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THE EFFECTIVENESS OF EXERCISE BALANCE IN IMPROVING POSTURAL STABILITY AND REDUCING THE RISK OF FALLS IN THE ELDERLY

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ABSTRAK. Seseorang yang telah memasuki usia lanjut (lansia) akan mengalami penurunan kondisi fisik dan terdapat perubahan fisik yang ditandai dengan penurunan kekuatan otot yang akan mengakibatkan gerakan tubuh mulai mengalami penurunan fungsi. Perubahan fisik pada lansia mengakibatkan gangguan mobilitas fisik yang akan membatasi kemandirian lansia dalam meningkatkan stabilitas postural untuk memenuhi aktivitas sehari-hari guna mengurangi risiko jatuh pada lansia. Gangguan keseimbangan merupakan penyebab utama yang sering mengakibatkan seorang lansia rentan terhadap cedera fisik akibat jatuh. Tujuan penelitian ini berupa kajian pustaka yaitu untuk meningkatkan stabilitas postural yang dapat dilakukan guna mengurangi risiko jatuh pada lansia. Penelitian ini menggunakan pendekatan metode kajian pustaka yang sesuai digunakan dalam studi pustaka ini yaitu kajian scoping karena tujuan dari studi pustaka ini adalah untuk mengetahui efektivitas intervensi latihan keseimbangan dapat dilakukan untuk mengurangi risiko jatuh pada lansia. Pencarian artikel dilakukan secara sistematis sesuai dengan Diagram Alir PRISMA 2020 berdasarkan tiga basis data yang digunakan yaitu Jurnal PubMed, Sciencedirect, dan Sage. Hasil penelusuran literatur menunjukkan bahwa terdapat beberapa intervensi latihan keseimbangan yang dapat dilakukan untuk mengurangi risiko jatuh pada lansia, yaitu Balance-Enhancing Exercise Program (BEEP), terapi fisik Walking Meditation, dan Multi-system Physical Exercise (MPE). Kesimpulannya, risiko jatuh merupakan salah satu keluhan utama pada pasien lansia. Risiko jatuh pada lansia sebenarnya dapat diatasi, terutama bagi lansia yang aktif berolahraga dan memiliki fungsi mental yang baik. Salah satu latihan fisik yang paling efektif untuk mengatasi risiko jatuh pada lansia adalah Self-Administered Balance-Enhancing Exercise Program (BEEP).

Kata kunci: Lansia, Latihan Keseimbangan, Stabilitas Postur, Risiko Jatuh

ABSTRACT. *A person who has entered old age (elderly) will experience a decrease in physical condition and there are physical changes marked by a reduction in muscle strength, which will result in a decrease in body movement function. Physical changes in the elderly result in physical mobility disorders that limit their independence. Increasing postural stability can help fulfill daily activities and reduce the risk of falls in the elderly. Balance disorders are the leading cause that often results in an elderly person being vulnerable to physical injury due to falls. The purpose of this research, in the form of a literature review, is to improve postural stability, which can be done to reduce the risk of falls in the elderly. This study uses a literature review method approach, which is suitable for this scoping review, as it aims to assess the effectiveness of exercise balance interventions in reducing the risk of falls in the elderly. An article search was carried out systematically following the 2020 PRISMA Flow Diagram using three databases, namely PubMed, ScienceDirect, and Sage Journals. The results of the literature search show that several exercise balance interventions can be carried out to reduce the risk of falling in the elderly, using the Balance-Enhancing Exercise Program (BEEP), Walking Meditation physical therapy, and Multi-system Physical Exercise (MPE). The conclusion is that the risk of falling is one of the main complaints in elderly patients. The risk of falling among the elderly can be overcome, especially for the elderly who are active in training and have good mental function. One of the most effective physical exercises to overcome the risk of falling in the elderly is the Self-Administered Balance-Enhancing Exercise Program (BEEP).*

Keywords: *Elderly, Exercise Balance, Postural stability, Risk of falling*

PENDAHULUAN

Life expectancy is an indicator of the level of health in society. Long life expectancy occurs with increasing numbers of people of advanced age. The elderly are individuals over 60 years who are going through the aging process and experiencing changes and decline in body function. Aging in the elderly will cause changes in the musculoskeletal system, which can reduce muscle strength. Balance disorders in the elderly are the inability of the elderly body to maintain balance when standing [1].

