

Implementation Of Gaze Stability Exercise With Ergonomic Approach Based On Home Training Program in Improving Balance in The Elderly

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ABSTRACT

Introduction: The aging process is characterized by a decrease in physiological function, which has an impact on balance disorders and can increase the risk of falling in the elderly. This study was to analyze differences in the balance of the elderly before and after the implementation of gaze stability exercise with an ergonomic approach based on a home exercise program. **Methods:** This research is an experimental study with a pre and post test one group design. Participants underwent training every day for 6 weeks. Balance ability was measured using time up and go test pre and post intervention. **Results:** There was a significant difference in the pre and post intervention time up and go test scores with $p < 0.05$. **Conclusion:** based on the results of the study, the implementation of gaze stability exercise with an ergonomic approach based on a home exercise program was significant in improving the balance of the elderly by 18.6% compared to before receiving the exercise.

Keywords: Balance, Elderly, Ergonomics, Gaze Stability Exercise

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INTRODUCTION

The aging process is a definite process experienced by a person and cannot be avoided by anyone in life. As people age, naturally the elderly will experience a decrease in physiological and cognitive functions with characteristics, among others, decreased skin elasticity, hair loss, memory loss, decreased muscle strength, visual impairment, hearing loss and decreased physical ability which leads to a decline in health conditions as a whole (Papa *et al.*, 2017).

The impact that occurs when an elderly person experiences limitations in seeing, hearing and walking is a balance disorder. One of the conditions and risk factors that can cause balance disorders is neurological disorders such as vestibular disorders. The vestibular sensory system is located in the ear which provides information about the position of the head and balances it. Balance is the ability to maintain proper posture during movement. The incidence

of falls in the elderly needs to be avoided, because it will cause physical and psychological trauma and reduce the function of independence (Vittala *et al.*, 2021). In Indonesia, the prevalence of injury due to falls in the elderly reaches a percentage of 49.4% in the age category above 55 years, while at the age above 65 the percentage is higher at 67.1% (Ministry of Health, 2017).

Under these conditions, an exercise program is needed to improve the balance of the elderly. Gaze stability exercise with the application of participatory ergonomics was chosen as a balance exercise, which is a safe form of exercise for the elderly. The participatory ergonomics approach in this study means that the elderly are involved in solving problems they face. In addition, the design of exercises that are ergonomic, simple, economical, energy efficient, environmentally friendly, safe, and in accordance with the local socio-cultural environment, can be easily implemented and practical for the elderly to do in the long term.

Research conducted by Khanna proved that gaze stability exercise carried out for 6 weeks was able to improve balance based on measurements of the Berg Balance Scale (BBS), Dynamic Gait Index (DGI), and Activities-Specific Balance Confidence (ABC) (Khanna & Sandeep, 2014). According to Limerick, the application of participatory ergonomics in an exercise intervention can foster a sense of ownership of the solutions that have been decided, so that the implementation process is carried out with awareness and full sense of responsibility and can create better changes. In addition, with a participatory approach, it is also expected to create long-term guarantees for the implementation of interventions (Limerick, 2018). The purpose of this study was to analyze differences in the balance of the elderly before and after the implementation of gaze stability exercise with an ergonomic approach based on a home exercise program.

METHODS

This research is an experimental study with a Quasi Experimental approach with a pre and post test one group design research conducted at the Elderly Community in Kedung Boto, Kesamben, Jombang, in September - November 2022. The study participants were selected through inclusion criteria: elderly aged 60 – 74 years old, body mass index 18.5 – 24.9 kg/m², has no history of stroke, parkinsonism, vertigo, lower extremity fracture, can walk independently without assistive devices, can hear well, can communicate and understand instructions and not participate in other balance exercises. Of the 20 elderly, there were 11 elderly who met the criteria and would undergo gaze stability exercise with an ergonomic approach, measurement of balance with the time up and go test would be carried out twice, namely pre and post intervention.

Participants perform a gaze stability exercise with a participatory ergonomics approach. The participatory ergonomics approach in this study is in the form of choosing the exercise time determined by the participation of the participants through the results discussed between the researcher and the participants, so that participants do not feel burdened by the exercise schedule and volunteer in the training process. Gaze stability exercise which is followed by

participants is an X1 type of exercise in accordance with the training guidelines (Gaikwad *et al.*, 2018). In the first week of adaptation, the exercise is carried out by rotating the head horizontally from side to side and keeping the eyes focused on an object in front of it, with a tolerable duration of one minute followed by a rest period of one minute, and a total of five minutes repetition, one time a day. In the 2nd to 6th week, the training dose will be increased by increasing the maximum duration of one minute per repetition, one minute rest, maximum frequency of twice times a day, speed (tolerance) and direction of horizontal and vertical head movements.

