

The Effect Of Static Stretching Calf Muscle Tendon Unit With Theraband Toward Range Of Motion Dorsi Flexion Ankle On Elderly Person

Novi Dwi Jayanti

Universitas Udayana

*E-mail: fisiobarengdije@gmail.com

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ABSTRACT

Background: Aging is a natural process. One problem that often occurs in the elderly is a decrease in the range of motion in the calf muscle tendons, which can interfere with their physical activities. **Purpose:** Knowing the effect of static stretching calf muscle tendon unit with theraband toward range of motion dorsi flexion ankle on elderly person. **Method:** Analytical study with a control group design. The sampling technique uses purposive sampling, with 60 respondents: 30 as the treatment group and 30 as the control group. A goniometer measured ROM. Static stretching can be done using theraband. **Result:** Dependent T-Test ($p < 0.05$) It means that there is an effect on the treatment and control groups. Independent T-Test ($p < 0.05$) it means a significant difference between the treatment and control groups. **Conclusion:** The research results showed a positive influence.

INTRODUCTION

Aging is part of the growth process. Humans being taken step by step to growing old, start to form from infants, children, and adults and eventually become old. It is also a natural process that God Almighty determines (Yenni, 2021). All people who live long will experience getting old and old age is the last period of human life. They will gradually experience a physical, mental, and social decline (Kemetrian Kesehatan RI, 2020)

The aging process is a process that continues naturally. Aging is not categorized as a disease, but it reduces the

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body's resistance to face stressors from inside and outside the body (Kemetrian Kesehatan RI, 2020). Each individual has various periods of the aging process Many factors affect an individual's aging period, such as genetic factors, nutritional intake, mental condition, lifestyle, environment, and activities (Deniro, Sulistiawati and Widajanti, 2017)

According to Law No. 13 of 1998 concerning the welfare of the elderly in the chapter, I article 1 paragraph 2, and the Elderly is someone who reaches the age of 60 years and more than 60 years old. Meanwhile, according to the World Health

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Organization (WHO), the old age limits include (1) middle age between 45-59 years old, (2) elderly between 60-74 years old, old age between 75-90 years old, (4) very old age above 90 years old.

According to data from the Central Statistics Agency (BPS), in 2020, In almost five decades, the percentage of the elderly in Indonesia has doubled (1971-2020) become 9.92 percent (26 million) in which woman elderly is one percent higher than man elderly (10.43 percent versus 9.42 percent). From these data, Indonesia has an aging structure (aging population) (Kemetrian Kesehatan RI, 2020).

Aging is an accumulative complex change process related to changes in multidimensional physical processes (Tri, 2014). In terms of health, the aging process is usually gathered with a decrease in synovial fluid production in the joints and muscle tone. The joint cartilage becomes thinner, the ligaments become stiffer, and there is a decrease in flexibility that causes pain, decreased ability to increase muscle strength and difficulty in moving. A mobility limitation and reduced joint movement can make the condition worse. The decreased musculoskeletal abilities can reduce physical activity and range of motion in the elderly so that they are limited in doing activities of their daily

living (Deniro, Sulistiawati and Widajanti, 2017).

Range of Motion (ROM) can be interpreted as the maximum possible movement in a joint without causing pain, influenced by several factors: the musculoskeletal system, the neuromuscular system, the spinal cord, the nervous system, the capsuloligamentous system, physical activity, and gender (Nagano, Uoya and Nagano, 2019). Problems in the elderly musculoskeletal system will affect their flexibility and ROM. Physiotherapy efforts are conducted to reduce the impact is doing exercise. One of the exercises that can be done is stretching exercises (Thomas *et al.*, 2018)

Stretching is an important exercise to increase joint motion range. The research states that if someone does stretching regularly, he/she will increase her/his flexibility and prevent injury (Thomas, 2018). Stretching has several techniques: static stretching, dynamic stretching, pre contraction stretching (Muanjai *et al.*, 2017). In this study, researchers chose the static stretching technique with theraband on the calf muscle-tendon unit. This stretching technique is conducted by the respondent itself, using a long elastic rope measuring 122x5 cm on the calf muscle-tendon unit.

