



Exercise using Elastic Bands Affects Balance Function, Flexibility, Risk of Elderly Falling

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Abstract : Physical decline occurs in the form of changes in the musculoskeletal system, which affects the decrease in muscle strength, resulting in slow movements, a tendency for unstable legs, and a decrease in the ability to anticipate slipping, tripping, and slow responses, thereby increasing the risk of falls in the elderly. This study is a Quasi Experiment with a Pretest-Posttest with One Group Design. The research was conducted from April to September 2019 at GMIM Sion Malalayang Manado. The subjects of this study were individuals aged \geq 60-75 years who did not have problems with cognitive and communication abilities and had the ability to live independently. They were selected through a selection process and agreed to participate in the study after an interview. There is an influence of physical exercise using an elastic band, as measured by TUGT, FSST, and CRST, on body balance, fall risk, and body flexibility in the elderly

Keywords - *body balance; exercise; muscle*

I. INTRODUCTION

Elderly people (elderly) along with increasing age will be followed by a decrease in their physiological functions, including various types of degenerative diseases that begin to attack. Declining physical abilities affect the mobility of the elderly, so there is a risk of falling which can be complicated with other diseases (Stanley & Beare, 2007). Falling is a human failure to maintain body balance when standing, this will result in various types of injuries, physical and psychological damage, one of the most feared of falls is a broken hip. Elderly who receive treatment at the hospital are likely to die (Dewi, 2017). The aging process affects a decrease in blood calcium levels and estrogen deficiency which in turn will have implications for a decrease in bone density and muscle mass. This will then trigger the occurrence of osteoporosis, porous and brittle bones so that the risk of fracture. The occurrence of osteoporosis will have an impact on decreasing the range of motion of the joints and decreasing muscle strength and endurance which can affect the functional abilities of the elderly (Dewi, 2014). State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results. Explain how you addressed the problem and clearly state the aims of your study. As you compose the introduction, think of readers who are not experts in this field. Please describe in narrative format and not using sub-chapter.

The impact of falling can cause psychological injury, shock after falling and the fear of falling again can have many consequences including anxiety, loss of confidence in limiting daily activities, falaphobia or phobia

of falling (Irawan, 2015). The incidence of someone falling is strongly associated with a decrease in posture balance and stability which is characterized by a wide base of support when standing, small steps, slow walking speed, and decreased arm movement when stepping (Dunsky et al., 2017). Optimum physical activity can improve balance and can reduce the risk of falling in the elderly (Peeters et al., 2010). Conversely, the elderly who have low physical activity and seen from the duration of walking time can increase the risk of falling which is high in the elderly (Klenk et al., 2015). Based on data from WHO (World Health Organization,) the projected increase in the percentage of the elderly population (> 60 years) in the world from 2013-2050 is 13.4% from the previous year, while in 2100 it is estimated that the world's population will increase by 35.1% from the previous year (Ministry of Health RI, 2014). Ministry of Health, 2017 shows that based on population projection data, in 2017 there were 23.66 million elderly people in Indonesia (9.03%). It is predicted that the number of elderly people in Indonesia will be in 2020 (27.08 million), 2025 (33.69 million), 2030 (40.95 million), and in 2035 (48.19 million).

WHO (2014), elderly aged over 60 years from 2000 to 2050 will increase from 11% to 22%. Elderly services in Veresa Italy stated that there were 293 elderly people with cases of falling 695 times, 221 women (75.4%)) and 72 men (24.6), as well as 133 (45.4%) elderly who had previously fallen. This study also illustrates that 152 elderly people who fell were not injured, 95 were lightly injured, and 46 elderly people were seriously injured (Baranzini et al, 2004 in Ashar, 2016).

Meanwhile for Indonesia itself, more than 55 years have experienced injuries reaching 22%, 65% of which are due to falls (Riskasdas, 2013). The incidence of falls in the elderly in the community increases every year from 25% at the age of 70 years to 35% after the age of 75 years (Stanley & Beare, 2012). Falls were also reported by Darmojo & Martono, 2009, about 30% of elderly aged 65 years and over who lived at home, half of that number experienced repeated falls. The elderly who live at home experience a fall of around 50% and require sick care of around 10-25%.

