Research Article

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The Impact of a Structured Balance Training Program on Elderly Adults

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Review of Literature

Several viewpoints existed as to what is considered a fall. These viewpoints were developed based on the aspect of an individual's involvement in a fall situation, knowledge level about falls, among other factors. A broad definition of a fall that has been widely accepted is "an event whereby an individual comes to rest on the ground or another lower level with or without a loss of consciousness" [1]. When referring to falls in more of a research typesetting, the researcher may have considered a fall, "an unexpected event in which the participants come to rest on the ground, floor, or lower level" [1]. Another proposed definition of a fall wasa "sudden unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force" [1].

There were many factors reviled that contributed to an individual's fall risk. Contributing factors according to included multiple-drug use, psychiatric activity, abnormalities or impairment of gait, compromised balance, poor muscular strength, depression, limitations pertaining to daily activities, dizziness, impaired thought processes, pain, arthritis, diabetes, and urinary incontinence [2]. Martin stated that lower limb weakness, vision impairments, perceived difficulty of mobility, cognitive impairment, poor posture, and the fear of falling were also factors to consider [1]. One or more of these conditions increased a person's fall risk [1]. Previous falls were included as a variable in determining a subject's fall risk because there can be a strong correlation for a subsequent fall [2]. If three or more of the following criteria were met, the individual was at significant risk of falling and should have received intervention:"taking four or more medications per day; history of stroke or Parkinson's disease; self-reported problems with balance; and unable to get out of chair at knee height, without using arms" [1].

In order to properly address falls, the researcher must first understand why they have occurred, in addition to having knowledge of the aforementioned material on falls. Aging was associated with decline in psychological and physical health, which significantly increased risk for falls [3]. Falls were mostcommonin older adults and may have become more prevalent combined with physical or cognitive limitations or exposure to unfamiliar surroundings; posing new risks and hazards [4]. Fear of falling increased with age [5]. Women were more likely to fall than men and were more prone to display other signs of fall risk such as fall-related injuries, lower balance performance, slower walking speed, and impaired physical function [5]. Reduced balance control, decreased gait performance, and an increased fear of falling may also have led to avoiding certain activities, lowered physical function and quality of life, leading to increased fall risk [5]. Many elderly subjects may have lived sedentarily because they had fear of falling [6]. Subjects at the highest and lowest activity levels were both at increased risk for falling due to their extreme activity or lack thereof [2].

"One or more falls have been reported by one-third of the population aged 75 and older and account for two-thirds of home accidents" [7]. Falls and related injuries were some of the leading causes of sickness and morbidity in older adults which lead to functional impairment, lower quality of life, breaks and fractures, and disabilities [5]. Falls were one of the leading causes of injuries leading to emergency room visits or death in those aged 65 and older [6].

In assisted-living communities, around 30% of the residents age 65 or older fell at least once a year [8]. Six percent of the aforementioned falls resulted in fracture [8]. "Although the international research community has spent a sizeable amount of effort and numerous publications on this issue have appeared, falls continue to present a threat to patient safety" [4].

In order to see results as a whole and with objectives in mind, the researcher must have used some sort of tool or rubric to sort results and other data. This provided a more accurate representation of what the entire study looked like or turned out, and how subjects performed on an individual and group basis. A calculation and regression tree (CRT) was used to analyze and identify interrelationships between risk factors [2]. The CRT also calculated an absolute fall risk of an individual or sample group [2]. It may also have been used to identify areas of particular interest for intervention [2]. Other fall risk assessment tools, such as the John Hopkins Hospital Fall Risk Assessment Tool calculated a subject's fall risk based on many variables [4]. The John Hopkins tool used age, fall history, elimination, mobility, mental status, medications, and quantity of assistive patient care equipment to develop a subject's fall risk score [4].Statistical analysis using Statistical Package for the Social Sciences, also known as SPSS, proved to be effective [6].

People who were at any level of fall risk were encouraged to decrease their fall risk. Those at low risk due to physiological performance levels were encouraged to strive to exercise on a regular basis, while incorporating balance training [2]. Safety and effectiveness were the focus of exercise programs for those at high risk of falling [2]. Careful consideration was taken with all physiological and psychological performance deficiencies when designing exercise intervention, to benefit the subject while minimizing risks [2]. Group-based exercise was beneficial for subjects that were unlikely to initiate an exercise program on their own [2]. Exercises, along with cognitive training, are effective prevention strategies [2].

Several exercises have shown to help increase subject stability, lower fall rates, and reduce subject fall risk. Trail-walking exercise was shown to have helped subject locomotion and cognitive performance while performing dual-task paradigms [8]. Trail-walking exercise also displayed evidence that it may decrease subject fall rates for up to six months following completion of an exercise program that includes trail-walking rather than standard indoor walking [8].