The calf muscle-tendon unit is the main muscle that makes up the calf, consisting of M. Gastrocnemius, M. Soleus, and the Achilles tendon (Ghadiali, 2014). This muscle is an important component in daily activities, such as walking, going up and down the stairs, and cycling (H *et al.*, 2021). The calf muscle-tendon unit is very vulnerable to the risk of injury, especially in the elderly because of their physical decline. Static stretching with theraband is effective and safe. It also does not cause a risk of overstretching or tearing the muscles if they do this stretching slowly (Buehler *et al.*, 2021)

METHODS AND MATERIALS

This research was conducted in Klewer Village Rt 02, Rw 07, Sragen, Gatak, Sukoharjo, involving 60 respondents. 30 respondents as the treatment group and 30 respondents as the control group with the following criteria:

a. Inclusion Criteria

- 1) Man and woman aged 45-74 years
- 2) Does not have legs defects

b. Exclusion Criteria

- 1) Using a walker tray
- 2) History of osteoarthritis
- 3) History of lower limb joint replacement

- 4) Subjects have metal implants in their ankles

c. Drop Out Criteria

- 1) Does not follow the stretching once per week
- 2) Doing related physical activities to increase flexibility, such as gymnastics and yoga.
- 3) An incident occurred: the respondent experienced an injury or got an accident.

The data collection technique in this research is using a questionnaire. The researcher sent the letter to the respondent, and the respondent filled out the blank sheet. The type of research used was quantitative research. This study uses the Quasi-Experimental method with a non-equivalent control group or non-randomized pretest-posttest control group design (Sugiyono, 2019). The measuring instrument used is a goniometer. It is used to measure the range of motion of the dorsiflexion ankle in the elderly. Then, the equipment used was theraband. The intervention given was static stretching with theraband on the calf muscle-tendon unit, with an exercise dose of 5 seconds 6 repetitions with a total of 30 seconds of stretching for each exercise. It is performed 5 times a week for 3 weeks.



Figure 1. A Eccentric training initial position, B. Final position of full knee extension

Picture 1. Static Stretching With Theraband
Source : (Aijaz, Hameed and Quddus, 2011)

RESULTS AND DISCUSSION

a. Characteristics of Respondents by Age and Gender

The characteristic of respondent age and gender in the treatment group and control group were men and women aged 45-74 years. According to the World Health Organization (WHO), it refers to the grouping characteristic of the elderly. the people aged 45-59 years in the treatment group (middle age) were 18 people (60%), and in the control group, there were 25 (83%). Then, those people aged 60-74 years (elderly) in the treatment group were 12 people (40%), and in the control group, there were 5 people (17%). Male respondents in the treatment group were 11 people (37%) and 7 people (23%) in the control group. Then, there were 19 women (63%) in the treatment group, and in the control group, there were 23 women

(77%). According to (Tri, 2014), in the book of the introduction of gerontology and geriatrics, women from the age of 30 have started to lose bone mass at a rate of 2-3% per year after menopause. Meanwhile, in men, bone loss suffers after the age of 50, with a decline rate of about 1% per year. Old age causes a person to experience a decline in the body's ability to do daily life activities. In the elderly, it also decreases muscle strength and contraction, a decrease in muscle elasticity and flexibility, muscle tissue regeneration slows down, and bone mass also decreases. Further, it will affect the reduction in joint flexibility (Deniro, Sulistiawati, and Widajanti, 2017). If the joint is not moved according to its ROM. The movement is also increasingly limited, and the muscles that cross the joint will

shorten and reduce ROM, increasing the risk of falling in the elderly.

b. Characteristics of Respondents by Physical Activity

The characteristics of respondents that doing light physical activity in the treatment group were 11 people and 13 people in the control group. The people who did moderate physical activity were 19 people in the treatment group and 17 people in the control group. This grouping of physical activity is based on the respondents' daily activities. Suppose the respondent has minimum movement in their daily life. In that case, they will be treated using light physical activity, whereas if the respondent is an active person in their daily life, it is grouped into moderate physical activity. According to (Deniro, Sulistiawati, and Widajanti, 2017), the more independent the elderly's daily

activities, the lower the fall risk percentage. The independence in doing their daily activities has benefits to increase flexibility, muscle strength, self-efficacy, or self-efficacy. It is in line with activity theory which states that successful elderly are the elderly that can be active in many social activities. Then, the elderly who continues to maintain their activity until old age tends to be more independent than other elderly (Azizah, 2011).

c. The Effect Of Static Stretching Calf Muscle Tendon Unit With Theraband Toward Range Of Motion Dorsi Flexion Ankle On Elderly Person.

Table 1. Dependent T-Test

Group	t count	t table	p-value	Conclusion
Treatment				
➤ Pretest Right ROM and posttest	-12,673	2.04523	0.000	Ha accepted
➤ Pretest left ROM and posttest	-12,551	2.04523	0.000	Ha accepted
Control				
➤ Pretest right ROM and posttest	-4,604	2.04523	0.000	Ha accepted
➤ Pretest left ROM value and posttest	-4,854	2.04523	0.000	Ha accepted

Based on the testing effect using the Dependent T-Test statistical test, the

measuring results of the ankle-dorsiflexion range of motion in the

treatment group and the control group showed $p = 0.000$ ($p < 0.05$) on the right ROM and left ROM. The t value shows a negative t value and $< t$ table value. Then the results of the p and t values show that H_a is accepted (the effect exists) in the treatment group who received and the control group who did not get any treatment static stretching calf muscle-tendon unit exercises with theraband for 3 weeks. The mechanism of increasing muscle length by static stretching causes the muscle fibers to be pulled out to the full length of the sarcomere. This method will help realign some fibers or abnormal cross-links in shortened muscles (Reid, 2017). Giving static stretching that is done slowly will stretch the sarcomere so that stretching will restore the elasticity of the dysfunctional sarcomere.

