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# Relationship between Flexibility with Balance in the Elderly Based on Clinical Pathophysiology

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***Abstract*—the decreased cognitive function is a normal condition experienced by the elderly. Flexibility is an important factor in the development of movement in humans. Muscle flexibility is largely determined by muscle length. When the hamstring muscle is shortened as a result of this process it flexibility will decreases, affecting the balance of muscle work leading to disruption of daily activities, such as a change in posture and walking activity. The objective of this research is to know, based on clinical pathophysiology, the relationship between muscle flexibility and balance in the elderly. The research is an observational study with a cross-sectional analytic design. The sample was defined as s 77 elderly persons. Data analysis techniques have been used as a pearson correlation. The result of the relationship between flexibility and balance in the elderly was p= 0,031, with a significant relationship between both variables. There is an evident relationship between muscle flexibility and balance in the elderly.**

***Keywords—flexibility, balance, elderly***

## I. INTRODUCTION

According to Pudjiastuti (2003) at the age of 60 years and over, elderly experience a decrease in the musculoskeletal system secondary to the reduction of the flexibility of muscles, joints, cartilage function, bone density, and muscle strength, especially in the lower extremities. Elderly according to World Health Organization, can be classified into four groups. As a result of this classification, someone aged 45-49 years is called middle age and someone 60-74 years old (elderly). Also, someone aged 75-90 is said to be elderly and someone over the age of 90 is called very old.

Flexibility is the ability of the muscles to stretch as long as possible. This function allows the movement of the body with maximum ROM and comfort. It is considered a determining factor for gaining movement in humans. One muscle that plays an important role in this activity is the hamstring muscle. The function of the hamstring muscle as an effector enters the terminal swing phase in the anterior muscles of the ankle to remain active to maintain the ankle in a neutral position during the subphase terminal swing. The main task of the effector system itself is to maintain the center of gravity / COG.

The motor response effector, in a standing position, maintains the attitude and balance of the movement carried out by a group of joints and muscles from both sides of the body. Decreased flexibility can lead to a decreased balance [1]. If the uncontrolled balance increases will increase as well the risk of falling in the elderly.

Aging is often accompanied by decreased balance, muscular strength and flexibility. Declining vision and sometimes the prescription of drugs can lead to loss of balance issues. The result of this process can be falling on weakened with consequent possible fractures due to the old bones.

Globally, about 80% of worldwide elderly individuals live in the developing countries[2]. Aging lead to a reduction of muscle strength reduced joint mobility and degradation of incoming sensory information that in turn may contribute to the risk of falls in elderly[3]. Fear of falling and sustained serious injury is increased with advancing age. However, loss of self-confidence associated with falling leads to decreased activity and physical ability.3 Risk factors for fall include balance dysfunction, muscular weakness, gait deviations, and poor joint mobility. Elderly is considered the second cause of death due to accidental injury all over the world [4].

Balance is the ability to maintain the body's center of mass (COM) within the limits of the base of support[5]. Depending on the motor task, people use different strategies to maintain their upright posture. These strategies are based on the ankle, hip, and step. Both hip and ankle strategies involve activation of hip and ankle muscles opposite to the direction of the perturbation[5]. When the amplitude of the perturbation is too large, the stepping strategy is utilized. The step strategy is performed by taking a step in the direction of the perturbation, although the base of support is realigned under the COM. This allows maintenance of the COM within the base of support preventing external forces to disturb the balance and thus maintain upright posture[5].

Although these systems and strategies help to maintain the balance of younger people They become less effective in the elderly population due to their physiological changes. For example, a study performed on animals has shown that the increase in connective tissue in the aging muscle would lead to a decrease in flexibility[6]. In addition, the muscle production force is decreased[7]. Aging results in a decrement of muscle cross-sectional area and the volume of connective tissue. Furthermore, the decrease in type II fast twitch muscle fibers would hinder the ability of the muscle to create a fast forceful contraction[7]. The aforementioned physiological modifications result in kinematic changes of the musculoskeletal system. There is a 50% loss of trunk extensor flexibility after the age of 70 years, which results in COM displacement posterior to the heels. In addition, ankle joint flexibility decreases by 50% in women and 35% in men after 55 years of age[5].