Some exercise programs used scaffolding to ensure subject growth and full engagement throughout the program. One six-week enhanced balance training program consisted of repetitive tasks that progressively became more difficult as subject functional balance increased [7]. An outcome included increased subject confidence while walking indoors as well as outdoors [7]. Those who maintained their typical exercise program with conjunction with mobility problem specific physiotherapy saw improvement as well [7]. Balance training and strength training of appropriate and sufficient intensity and duration has been confirmed to be important by a recent systematic review in England [1].

Elderly participating in individual static balance training exercises in a safe environment for 36 minutes per week for 12 weeks yielded significant improvement over counterparts who maintained their regular exercise program [6]. Intervention participants scored better in the 30-second chair test, 8-foot up and go test, balance assessment, and leg functionality assessments [7]. Balance training that incorporated multi-task exercises for elderly with osteoporosis showed evidence of improving fall-related self-efficacy, balance performance, walking speed while performing dual tasks, fast walking speed, and lower extremity physical function when compared to peers [5]. Sessions lasted 36 minutes in addition to one and a half hours walking per week [5]. Balance training was also found to have reduced fall risk in older adults, specifically those with diabetes [9].

Another article offered several valid points to this research. This substantive research analyzed 12 different studies using 4933 subjects, both male and female, age 60 or older [10]. Most notably, exercise programs must be regular and sustainable in order to be effective [10]. Gardner also stated that more trials are needed in order to determine frequency, intensity, and time needed to obtain the best results [10]. The purpose of this study was to examine the impact of a structured balance training program with elderly adults.

Methods

The purpose of this study was to examine the impact of a structured balance training program with elderly adults. Eight elderly individuals, age 70 or more years of age participated in the study. Both males and females participated. Exclusion criteria included being wheelchair bound or having the need to walk with a walker. Participants who walked with a cane were permitted to participate in the study. No other pre-perceived notions in regards to one's balance ability and ability to succeed in the study were made. All procedures and persons not allowed to participate in the study were made with safety in mind and with approval within the permissions of the site of the testing and stability training. No bias towards any individuals who wished to participate in the study was intended.

Initial assessment of all subjects included a complete pertinent past medical history, physical exam, central and peripheral nervous system check, mental status check, and PAR-Q (Physical Activity Readiness Questionnaire). If a subject was not healthy enough to participate without question, a doctors consent to exercise was obtained. Medical history was obtained to ensure test subject safety and sufficient health to participate. The physical exam included a quick overview of the body to take note of any conditions that could potentially lead to safety concerns or performance enhancement, such as ankle braces. Tests of the central and peripheral nervous system included ability to pupil reaction to light test, ability to feel touch or pain in distal extremities, and ability to move distal extremities against force. The hands were tested for equal strength with a grip strength test, when they squeezed the examiners hands. The feet were tested for equal plantar-flexion and extension, with equal and opposite forces applied.

Following screening, a record of previous falls, self-perceived ability to balance, a fall risk assessment, and single-leg balance test in seconds per each leg were completed for each participating subject. Mental status was checked with three different simple questions that oriented a subject to time, place, and situation. The PAR-Q was filled out by the subjects with assistance provided as needed.

Following initial assessments, a random sample of participating individuals, totaling four out of eight subjects, completed six fifteen-minute balance training sessions within a two week training window/ period. The other four subjects simply continued their daily routine for the duration of the training period.

Each balance training session consisted of exercises that potentially could positively effect a subject's balance and fall risk. Participants were put through rigorous balancing training for the duration of each fifteen-minute training session. The only rest and relaxation provided was if a subject had to wait in a line behind other subjects in the training sessions. The balance training in each session started off easier to allow for the patient to become accustomed to the exercise and lack of stability. Exercises then progressed to get harder and harder until the training session time had elapsed. Dependent on subject response to training, sessions either started harder if subjects excelled previously, or stayed the same if subjects were not ready to move to more challenging training.

Fall risk assessment methods

Subject fall risk was determined using the John Hopkins Fall Risk Assessment Tool (JHFRAT), a tool designed by John Hopkins Hospital in Baltimore, Maryland. This tool had been tested for validity and uses a combination of patient age, fall history, mental status, elimination process status (i.e. urinating and defecation), number of medications, quantity of patient care equipment used by subject, and degree of mobility to develop a fall risk score. The higher a subject's assessment score, the higher their fall risk.

A post-assessment of balance performance and fall risk was performed within one week of the final training session with results being graphed to visually observe and analyze results. One-way ANOVA tests were performed to determine the degree of relationship between subjects that performed the balance training as well as those who did not, in relation to the degree of fall risk with P < .05.