Many factors affect the risk of falling due to musculoskeletal and environmental disorders, which have an impact on the elderly such as gait disturbances, lower extremity weakness, joint stiffness, insufficient light in the room and slippery floors (Stanley, 2006). Therefore, a way is needed to anticipate the risk of falling in the elderly, including: combination exercises (exercise) can increase aerobic capacity, strength, flexibility, and each individual can reduce the risk of bone disorders (Astuty, 2017). Balance training, to increase muscle strength in the lower limbs (legs) and improve the body's balance system. Balance training is very important for the elderly because this exercise really helps maintain the body to be stable so as to prevent frequent falls in the elderly (Avelar et al, 2016). So the solution that is used in overcoming the risk of falling in the elderly is balance training which is a simple and easy technique for anyone to practice balance to overcome the risk of falling (Syapitri, 2016).

The purpose of this study was to determine the effect of elastic band training with 3 measurement methods TUGT, FSST, and CRST on balance, fall risk and body flexibility in the elderly.

II. METHOD

This type of research is a Quasi Experiment with a Pretest-Posttest with One Group Design research design. The research was conducted in April-September 2019 at GMIM Sion Malalayang Manado. As subjects of this study, aged ≥ 60 - 75 years and over who did not have problems in cognitive and communication skills and had the ability to live independently were selected through a selection process and who were willing to do research after interviews. Subjects taken are also considered eligible if one of the results of the measurements carried out has an abnormal value, namely:

1. Dynamic balance level: TUGT > 10 seconds
2. Risk of falling: FSST > 15 seconds
3. Flexibility of the lower body: CSRT according to the table below

Gender/Age	60-64	65-69	70-74	75-79
Man	Less than – 2.5 cm	Less than - 3.0 cm	Less than -3.5 cm	Less than -4.0 cm
Woman	Less than -0.5 cm	Less than - 0.5 cm	Less than -1.0 cm	Less than -1.5 cm

The treatment group and the control group underwent preliminary checks for dynamic balance, fall risk, and flexibility. The treatment group did 3 sets of elastic band resistance exercises 1 time, 60 minutes per time, 3 times a week for 6 weeks. The treatment group and the control group underwent regular physical therapy 60 minutes per time, 2 times a week for 6 weeks. After 6 weeks, a post-test measuring dynamic balance, fall risk, and flexibility was performed.

Elastic band resistance training was performed for 6 weeks, 3 times a week, 60 minutes per time and 3 sets after the general. This research was conducted for each participant with 1 elastic band resistance exercise research assistant and 2 research assistants for measurement (Idrus, Modding and Basalamah, 2022). Prior to each experiment and measurement, education was carried out on sports instruction methods and equipment instructions, measurement methods for 2 hours 1 time a week 1 week ago. For elastic band resistance exercise, lower extremity strengthening using elastic band resistance exercise from "Scientific & Clinical Applications of Elastic Resistance" from Pill & Todd was applied 21).

Warm up is done for 5 minutes and stretching and joint mobilization exercises promote movement around the spine and large joints, head, trunk, hip exercises are performed. Lower leg resistance exercises using elastic bands are carried out for 60 minutes. First, the ankle joint, knee joint, hip joint, and distal body joint are sorted. Ankle and knee, flexion and extension exercises are performed while lying on your stomach or lying down or sitting upright in bed or by attaching a bandage to a corner or post. The bed and hip joint, flexion and extension, pronation and supination are performed while securing the band to the corner or pole.

Data analysis was descriptive, according to the results of the pre-test and post-test measurements carried out and analytically using paired T-test and independent T-test.

III. RESULT

Result should be presented continuously start from main result until supporting results. Unit of measurement used should follow the prevailing international system. It also allowed to present diagram, table, picture, and graphic followed by narration of them. Elderly women in the treatment group were the most common sex (85%) compared to elderly men (15%) out of a total of 20 samples. Likewise in the control group, women were 80% while men were 20%, out of a total of 20 samples.

Pre Test Measurement Results

The results of the Time Up Go Test (TUGT) pre-test measurement to measure dynamic balance showed good results (85%) and normal 15%. (see Table 1).

Table 1. Time up Go Test (TUGT) pre test

Time Up Go Test (pre)	n	%
Normal	3	15
Good	17	85
Total	20	100

The results of the Four Square Step Test (FSST) measurements show that the risk of falling is 15% while the normal one is 85% (see Table 2).