Static stretching is an effective stretch exercise to increase ROM. This method can affect all muscles, including the calf muscle-tendon unit (Thomas et al., 2018). Physical activity factors also influence the control group. It is in line with the activity theory in the gerontic nursing book (Azizah, 2011), which states that successful elderly are active in many social activities. An elderly who continues to maintain physical activity until old age tends to have a high level of independence and better muscle flexibility when compared to the other elderly (Deniro, Sulistiawati, and Widajanti, 2017).

d. Comparison between Treatment Group and Control Group

Table 2. Independent T-Test

		t count	t table	p-value	Conclusion
Posttest Treatment and control groups	Right ROM	6,601	2.00172	0.000	H_a accepted
	left ROM	5,134	2.00172	0.000	H_a accepted

Comparative statistical tests conducted with the Independent T-Test in the treatment and control groups result in a p -value = 0.000 ($p = <0.005$) on the right and left ROM. Then, the t value showed a positive t -count and $> t$ table; from the

results of the p and t values, it can be concluded that H_a is accepted (there is a significant difference) between the treatment group and the control group. These results are supported by the results of different means in the treatment group

with greater results, namely 6° (right ROM) and 6.4 (left ROM), while in the control group, there are 0.7 different means (right ROM) and 0.7 (left ROM). It can be concluded that the static stretching of the calf muscle-tendon unit with the theraband is better and more effective in increasing the range of motion of the dorsiflexion ankle in the elderly. The results of this study are by the theory (Reid, 2017) in his book "The Science of Stretching," which states that the static stretching calf muscle-tendon unit exercise with the theraband is a form of exercise to increase flexibility and ROM dorsiflexion of the ankle. The elderly in carried their activity relies on the work of the calf muscle and ankle muscles. These muscles include M. Gastrocnemius, M. Soleus, Achilles tendon, M. Tibialis anterior, M. Tibialis posterior, M. Peroneus Brevis, and longus, M. Extensor hallucis longus. That muscle takes an important role in daily activities, such as walking, going up and downstairs, and cycling (Muanjai et al., 2017). In the elderly, calf muscle is risked on the various injury. Therefore it is necessary to give special stretching exercises, such as the static stretching technique using theraband

According to Aijaz et al. (2011) in their research entitled "A comparative

study of Eccentric Training Using Theraband and Static Stretching in Improving Triceps Surae Muscle Flexibility," defined that static stretching with theraband is carried out routinely on the calf muscle-tendon unit for 5 seconds, 6 times repetitions with a total of 30 seconds of stretching for each exercise, performed 5 times a week for 3 weeks proved to be effective in increasing flexibility and preventing injuries and falls on the elderly. Following the analysis results, that research also proves that giving a static stretching calf muscle-tendon unit with theraband in the treatment group is more effective in increasing the range of motion of ankle dorsiflexion in the elderly. Based on (Medeiros et al., 2016), static stretching that is done slowly will stretch the sarcomere. That stretching will restore the elasticity of the dysfunctional sarcomere and increase its flexibility and ROM. A research journal conducted by (Muanjai et al., 2017) entitled "The acute benefits and risks of passive stretching to the point of pain" also explained that static stretching that is effective for increasing the greatest change in ROM is with 15 to 30 seconds of static stretching.

CONCLUSIONS AND SUGGESTIONS

Based on the research results, it can be concluded that the static stretching calf muscle-tendon unit exercise with theraband can increase the range of motion of dorsiflexion ankle in the elderly. Static stretching exercises with theraband on dorsiflexion ankle movements can be recommended for the elderly. It can increase the flexibility of the elderly ankle. Then, the health problems such as muscle injury and the risk of falling can be prevented. Therefore it is expected that the quality of life of the elderly can increase. The research can be developed with more complex variables because many factors still affect ROM in the elderly.