The National Health and Nutrition Examination Survey in America conducted body balance tests on 5000 people aged over 40 years. From these results, it was found that 19% aged over 49 years, 69% aged 70-79 years and 85% aged 80 years or more experienced balance problems. On average, elderly people aged 65-75 years' experience changes in body balance which affect the quality of life. Elderly people who experience balance changes are at risk of falling. Falling is a person's inability to maintain body strength when standing or to respond slowly when the body position changes [2].

According to WHO, in the Southeast Asia region the elderly population is 8% or around 142 million people. In 2050, it is estimated that the elderly population will triple this year. In 2000 the number of elderly was around 5,300,000 (7.4%) of the total population, while in 2010 the number of elderly was 24,000,000 (9.77%) of the total population, and in 2020 it is estimated that the number of elderly will reach 28,800,000 (11.34%) of the total population. Meanwhile, in Indonesia itself, in 2020 it is estimated that the number of elderly will be around 80,000,000 [3].

Someone who has entered old age (elderly) will experience a decline in physical condition and there will be physical changes characterized by less clear hearing, increasingly worsening vision, decreased muscle strength which will result in slow movements, and body movements [4]. Physical changes in the elderly result in impaired physical mobility which will limit the independence of the elderly in fulfilling daily activities and will cause the risk of falls in the elderly [5]. Balance disorders are the leading cause of falls among elderly people [6].

Falls can threaten the safety of the elderly and result in various types of injuries, physical and psychological damage. The prevalence of fall risk in people over the age of 55 years reaches 49.4% and in people over the age of 65 years, it is 67.1% [6]. The incidence of falls each year for elderly people living in the community increases from 25% at the age of 70 years to 35% after the age of >75 years. Falls occur in around 30% of elderly people aged 65 years and over who live in the community, some of whom experience repeated falls [7]. The psychological impact is that even if physical injury does not occur, the shock after falling and the fear of falling again can have many consequences, including anxiety, loss of self-confidence, limitations in daily activities, fear of falling [8]. There are several ways to prevent falls in the elderly, including consuming a balanced diet, using calcium, using surrounding facilities safely, and engaging in regular exercise [9]. Balance exercise is physical exercise that can improve body balance [10]. This case study aims to increase postural stability by reducing the risk of falls in the elderly through balance exercises that will enhance body composition, including fat and muscle mass, boost immunity, increase muscle strength, promote heart health, improve breathing, and reduce anxiety or depression [11].

Exercises for the elderly include factors such as flexibility, strength, balance and stretching. Physical exercise can also slow the loss of bone density and increase muscle mass and strength, including heart muscle [12]. Various types of exercise, including walking, were found to improve balance significantly [13]. Research with a sample of 113 elderly people with a history of falls found that the incidence of falls was reduced by 46% in the group of elderly people who underwent an exercise program twice a week for five weeks. The results of research conducted. It was found that elderly people who were given intervention in the form of balance exercises 3 times a week for 6 weeks were better than elderly people who did not do these exercises, and it also resulted that elderly people who did physical

balance exercises had improved balance compared to before [14].

The results of the case study showed that the three respondents were in the elderly category aged 60-74 years. As you get older, body functions will decrease, including the body's balance function (Agung, 2020). In the elderly there will be changes in muscle strength due to decreased protein levels in the body [15]. Changes in the neurological system in the brain also affect the stability of the elderly's body, for example motor nerves which cause body reflexes [16]. The results of the case study showed that the home environment of the three clients was less safe because there were no handrails, especially in the bathroom, causing a higher risk of falls. The risk of falls in the elderly is not only caused by intrinsic factors, but also extrinsic factors from the environment, for example, slippery and uneven floors, poor lighting, the presence of stairs, the absence of handrails [17]. The evaluation results for the three respondents showed that body balance in the elderly can be improved by using balance exercise movements. The three respondents' Berg Balance Scale (BBS) scores increased after carrying out balance exercise 4x in 1 week, there was an increase with the first respondent's average being 39.25; second respondent 31.5; and third respondent 36.75.