Table 2. Four Square Step Test (FSST) pre test

Four Square Step Test (pre)	n	%
Normal	17	85
Risk of falling	3	15
Total	20	100

The results of the Chair Sit Reach Test (CSRT) measurement show that the most flexibility measurement results are less, namely 65% while the Normal is 7 people (35%) (see Table 3).

Table 3. Chair Sit Reach Test (CSRT) pre test

Chair Sheet Reach Test (pre)	n	%
Normal	7	35
Less	13	65
Total	20	100

Post Test Measurement Results

The results of the Time up Go Test (TUGT) measurements which show dynamic balance with good results are 35%, while the normal ones are 65% (see Table 4).

Table 4. Time up Go Test (post)

Time Up Go Test (post)	n	%
Normal	13	65
Good	7	35
Total	20	100

The results of the post measurement on the Four Square Step Test (FSST) show that no one is at risk of falling (0%) (see Table 5).

Table 5. Control Group Time up Go Test (TUGT).

Time Up Go Test	Pre test		Post test	
	n	%	n	%
Normal	3	15	2	10
Good	16	80	17	85
Less	1	5	1	5
Total	20	100	20	100

The results of the TUGT measurement showed a dynamic balance, that the control group had the most pre-test, namely Good, 16 people (80%) and the post-test also showed the most good results (85%).

Table 6. Four Square Step Test (FSST) Control Group

Four Square Step Test (FSST)	Pre test		Post test	
	n	%	n	%
Normal	10	50	9	45
Risk of Falling	10	50	11	55
Total	20	100	20	100

The FSST results in the control group were the highest, namely the Risk of Falling of 10 people (50%) during the pre test and during the post test there were also many who were at risk of falling (55%).

Table 7. Chair Sit Reach Test (CSRT) Control Group

Four Square Step Test (FSST)	Pre test		Post test	
	n	%	n	%
Normal	8	40	7	35
Less	12	60	13	65
Total	20	100	20	100

The most CSRT results for measuring the feasibility of the control group were less than 12 people (60%) during the pre test and also less (65%) during the post test.

Variable Average Difference (Pre And Post)

Table 8. Variable Average Difference (Pre and Post)

Variable	Pre (n = 20)		Post (n = 20)		p value
	Mean	SD	Rata-Rata	SD	
TUGT (balance function)	12,866	2,182	9,905	1,539	0.000*
FSST (risk of falling)	12,690	3,271	9,466	2,039	0.000*
CSRT (body flexibility)	-6,005	7,620	0,720	3,385	0.000*

In the treatment group, the average values for the three measurement variables (TUGT, FSST, CSRT) were obtained before giving the elastic band exercise which had a significant difference with after being given the elastic band exercise. The statistical test results using paired t test obtained a significant value of $p < 0.000$ ($p < 0.05$) which indicated that there was a significant difference before and after giving the elastic band exercise.

Variable Average Difference (Treatment and Control)

Table 11. Differences in Average Variables (Treatment and Control)

Variable	Treatment (n = 20)		Kontrol (n = 20)		p value
	Mean	SD	Rata-Rata	SD	
TUGT (balance function)	9,905	1,539	14,009	3,301	0.013*
FSST (risk of falling)	9,466	2,039	16,281	4,665	0.008*
CSRT (body flexibility)	-0,720	3,385	-7,525	8,007	0.000*

IV. DISCUSSION

The characteristics of the sample in terms of gender showed that there were more women than men, namely 17 people (85%) in the treatment group and 16 people (80%) in the control group. This is influenced by the fact that the elderly who are female experience high functional decline and suffer from chronic diseases and their relation to degenerative factors. This is in line with the theory that women over 50 who have experienced menopause will have reduced hormone production in their bodies. When the production of the female hormone estrogen decreases, chondrocyte synthesis decreases and results in a decrease in proteoglycan and collagen synthesis. This happens because one of the functions of the hormone estrogen is to help synthesize chondrocytes in the bone matrix, so that if estrogen decreases, this causes women to suffer from degenerative diseases and has an impact on functional decline (Suriani & Lesmana, 2013).

