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# 5 RELATIONSHIP BETWEEN FLEXIBILITY WITH BALANCE IN THE ELDERLY BASED ON CLINICAL PATHOPHYSIOLOGY

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**Abstract**—Decreased of cognitive function is a normal condition experienced by the elderly. Flexibility is the deciding factor for gaining movement in humans. Muscle flexibility is largely determined by muscle length. When the hamstring muscle is shortened then the flexibility of the muscle in the condition of flexibility decreases, thus will affect the balance of muscle work and can lead to disruption of daily activities, such as change in posture and walk activity. The objective of this research is to know the relationship between muscle flexibility with balance in the elderly based on clinical pathophysiology. The research is observational study with cross sectional analytic study design aims to find out the relationship of muscle flexibility with balance in the elderly, with a large sample of 77 people. Data analysis techniques using pearson correlation. The relationship between flexibility with balance in the elderly obtained the result of  $p= 0,031$ , so a significant relationship between the two variables. The conclusion is the relationship between muscle flexibility with 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 which causes a decrease in flexibility of muscles, joints, cartilage function, reduced bone density and decreased muscle strength, especially in muscle strength of the lower extremities with increasing age. Elderly according to World Health Organisation, can be classified into four groups, namely: someone aged 45-49 years is called middle age, someone 60-74 years old (elderly).

Called the elderly, 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 so that the body can move with maximum ROM and comfort. Flexibility is a determining factor for gaining movement in humans. One muscle that plays an important role in 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. Where is the task running.

In a standing position the motor response effector maintains the attitude and balance of movement carried out

by a group of joints and muscles from both sides of the body. Decreasing flexibility can lead to a decrease in balance [1]. If the uncontrolled elderly balance increases the risk of falling.

Aging is often accompanied by decreased balance, muscular strength and flexibility. The loss of muscle elasticity causes muscles to become tighter and shorter. Declining vision and sometimes the prescription drugs that one takes as an older person can lead to loss of balance issues and the result is falling on weakened, old, brittle bones that can't withstand the impact.

Globally, about 80% of worldwide elderly individuals live in the developing countries[2]. Aging lead to reduction of muscle strength reduced joint mobility and degradation of incoming sensory information that in turn may contribute to risk for falls in elderly[3]. Fear of falling and sustained serious injury is increased with advancing age, thirty percent of elders aged 65 years or more, half of them fall once per year. 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, while among elderly is 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 3 different strategies to maintain their upright posture. These are known as ankle, hip, and step strategies. 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 step 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 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 because of 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

1 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 correlation between short gastrocnemius muscle and increased falls in the elderly.5

5 The objectives of this study were to know the relationship between muscle flexibility with balance in the elderly based on clinical pathophysiology.

## II. METHODS

The research is observational study with cross sectional analytic study design aims to find out the relationship of muscle flexibility with balance in the elderly, with a large sample of 77 people. Data analysis techniques using pearson correlation.

## III. RESULT AND DISCUSSION

The data in this study were taken with an instrument in the form of flexibility and balance test. The analysis result show.

TABLE I. PEARSON CORRELATION ANALYSIS RESULT

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

The table above shows that there is significant correlation between flexibility and balance in the elderly. 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 that greater efficacy of the lumbopelvic muscles can contribute to postural stabilization. Balance improvement is associated with decreased risk and fear of falling, and with an improvement in quality of life.

the elderly experience a decrease in muscle mass which causes a decrease in 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 elasticity of the connective tissue, changes in collagen in the annulus and decreased water content in the nucleus pulposus which will cause discus volume to decrease so that a decrease occurs flexibility in the trunk and become inflexible [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 heel so that it is no longer in the base of support and the resultant all forces acting no longer equal to zero. As a result of these changes the body cannot maintain its posture. In maintaining the postural response, the central nerves system (CNS) through its pathways receives peripheral sensory information from the visual, vestibular, and proprioceptive systems in the gyrus post contralateral central lobe pariental. 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

Based on analysis result we can conclude that flexibility had significant correlation with balance in the elderly. it requires the application of flexibility and balance exercises to help maintain flexibility and balance in the elderly.

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