Balance exercise movements can activate the body's postural response and movement system. When performing Single Limb Stance, Tendem Stance, 3 Way Hip Kick, Lateral Stepping, Standing Marching, Mini Lunge, Calf Stretch, Heel Raises, Hamstring Stretch, Foot Taps To Step, the body will provide information to the sensory organs through receptors due to changes from the joints to the nervous system and continues to the brain. In somatosensory, a feedback response is given to motor via sensory in accordance with muscle contractions. A response will appear in the muscles, tendons and skin receptors which will cause changes in the return response. In balance exercise training there is an increase in muscle strength so that the body will experience stability when making movements. The body's automatic postural response also appears when doing balance exercises [18].

This case study states that balance exercise can reduce the risk of falls and improve body balance. This is the same as Ida's research with the results that doing balance exercise four times can improve body balance in the elderly [19]. Balance exercise training can increase the limit of stability, increase static and dynamic stability, improve the motor system, increase sensory integration, and improve postural control. Similar results were also explained in another study which explained that there were differences in fall risk scores before and after balance exercise [20].

METHOD

The method used to conduct a literature review is by searching via the internet. Article searches were carried out systematically under the PRISMA Flow Diagram 2020 based on the three databases used, namely PubMed, ScienceDirect, and Sage Journals. *A scoping review is a comprehensive analysis that* identifies literature related to the research question [21]. There are five stages in carrying out the method *scoping review*. The five stages are identifying research questions, searching and identifying literature that can be used to answer predetermined research questions, sorting literature, presenting data or information from each literature, and forming conclusions, suggestions and reports on the results of the overall literature analysis [22].

Based on the total search for articles from three databases, this was obtained 610 article. Articles were identified based on combining keywords with the application of the PICO approach including *Population*: Elderly, *Intervention:* Physical exercise*, Comparison:* -, *Outcome:* Reduced risk of falls. The inclusion criteria in this literature review were articles *Free full-text* published in the last 10 years (2011 - 2021) with research design *Randomized Control Trial* And *Like an experiment*, published in English, and a minimum sample size of 30 in each group for consisting of 2 groups. Keywords used in article searches are: *((“Aged” OR “Elderly” OR Frail elderly) AND (“Physical exercise” OR Physical activity OR “Physical training” OR “Exercise training”) AND (“Fall risk reduction” OR “Balance*.

RESULTS

The results of the author's analysis show that several types of physical exercise can be given to the elderly to reduce the risk of falls, including: Balance-Enhancing Exercise Program (BEEP), walking meditation physical therapy (Walking Meditation), and Multi *Physical Exercise (MPE)*. These three physical exercises showed a significant increase in balance, muscle strength and movement coordination in the elderly. This is proven from the journal articles that the author analyzed.

The results of the review of each literature used will be presented in tabulated form. The tabulation created will contain ways to find out physical exercise interventions that can be carried out to reduce the risk of falls in the elderly, the author of the article, along with the year the article was published, type of research, research methods, and research results. Based on the journal search results, 3 journals were found that showed positive results from several physical exercise interventions that can be carried out to reduce the risk of falls in the elderly, which are presented as follows.

DISCUSSION

Balance-Enhancing Exercise Program (BEEP)

From research conducted by Anna Hafström, MD, PhD, et al in 2016 entitled "*Improved Balance Confidence and Stability for Elderly After 6 Weeks of a Multimodal Self-Administered Balance-Enhancing Exercise Program: A Randomized Single Arm Crossover Study*" shows that one-leg standing time increased 32% with eyes open (EO), 26% with eyes closed (EC) on a solid surface, and 54% EO on a compliant surface (P < .001). *Posturographers* confirmed the increase in balance when perturbed on a solid surface and corresponded to EO and EC (P .033). Walking, bench stepping, and speed *Timed Up and Go* increased (P .001), as did scores in *Berg Balance* and balance confidence scale (P .018). The interventions given to participants in this study were: *balance-enhancing exercise program* (BEEP) for 6 weeks. Only exercises that are easy to implement and safe to do in a home environment are included. To minimize the risk of orthostatic hypotension and syncope, the program begins with a 3-minute warm-up. This also allows the participants to focus mentally on the training. This program includes exercises that facilitate the sensory reweighting process because aging causes many degenerative processes that affect the ability of all sensory systems to detect position and movement. Therefore, BEEP consists of exercises on a solid (floor) and compliant surface (double-fold exercise mat) with eyes open and eyes closed. Despite being asked to do the training every day, participants performed the BEEP intervention for an average of 16 minutes 4 times per week. None of the participants reported any incidents or side effects from the training [23].