The results of the pretest showed that the highest level of balance (TUGT) was in the good category, 17 people (85%) and only 3 people (15%) were in the normal category. This is because the elderly do not do physical exercise so that it affects the work performance of the muscles. After being given treatment in the form of training using elastic bands on the results of the post test showed the highest category, namely normal 13 people (65%). There is an increase in the level of balance to normal after being given training using an elastic band. This shows that by exercising using elastic bands there is an increase in the body balance of the elderly. The results of Maryam's research (2009) also stated that body balance was better in the elderly after being given physical balance exercises (Maryam, 2009).

Treatment in the form of exercises using elastic bands, the post-test results showed that no one was at risk of falling (0%). These results indicate that the use of elastic bands can reduce the risk of falling in the elderly. The results of the study are also in line with the results of Dirmayanti's research (2018), which states that there is an effect of giving elastic band exercise on the risk of falling in the elderly (Dirmayanti, 2018). Likewise with the results of research conducted by Kwak et al. (2016) which shows that giving resistance exercise using elastic bands has a good effect on reducing the risk of falling in the elderly (Kwak et al., 2016). In the results of Nurkuncoro's research (2015) there was an influence from the results of a fall risk examination after three weeks of being given balance exercises (Nurkuncoro, 2015).

The results of the most body flexibility pretest (CSRT) were in the less category with 13 people (65%). This is due to increasing age and the elderly not doing physical exercise so that it affects the flexibility of the body, especially the lower body. After being given treatment in the form of exercises using elastic bands, the results of the post test showed that the highest category was normal, 19 people (95%). The results of this study obtained significant results after being given treatment. Based on the results of the paired t test, it is known that there is a difference between before and after giving the elastic band exercise. So from these results it can be concluded that there is an effect of giving elastic band exercise on the level of balance, risk of falling, and flexibility in the elderly. This is in line with research conducted by Istimantika (2016) with the results showing that resisted exercise using therabands had a good effect on increasing the dynamic balance of the elderly (Istimantika, 2016).

Elastic Band Exercise has an effect in increasing the level of balance (Idrus, Mustamin and Zufahmidah, 2023). This is because elastic band exercise will improve neuromuscular function and can also cause post-activation potentiation, namely a temporary increase in muscle work which is the result of previous contractions. The increased performance through bridge traffic will result in more cross-bridges being formed so that muscle strength production increases (Behm & Chaouachi, 2011). Giving elastic band exercise can increase the level of dynamic balance in the elderly (Mora)

In the given exercise, it does not only affect muscle strength but also affects flexibility and joint ROM. This is in line with research conducted by Horak et al. (1989) who said that strength and flexibility are needed when the body is exposed to gravity or external forces. This is in line with research conducted by Bok et al. (2013) who said that joint motion or joint range of motion will affect the maintenance of dynamic balance. During exercise, the body will fight against the resistance of the elastic band which stimulates it so that joint movement is wider to be able to fight against the resistance of the band. The range of motion of the joints will cooperate with muscle flexibility to get results. Optimal ROM so that the body can determine and direct movements, especially during movements that require high balance.

Elastic band exercise will have an effect on reducing the risk of falling in the elderly. This is because elastic band exercise will increase neuromuscular adaptation. The occurrence of neuromuscular adaptation is caused because the exercise can affect the efficiency of the neuromuscular system by increasing the recruitment of motor units. The motor unit is defined as the motor nerve, and all of the muscle fibers are innervated by the motor nerve. One motor nerve innervates more than 100 muscle fibers. The force of contraction of a muscle is directly related to the number of muscle fibers involved. The greater the number of motor units recruited (the greater the number of muscle fibers recruited) to do the work, the stronger the contractions of the muscles involved. The more muscle fibers innervated by motor nerves, the greater the muscle strength (Higgins, 2011) There is an effect of physical exercise using elastic bands by measuring TUGT, FSST, and CRST on body balance, risk of falling and body flexibility in the elderly. In the pretest results the highest risk of falling (FSST) was in the normal category as many as 17 people (85%) and there were 3 people (15%) who were at risk of falling. After being

V. CONCLUSION

It is recommended for the elderly to always do physical exercise using an elastic band to improve physical balance, reduce the risk of falling and increase body flexibility.

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