changes in balance and lower limb muscle strength with a value (p = 0.001) in the group treated with the Square step exercise. In the Balanced exercise strategy treatment group, there were also significant changes in balance and lower leg muscle strength (p = 0.001). The results of the independent t-test indicated a significant difference between the group of respondents who were given the Square step exercise and the group of respondents who were given the Balance exercise strategy that includes balance changes (p = 0.033) and changes in muscle strength leg (p=0.027). In conclusion, the Balance exercise strategy is better in increasing limb muscle strength and balance in the elderly compared to the Square step exercise. Hence the Balance exercise strategy can be used as a reference in reducing the risk of falling in the elderly.

Keywords: Exercise; Square Step; Balance Strategi; TUGT; 30sCST.

INTRODUCTION
Over time, life expectancy has increased. In Indonesia, the population of elderly in 2019 continued to increase by 9.60%, or around 25.64 million people and it is predicted that the number of the elderly population in 2025 will increase by 33.69 million people, 40.95 million in 2030, then in 2035, it will be 48.19 million (BPS, 2019). In almost five decades (1971-2019), the percentage of the elderly in Indonesia has approximately doubled, namely to 9.6% or (25 million). Of all the elderly in Indonesia, the young elderly (60-69 years old) far dominates with a number reaching 63.82%, followed by the
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zulfitra85@gmail.com

middle-aged (70-79 years) and the old elderly (80+ years) with 27.68 percent and 8.50 percent, respectively (BPS, 2019). The problem that is, approximately 28-35% of people aged 65 and over fall every year. This figure increases two to four times making up 32-42% of the elderly over the age of 70. That is, the frequency of elderly falls increases with age and the level of weakness.

Imbalance Posture is one of the impacts caused by a decrease in physiological and morphological systems in the elderly which causes an increased risk of falls leading to injury and death (Rohima et al., 2021). With age, there will be a decrease in neuromuscular function, for example, sarcopenia which can cause muscle weakness and lack of physical ability as well as an increased risk of falling (Akhtar, 2020).

The elderly health program as the prevention and control of the risk of falling that have been carried out so far in health services are considered to be lacking. Lack of elderly gymnastics training and physical activity counseling, lack of attention from family, and other intrinsic factors predispose the elderly to have more risk of falling (Rohima et al., 2020). Therefore, it is necessary to have simple, effective, and efficient physical activity exercises that can be done independently and are not costly. It is expected that giving this exercise, can increase muscle strength and balance in the elderly to reduce the risk of falling. Square Step Exercise and balance exercise strategies may reduce the risk of falling and have an impact on increasing productivity (Quality of life) so that the elderly become better and do not experience dependence.

Based on the research conducted by Bhanusali et al. (2016), using the Time Up to Go test (TUGT) for 4 weeks elderly, the results were 11.12±1.92 in pre-test and 9.30±1.91 in post-test. Likewise, related to the balance exercise strategy, research (Dzakirah, 2021) applies the Balanced Exercise Strategy with the results of the Time Up to Go test (TUGT) the risk of falling from (75%) changed to (12.5%).

METHOD

The subjects of this study were 40 people at the Batara Sabintang Social Welfare Institution (LKS) who met the inclusion criteria and were not included in the exclusion criteria. The inclusion criteria were elderly people aged 60-75 years who experienced balance disorders and leg muscle strength (Time up go test and 30-second chair stand test). Exclusion criteria were elderly who suffer from physical disabilities, have a history of vertigo, and use assistive devices when walking. This research has been approved by
the ethics commission of Hasanuddin University, Makassar, Indonesia with ethical license number 797/UN4.6.4.5.31/PP36/2021.

Subjects were divided into 2 groups, each group consisting of 20 people. The first group consisted of respondents who were given the Square step exercise treatment and the second group consisted of 20 respondents who were given the Balance exercise strategy. Both groups were given exercise 3 times a week for 4 weeks. Before commencing the exercise, respondents were given a pretest to assess balance on the risk of falling using the Time up go test and limb muscle strength using the 30-second chair stand test.

Square Step Exercise is an exercise using a pattern in the form of a square box sized 25 cm totaling 40 boxes with a certain pattern according to the stages which aim to improve balance, agility, speed, endurance, and increase strength in the lower extremities, while the Balance Strategy Exercise (BSE) is a form of balance exercise based on the individual's strategy or ability to control the center of mass of the body, to be able to maintain balance. Balance Exercise Strategy has three stages of movement, namely ankle exercise strategy, hip exercise strategy, and stepping exercise strategy.