REFERENCE

- Aijaz, S. M., Hameed, U. A. and Quddus, N. (2011) 'A Comparative Study of Eccentric Training Using Theraband and Static Stretching in Improving Triceps Surae Muscle Flexibility' *International Journal of Sport Science and Engineering*, vol. 05 (3).
- Azizah, Lilik M. 2011 'Keperawatan Lanjut Usia', Yogyakarta: *Graha Ilmu*.
- Behm, D. G. *et al.* (2015) 'Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: A systematic review', *Applied Physiology, Nutrition and Metabolism*, 41(1).
- Buehler, C. *et al.* (2021) 'Quantifying Muscle Forces and Joint Loading During Hip Exercises Performed With and Without an Elastic Resistance Band', *Frontiers in Sports and Active Living*, 3(August).
- Deniro, A. J. N., Sulistiawati, N. N. and Widajanti, N. (2017) 'Hubungan antara Usia dan Aktivitas Sehari-Hari dengan Risiko Jatuh Pasien Instalasi Rawat Jalan Geriatri', *Jurnal Penyakit Dalam Indonesia*, 4(4).
- Ghadiali, M. T. and Surgery, G. (2014) 'Anatomy of The Foot and Ankle', *Diplomate of American Board of Surgery*: 'Www.Ghadialisurgery.Com'.
- H, A. *et al.* (2021) 'A Comparative Study of Two Manual Technique on Triceps Surae Muscle Flexibility in Working Females Wearing High Heels', *International Journal of Current Research and Review*, 13(14).

- Hwang, H. S. (2018) 'The effect of stretching type on hamstring flexibility', *Journal of International Academy of Physical Therapy Research*, 9(2).
- Ibrahim, H, Nurhasanah, & Juanita 2018, 'Relationship between Balance and Daily Activities among Elderly In Aceh Besar Health Center', *Idea Nursing Journal*, Vol. IX, No. 2
- Jang, H.J., Kim, S.Y. and Jang, H.J. (2014) 'Comparison of the Duration of Maintained Calf Muscle Flexibility After Static Stretching, Eccentric Training on Stable Surface, and Eccentric Training on Unstable Surfaces in Young Adults With Calf Muscle Tightness'. *Phys Ther Korea*, ;21(2):57-66.
- Kemetrician Kesehatan RI (2014) 'Infodatin "Situasi dan Analisis Lanjut Usia"', *Geriatric*, p. 8.
- Kemetrician Kesehatan RI (2020) 'Pusdatin "Profil Kesehatan Indonesia 2019"'.
Volume 20 Number 2, August 2022
- an Active Warm up on Anaerobic Performance.', *International journal of exercise science*, 10(1).
- Kisner, C, & Lynn, A. (2017), *Terapi Latihan Dasar Dan Teknik*, Jakarta: Buku Kedokteran EGC, vol. 1 edisi 6.
- Konrad, A., Stafilidis, S. and Tilp, M. (2017) 'Effects of acute static, ballistic, and PNF stretching exercise on the muscle and tendon tissue properties', *Scandinavian Journal of Medicine and Science in Sports*, 27(10).
- Medeiros, D. M. *et al.* (2016) 'Influence of static stretching on hamstring flexibility in healthy young adults: Systematic review and meta-analysis', *Physiotherapy Theory and Practice*, 32(6).
- Muanjai, P. *et al.* (2017) 'The acute benefits and risks of passive stretching to the point of pain', *European Journal of Applied Physiology*, 117(6).
- Nagano, K., Uoya, S. and Nagano, Y. (2019) 'Effects of antagonistic muscle contraction exercises on

- ankle joint range of motion’, *Journal of Physical Therapy Science*, 31(7).
- Paul, J., Balakrishnan, P. and Izham, M. (2014) ‘Comparative Effect of Static and Dynamic Stretching Exercise to Improve Flexibility of Hamstring Muscles among Non Athletes’, *International Journal of Physiotherapy*, 1(4).
- Pusat Data dan Informasi Kementerian Kesehatan RI. (2013) ‘Gambaran Kesehatan Lanjut Usia di Indonesia’, *Kemendes RI*.
- Reid, Alex. (2017), *The Science Of Stretching*, *British library Cataloguing*.
- Sugiyono. (2019), *Metode Penelitian Kuantitatif Kualitatif R&D*, Bandung: Alfabeta..
- Thomas, E. *et al.* (2018) ‘The Relation between Stretching Typology and Stretching Duration: The Effects on Range of Motion’, *International Journal of Sports Medicine*, 39(4), pp. 243–254. doi: 10.1055/s-0044-101146.
- Tri Budi. (2014), *Pengenalan Gerontologi Dan Geriatri Sebagai Buku Acuan Multi Disiplin Dan Untuk Masyarakat*, Jakarta: CAS UI.
- Widarti, R. and Triyono, E. (2018) ‘Pemberian Ankle Strategy Exercise Pada Lansia Terhadap Keseimbangan Dinamis’, *Gaster*, 16(1).
- Yenni Ferawati. (2021), *Keperawatan Gerontik*, Medan: Yayasan Kita Menulis.