Walking Meditation (WM)

In subsequent research carried out Apsornsawan Chatutain, Jindarut Pattana, Tunyakarn Parinsarum, and Saitida Lapanantasin in 2018 entitled *"Walking meditation promotes ankle proprioception and balance performance among elderly women"* show *Walking Meditation* improves ankle proprioception and balance performance elderly women. The characteristics of WM, as a slow form of walking along with attention to leg and foot movements, provide more extended single-leg stance periods and improve neuromuscular control. Therefore, WM is a form of gentle exercise and balance with mind-body exercises that promote proprioception and balance performance among elders. In addition, the results also support that balance performance and ankle proprioception are associated with age-related decline among older people, who are not involved in any physical training. The intervention carried out on the WM participant group took part in WM training for 8 weeks (3 days/week), while the control group carried out daily activities as usual. WM training was conducted by a Buddhist monk, who had more than 5 years of experience in WM training. WM exercises are carried out with the help of a steady mind (or attention) by focusing on the movements of the legs and feet at each left and right step, alternately, while walking back and forth slowly 8 to 12 steps repeatedly for 30 minutes every day. Flavor *proprioceptive* Right ankle joint and balance performance were assessed at baseline, week 4 post-training, and week 8 post-training. The assessors were the same person throughout the

experiment and were blinded to group randomization [24].

***Multi-System Physical Exercise* (AND)**

Furthermore, in research conducted by Jiraporn Chittrakul, Penprapa Siviroj, Somporn Sungkarat and Ratana Sapbamre in 2020, intervention with *Multi-System Physical Exercise* (MPE) demonstrated reduced risk of falls in older adults with pre-frailty (Chittrakul et al., 2020). Intervention is carried out with programs *Multi-System Physical Exercise* (MPE) designed based on falls risk assessment components (using Physiological Profile Assessment (PPA)) and literature on exercise interventions for falls prevention. The MPE program consists of four parts: proprioception training, muscle strength training, reaction time training with auditory cues, and postural balance training [25].

The MPE program was carried out with participants in the intervention group for three days per week for 12 weeks, totaling 36 sessions. To ensure that all participants exercised properly and safely, they exercised in supervised sub-groups of twelve participants. Each training session lasts 60 minutes, starting with a ten-minute warm-up, and ending with a five-minute cool-down. All participants begin the program by learning the basics of the program's four components. The program is divided into three levels, beginner, intermediate, and advanced, however all participants in this study had comparable abilities at the start, therefore, all participants started at the beginner level then moved to the intermediate and advanced levels as a group [26].

The exercise regimen is geared to enable the person to pass each level. Each exercise component had three sets, each performed for 15 repetitions, and participants were instructed to maintain the contraction for 10 seconds. The rest interval was set as 10 seconds between each set. A lead instructor who is a physiotherapist with experience in teaching exercise delivers a 12-week training course. Meanwhile, the control group received flexibility training three times each week of the program. They met with a researcher in the primary care unit once a week during the 12 consecutive weeks of the study to share their health experiences [27].

Based on the explanation of each intervention above, overall it was found that these three interventions can reduce the risk of falls, which is characterized by increasing balance, muscle strength and movement coordination. But there is One of the most effective physical exercises to overcome the risk of falls in the elderly is *Self-Administered Balance- Enhancing Exercise Program* (BEEP). Aging or old age is the final stage of life where it is important to pay attention to your health. This is because elderly people will experience a decline in physiological, psychological, cognitive and functional functions. Physical changes in the elderly result in impaired physical mobility which will limit the independence of the elderly in fulfilling daily activities and will cause the risk of falls in the elderly [28].