All exercises are performed with a home workout program. Each participant is given a training guide and video of gaze stability exercise training by a physiotherapist, which will be carried out at home with family supervision. During the training, the participant's family is required to send photos/videos while the participant is doing the exercise. Researchers will visit twice a week.

RESULT

Table 1 shows the participant characteristics of the 11 elderly. Participants were dominated by elderly women, amounting to seven elderly and four elderly for male elderly participants. All participants had normal BMI values, and entered old age with a mean of 64.8 years.

Table 1. Characteristics of Participants

Variable	
Gender (%)	
Man	4
Woman	7
Age (Years) Mean±SD	64.8±1.94
BMI (Kg/m ²) Mean±SD	21.3±1.36

Age is related to vestibular function. As is the case with the vestibulo ocular reflex which decreases with age which puts the elderly category at risk of falling. Elderly age requires a long response in focusing the gaze during fast movements. This affects postural coordination which causes problems with balance (Khanna & Sandeep, 2014).



Table 2 shows the normality test and the difference test on the balance variable which was measured using the time up and go test pre and post intervention. Research data are normally distributed. So it can be concluded that the hypothesis test uses parametric test. The different test showed that there were significant results in the application of gaze stability exercise with an ergonomic approach based on a home exercise program in improving the balance of the elderly with a p value of <0.05.

Table 2. Normality Test and Difference Test Pre and Post Intervention

Variable	Mean±SD	Normality Test	p value
Pre Intervention	12.155±1.403	0.357	0.000
Post Intervention	9.895±1.099	0.826	

Based on the results of the statistical paired sample t test, the p value < 0.05 indicates that there is an effect of gaze stability exercise on balance in the elderly. The results of this study are in line with research by Bhardwaj & Vats (2014), Gaze stability exercise a significant increase in balance based on the Berg Balance Scale (BBS) and Activities-specific Balance Confidence scale (ABC) and based on statistical tests with a p-value of 0.000. Another Gaze Stability Exercise study conducted by Gaikwad et al., (2018) also showed significant results in improving balance after six weeks of exercise.

DISCUSSION

In the elderly, there is a decrease in responsiveness in focusing the gaze, this affects postural coordination related to balance in the elderly. In addition to decreased response in focusing the gaze, the elderly also experience a decrease in the vestibulo-ocular reflex (VOR). Gaze stability exercise is an exercise based on the demonstrated ability of the vestibular system to modify the magnitude of the vestibulo-ocular reflex (VOR) in response to a given input (Fatima *et al.*, 2022). Adaptation exercises should be designed in such a way that they reflect the respondents being in various environments when individuals perform their daily activities. Regular exercise carried out by respondents can cause the

elderly to adapt in focusing objects and changes in head position, when the change in head position is good it will cause a good balance as well (Matsugi *et al.*, 2017). It takes a minimum of 6 weeks to be able to cause adaptation of the sensorimotor (Roh & Lee, 2019). The vestibular system is a sensory system that functions in balance, head control and eye movement in the ear called the labyrinthine system. Through the vestibulo-ocular reflex, they control eye movements, especially when looking at moving objects and then forward to the brainstem through the cranial nerves, precisely in the vestibular nucleus. Input from the vestibular nucleus goes to motor neurons through the spinal cord, especially to motor neurons that innervate the proximal muscles, a collection of muscles in the neck and back muscles (postural muscles). The system interacts very quickly so that it helps maintain body balance by controlling the postural muscles (Ueta *et al.*, 2017; Roh & Lee, 2019).

The participatory ergonomics approach is believed to have a greater chance of succeeding in the training program, because all elements can be directly involved from the problem analysis process to solving the solutions that will be implemented. This condition gives a great sense of ownership of the resulting solution, so that a sense of responsibility in the implementation process can grow well and the results achieved are maximized. In addition, a participatory approach is taken, so that the socio-cultural aspects of the daily life of the elderly do not change in an extreme manner, so as not to cause discomfort during exercise. In addition, the participatory approach is also expected to create long-term guarantees for the implementation of the intervention (Driessen *et al.*, 2010; Tappin *et al.*, 2016; Suhardi *et al.*, 2021).

CONCLUSION

The implementation of gaze stability exercise with an ergonomic approach based on a home exercise program was significant in improving the balance of the elderly by 18.6% compared to before receiving the exercise.

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