RESULTS AND DISCUSSION

Results

This research was conducted on the elderly who were housed in the Batara Sastar Social Health Institution (LKS) in Takalar Regency for 4 weeks starting from 22 December 2021 to 18 January 2022. The population in this study were all elderly people who were in the Batara Sastar LKS Takalar Regency. Those with leg muscle weakness and balance disorders were then selected based on inclusion and exclusion criteria. The sample from the study amounted to 40 elderly people who were divided into 2 groups consisting of 20 people in the Square step exercise group and 20 people in the Balance exercise strategy group. Data were obtained from primary data sources based on the results of leg muscle strength using the 30-second chair stand test (30sCST) and the balance of fall risk was measured using the Time up to go test (TUGT). The data obtained are then processed according to the research objectives which are presented in tabular form to illustrate the comparison of the effects of the square step exercise with the Balance strategy exercise.

Table 1.
Characteristics of Respondents
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Sulfitra1, Irfan Idris2, Djohan Aras3
zulfitra85@gmail.com

Table 2.
Data Normality Test

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Amount</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-65</td>
<td>19</td>
<td>47.5</td>
</tr>
<tr>
<td>66-70</td>
<td>15</td>
<td>37.5</td>
</tr>
<tr>
<td>71-75</td>
<td>6</td>
<td>15.0</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18</td>
<td>45.0</td>
</tr>
<tr>
<td>Female</td>
<td>22</td>
<td>55.0</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>History of falls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Never</td>
<td>36</td>
<td>90</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on age, the majority of respondents were from the 60-65 age group, which amounted to 19 (47%) respondents. Based on gender, there were more women with a total of 22 (55%) respondents compared to men with a total of 18 (45%) respondents. In the history of falls, the incidence of never falling is more with 36 (90%) respondents compared to those who have fallen with 4 (10%) respondents.

Kolmogorov-Smirnov was used for the normality test because the sample was >30 respondents. Based on table 2, all groups are normally distributed because the p-value = > 0.05.

Table 3.
Exercise giving effect test to the value of TUGT and 30sCST

<table>
<thead>
<tr>
<th>Group</th>
<th>TUGT</th>
<th>30sCST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SD</td>
<td>p</td>
</tr>
<tr>
<td>Square step exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>15.66±0.925</td>
<td>0.001</td>
</tr>
<tr>
<td>Post-test</td>
<td>10.51±1.56</td>
<td>12.75±2.22</td>
</tr>
<tr>
<td>Balance strategi exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-test</td>
<td>15.35±1.30</td>
<td>0.001</td>
</tr>
<tr>
<td>Post-test</td>
<td>11.23±1.61</td>
<td>13.75±1.65</td>
</tr>
</tbody>
</table>

There was an effect of giving exercise to the group that was given Square step exercise treatment and to the group that was given the Balance exercise strategy, which
there were changes in balance and limb muscle strength in the elderly after 4 weeks of exercise in both treatment groups with a significant value (p = 0.001).

Table 4.
Comparative analysis of Square step exercise with a Balance exercise strategy

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean±SD</th>
<th>TUGT Difference</th>
<th>p</th>
<th>Mean±SD</th>
<th>30sCST Difference</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square step exercise</td>
<td>5.14±1.70</td>
<td>1,025</td>
<td>0.033</td>
<td>3.35±1.63</td>
<td>1,200</td>
<td>0.027</td>
</tr>
<tr>
<td>Balance strategy exercise</td>
<td>4.11±1,21</td>
<td></td>
<td></td>
<td>4.55±1.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Between the group that was given the Square step exercise treatment and the group that was given the Balance strategy exercise treatment, there was a significant difference in the results of limb muscle strength with a value (p=0.027) and an increase in balance with a value (p=0.033). Limb muscle strength was measured using 30sCST with a difference of 1,200 between the two groups. This means that the higher the 30sCST value, the better the limb muscle strength. Meaning that the group given the Balance exercise strategy with the highest mean value of 4.55±1.70 was better than the Square step exercise with a mean value of 3.35±1.63. In the change in balance, as measured using TUGT, there was a difference of 1.02 between the two groups. The lower the TUGT value obtained, the better the balance. Hence, the balance strategy exercise group with the lowest mean value of 4.11±1.21 was better than the Square-step exercise group with a mean value of 5.142±1.70.

Discussion

This study was conducted on the elderly who have impaired limb muscle and balance disorders. Most respondents from the two treatment groups were aged 60-65 years totaling 19 respondents, while the smallest number came from the age group 71-75 years, amounting to 5 respondents. The risk of falling in the elderly is due to the postural control system which is unable to detect the shift in the position of the gravity center stably at the same time accurately. The emergence of this risk of falling is a result of a decrease in the ability of the network in the musculoskeletal system, and nervous system, and reduced cell ability so that it has an impact on the physical changes of the elderly (Ekasari M.F., N.I.Riasmini, 2018).