Normal functioning of the musculoskeletal system is imperative for balance maintenance. The decreased flexibility and strength in the elderly also decrease their ability to recover quickly from a perturbation. Lack of necessary range of motion (ROM) would decrease the effectiveness of hip and ankle strategies. If a person is

unable to counteract a perturbation due to lack of flexibility and lack of appropriate ROM, the perturbation may result in fall. Prior research has shown that there is a correlation between short gastrocnemius muscle and increased falls in the elderly.

The objective of this study is to identify the relationship between muscle flexibility with balance in the elderly based on clinical pathophysiology.

## II. METHODS

This research is an observational study with a cross-sectional analytic design with the aims to define the relationship of muscle flexibility with balance in the elderly, in a sample of 77 people. Data analysis techniques used Pearson correlation.

## III. RESULT AND DISCUSSION

The data in this study were taken with a flexibility and balance test. .

TABLE I. PEARSON CORELATION ANALYSIS RESULT

| Variabel | n | Sig | Explanation |
|---|---|---|---|
| Flexibility * balance | 77 | 0.031 | Significant |

There are significant correlations between flexibility and balance in the elderly according to the table above. Studies in older adults have shown a relation between the lack of muscle flexibility and poor walking ability and body balance. It has been described impact of lumbopelvic muscles and its contribution to postural stabilization. Balance improvement is associated with decreased risk and fear of falling, and improvement in the quality of life.

The elderly experience a decrease in muscle mass with a consequent reduction of muscle strength, especially the strength of the lower limb muscles. In addition, these changes will also result in decreased elasticity and collagen, cartilage tissue in the joints to soften and undergo granulation, decreased bone density, decreased muscle strength and muscle fibers, decreased the elasticity of the connective tissue, and decreased water content in the nucleus pulposus. All of these changes will decrease the flexibility in the trunk [1].

When there is a decrease in trunk flexibility, the center of gravity (COG) in the body undergoes postural alignment changes such as compensation for a vertical shift in body mass in front of the heels. As a result of these changes, the body cannot maintain its posture. The central nerves system (CNS) will maintain the postural response, through its pathways receives peripheral sensory information from the visual, vestibular, and proprioceptive systems in the gyrus post the contralateral central lobe patients. Furthermore, this information is processed and integrated at all levels of the nervous system. Finally, in a very fast time, a correct postural response will form and will be expressed mechanically through the effector in a series of specific movement patterns. When experiencing interference, the mechanical system between the effector will also be disrupted and will affect the body's ability to control posture so that a balance disorder will occur [8].

## IV. CONCLUSION

The flexibility had a significant correlation with the balance in the elderly. It is very important the application of flexibility and balance exercises with the aim to maintain the equilibrium of the posture in the elderly.

## REFERENCES

[1] M. Stanley dan G. B. Patricia 2007. Buku Ajar Keperawatan Gerotik. Edisi 2. Ed. Meiliya Eni dan Ester Monika, Jakarta : kedokteran EGC.

[2] UN Population Division. World Population Prospects. 2008 World population data Sheet population Reference Bureau. USA, 2008.

[3] L. D. Gillespie, M. C. Robertson, W. J. Gillespie, et al. Interventions for preventing falls in older people living in the community. *CDS Rev*. 9:CD007146, 2012.

[4] E. Tuunainen, J. Rasku, P. Jantti, et al. Risk factors of falls in community dwelling active elderly. *Auris Nasus Larynx*. 41(1):10–16, 2014.

[5] A. Shumway-Cook, W. H. Marjorie. Motor Control Translating Research Into Clinical Practice.3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins 159-219, 2007.

[6] M. A. Alnaqeeb, N. S. Al Zaid, G. Goldspink. Connective issue changes and physical properties of developing and ageing skeletal muscle. J Anatomy, vol. 139, p. 677–689, 1984.

[7] G. N. Williams, M. J. Higgins, M. D. Lewek, Aging Skeletal Muscle: Physiologic Changes and the Effects of Training, Phys Ther, p. 82:62–68, 2002.

[8] M. Chiacchiero, The Relationship Between Range of Movement, Flexibility, and Balance in the Ederly. College Of Staten Island, New York, 2010.