Based on the three journal articles that we analyzed, we found the effectiveness of physical exercise interventions to reduce or reduce the risk of falls in the elderly. This is in line with research conducted by Quanjer [29]. that structured physical exercise can improve the body fitness of the elderly. Regular physical exercise can increase strength and dexterity, prevent falls and increase the independence of elderly people in their daily activities. Physical exercise can also slow bone density loss and increase muscle mass and strength, including heart muscle [30].

Various types of exercise including walking have been found to significantly improve balance [31]. Several physical exercise interventions have been widely applied to reduce the risk of falls in the elderly, including: *Balance-Enhancing Exercise Program* (BEEP), walking meditation physical therapy (*Walking Meditation*), And *Multi-System Physical Exercise* (MPE). Researchers analyzed each of these interventions and found that overall there was a significant improvement in balance in the elderly after the intervention of these 3 physical exercises. However, as mentioned in the explanation of the results above, *Balance-Enhancing Exercise Program* (BEEP) is considered to be the most effective and relatively easy intervention for elderly people to follow in reducing the risk of falls [32].

On intervention *Balance-Enhancing Exercise Program* (BEEP) obtained increased balance when disturbed on a solid surface and corresponded to eyes open and eyes closed, walking, bench stepping, and Timed Up and speed. After the intervention, 30 m walking speed, modified bench step test, and scores on the BBS also improved for all participants. The participants also explained that their balance had improved when walking and that it was easier for them to walk, especially wearing socks.

Apart from that, the advantage of *Balance-Enhancing Exercise Program* (BEEP) itself is that BEEP has the potential to be implemented before balance dysfunction becomes too advanced or gets worse, which is where it is hoped that this intervention has the potential to prevent falls in the long term by successfully improving balance and improving health.

This program can assist and help maintain the functional ability and mobility performance of seniors living in communities with a relatively low risk of falls. This is also reinforced by research conducted [33]. Which in his research stated that when participants had completed 6 weeks of intervention, their ability to balancing on one leg with available visual information has improved by more than 30% [34].

This improvement could have a significant positive impact in preventing fall-related fractures as this balance measure has been validated to predict hip laxity and fractures in community-dwelling elderly populations [35]. One of the typical strengths in this intervention may include exercises designed to train balance in the absence of vision [36]. Most other balance training interventions have been delivered by health care professionals either individually at home or in group sessions or with a mixed approach several times a week. They are thus relatively expensive compared with self-paced training [37].

BEEP is a purely home-based intervention where exercises can be adjusted individually by participants as their balance abilities improve. The improved balance results suggest that the exercise can be made complex enough by participants to challenge their postural control system and trigger learning processes [38]. However, behind the various advantages *Balance-Enhancing Exercise Program* (BEEP) which has been displayed above, *Balance-Enhancing Exercise Program* (BEEP) also has various shortcomings, as indicated by high scores in the BBS, HAP, ABC, and Mattiasson-Nilo questionnaires, whose participants are elderly who may not have a high level of fall risk. So, it can be concluded that elderly people who have a high risk of falling are not recommended to carry out this BEEP intervention [39].

CONCLUSION

The risk of falling is one of the main complaints in elderly patients. The risk of falls in the elderly can be overcome, especially for elderly people who actively exercise and have good mental function. There are several non-pharmacological therapies to overcome the risk of falls, such as: *Self-Administered Balance-Enhancing Exercise Program* (BEEP), *Walking Meditation*, and Multi-System *Physical Exercise* (MPE). Based on the results of the literature review that we have conducted, one of the most effective physical exercises for overcoming the risk of falls in the elderly is the *Self-Administered Balance-Enhancing Exercise Program* (BEEP). Researchers found that in studies on the effects of the Self-Administered Balance-Enhancing Exercise Program (BEEP), there was a decrease in the risk of falling in subjects who exercised regularly. In the world of nursing, nurses should be able to make a *Self-Administered Balance-Enhancing Exercise Program* (BEEP) as an intervention for patients with nursing problems at risk of falls.

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