Based on gender, the number of elderly women, which is 22 respondents, exceeded the number of elderly men which only amounted to 18 respondents. The decrease in limb muscle strength and balance is more common in elderly women than men because the activities of elderly women have begun to decrease compared to elderly...
men who are still actively going to the fields to farm. Elderly women are also affected by hormonal factors, namely estrogen, where this estrogen hormone has an important role in the calcium production process. This reduction in the hormone estrogen will occur in women who have entered the menopause phase where the calcium metabolism process will also decrease which has an impact on the process of decreasing function until the occurrence of osteoporosis (Lupa et al., 2017).

In this study, it can be seen that in both groups, both given the Square step exercise treatment and the group given the Balance exercise strategy treatment, there was an effect on changes in limb muscle strength and balance. The effect of the Square Step Exercise on the sensory system that is stimulated during the Square Step Exercise is a proprioceptive system found in the joints and the visual sensory system. These two sensory systems help maintain body balance in the elderly. Proprioceptive stimulation obtained through the dorsal column of the spinal cord will be transmitted to the brain. In the brain, it will be conveyed to the cerebellum and some will be channeled to the cerebral cortex which causes motor responses that lead to improvements in body stability through increased strength and the adaptive neuromuscular system that produces balance. An improvement in the cortical center influences the vestibular and direction control which will increase balance and mobility in activities (Le Pichon & Chesler, 2014). This is in line with the research conducted by Ashim (2017) which applied the use of the Square Steep Exercise (SSE) exercise showing an increase in the balance value with the BBS scale from 34.88 to 40.88.

Based on the comparative test, it can be seen that the results of the Balanced Exercise Strategy have a better effect on the TUGT and 30sCST values compared to the Square step exercise. This is due to the Balance Strategy Exercise supporting the body's working mechanism that carries sensory information about changes in body position sensation through mechanoreceptors. This is related to the work of the proprioceptive system from the joints to the thick myelinated nervous system which then sensory information is transmitted to the somatosensory system and processed in the cerebral cortex to produce motor signals. From the motor signal, it will be transmitted to the pyramidal fibers through the lateral corticospinal tract, and spinal cord which then ends directly in the anterior motor neurons. Following this, the anterior motor neuron will conduct a potential action on the axon terminal. The occurrence of a potential action will cause the sarcoplasmic reticulum to release large amounts of calcium ions. This will cause
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an attractive force between the actin and myosin filaments which then results in a process known as muscle contraction (Sasmita, 2020).

The occurrence of muscle contraction starts from the distal to the proximal direction. In the ankle strategy for forwarding movement (anterior sway), muscle activation starts from the gastrocnemius muscle, then continues to the hamstring muscles, and the paraspinal muscles are also facilitated. As for the response to the backward movement (posterior sway), muscle activation starts from the tibialis anterior, quadriceps, and abdominal muscles. In the hip exercise strategy, muscle activation starts from proximal to distal, the activation of the muscles in response to forwarding body movements starts from the abdominal muscles followed by the activation of the quadriceps muscles. Meanwhile, the activation of the muscles is in response to backward body movements, starting from the paraspinal muscles and then followed by the activation of the hamstring muscles. The stepping exercise strategy (stepping strategy) functions in increasing the base of support (BOS) or the fulcrum so that dynamic balance control related to gait and locomotion can be obtained by activating all lower limbs (Kisner et al., 2017).

Research conducted by Dzakirah (2021) which used a Balanced Exercise Strategy to assess the risk of falling in the elderly also found a decrease in the percentage from (75%) to (12.5%). Therefore, it can be interpreted that the Square step exercise and Balance Exercise Strategy play an important role in providing an increasing effect on the value of muscle strength and balance in the elderly. By obtaining a good balance from the two exercises, muscle strength, elasticity, and flexibility, as well as the speed of muscles in responding to movement are also well facilitated. This increase is very significant in improving the quality of life of the elderly as the level of development of a nation can be measured by the life expectancy of its population (Ekasari M.F., N.I. Riasmini, 2018).

CONCLUSIONS AND SUGGESTIONS

Conclusions: Based on the result of the study conducted on the elderly in Social Welfare Institute (LKS) Batara Sabintang, Takalar Regency, with 40 respondents, it can be concluded that Balance strategy exercise is better in improving muscle strength and balance in the elderly compared to Square step exercise. Therefore, the Balance strategy exercise may be used as a reference for reducing the risk of falls in the elderly.

Suggestions: The next research is to be able to control physical activity which can be a confounder in assessing the success of this exercise, adding measurement variables
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zulfitra85@gmail.com

...to these two exercises, and making recommendations for elderly rehabilitation centers that correlate with balance and leg muscle strength.

REFERENCES