Results

The purpose of this study was to examine the impact of a structured balance training program with elderly adults. It was hypothesized there would be notable improvement in balance ability seen in subjects who participated in a structured balance training program. It was also hypothesized that those subjects would also have an increased sense of ability to balance. Data was analyzed using a one-way ANOVA. A pre-test comparison of the balance on the left foot of subjects that participated in the study revealed no significant difference (F (1, 6) = .850, p > .05). The subjects who did not partake in the balance training sessions had a mean score of 1.625 (sd = 1.25). The subjects who did partake in the balance training sessions had a mean score of 3.0 (sd = 2.71). A pre-test comparison of the balance on the right foot of subjects that participated in the study revealed no significant difference (F(1,6) = .948, p > .05). The subjects who did not partake in the balance training sessions had a mean score of 1.625 (sd = 1.25). The subjects who did partake in the balance training sessions had a mean score of 2.5 (sd = 1.29). A pre-program comparison of subject self-perceived balance ability score revealed no significant difference (F(1,6) = .824, p > .05). The subjects who did not partake in the balance training sessions had a mean score of 3.75 (sd = 2.63). The subjects who did partake in the balance training sessions had a mean score of 5 (sd = .82).

A post-test comparison of the balance on the left foot of subjects that participated in the study revealed a significant difference (F(1,6) = 1.66, p < .05). The subjects who did not partake in the balance training sessions had a mean score of 2 (sd = 1.41). The subjects who did partake in the balance training sessions had a mean score of 12 (sd = 15.44), of which is not significantly different than those who did not partake. A post-test comparison of the balance on the right foot of subjects that participated in the study revealed no significant difference was (F(1,6) = 1.22, p > .05). The subjects who did not partake in the balance training sessions had a mean score of 1.88 (sd = 1.65). The subjects who did partake in the balance training sessions had a mean score of 9.3 (sd = 13.28). A post-program comparison of subject self-perceived balance ability score revealed no significant difference (F(1,6) = .659, p > .05). The subjects who did not partake in the balance training sessions had a mean score of 4.5 (sd = 3.32). The subjects who did partake in the balance training sessions had a mean score of 6 (sd = 1.63).

With thorough analysis of data-statistics, I was concluded that a structured balance training program did produce improvement in balance ability. It was also concluded that a structured balance training program did produce an increased sense of ability to balance.

Discussion

Results of this study indicated there was a significant difference of post-assessment single-leg balance-test performance for subjects who participated in the study. Other pre- and post-scores revealed improvement for the majority of participants who participated in the experimental balance-training session participants, while those who did not participate did not see notable improvement, if any, in pre- and post-scores. This included scores for balance-test performance as well as self-perceived balance ability.

Improvement in subject single-leg balance ability could be contributed to several factors. Having confidence in balance-ability holds the potential to improve subject balance. This confidence being a benefit of structured balance-training sessions. Wolff's Law, stating that the body will adapt to stressors, indirectly points out several more potential causes for subject increase in performance and balance self-efficacy. Stabilizer muscles, tendons, and ligaments also could have gained strength or tone, hence leading to improved subject balance-ability and decreased chances of injury, if a fall occurred. Subject equilibrium "exercise" produced the potential for improved balance performance, due to improved perception and reaction to the body being off balance.

Structured balance training, of which included standing on one leg, dynamic locomotive movements, and other strength exercises could have been a significant factor in notable performance increases. Standing on one leg provided additional stress on subject joints, bones, muscles, and the equilibrium. This stress could have led to increased joint stability and density, increased bone density, increased muscular strength, and increased sense of balance and body awareness.

Some subjects that participated in balance-training sessions did not gain substantial improvement in their balance ability. This could have been due to beginning balance ability level, self-perceived balance ability, and fitness and health levels. Subjects that participated in the balance-training sessions ranged from "good health" with great fitness levels and above average balance-ability to those with "struggling health" with moderate fitness levels and little to no balance-ability. For instance, if a subject felt intimidated by balance training sessions, it would have been highly-likely for that subject to also struggle with balance-tests and pushing themselves through comfort zones when training. If a subject was of good health, with great fitness levels, and above average balance ability, they would have been most likely to be able to improve their balance ability, although their proportional gains may not be as much as their counterparts.

Subjects who did not participate in the balance-training sessions performed at different levels as well, with some showing improvement while others showed none. One of these subjects required the use of assistive equipment to maintain mobility throughout the day. This subject who also had no feeling in their legs, was on several medications that could increase fall risk, and was one of the oldest participants in the study had many factors of adversity working against them. With age, human performance and ability levels decrease, hence diminishing chances of increased balance performance or increased balance self-efficacy.

This being supported by Morrison in his study on balance training reducing falls risk in older individuals with Type-II diabetes. "Normal aging is associated with slower cognitive processing, slower postural reactions, and decreased muscle strength, all of which are essential for optimal balance. The current study demonstrated that all older individuals showed a decline in SRT (simple reaction time) and strength, although the decrement was more pronounced for those with diabetes. The decline in function for older diabetic individuals was further compounded since they had a higher previous history of falls and all exhibited mild-to-moderate neuropathy, the latter being associated with increased falls risk" [9].

The absence of feeling in the subject's legs was likely to be the fore mentioned subject's largest struggle in being able to balance and improve said balance. This subject displayed no change in balance ability or balance self-efficacy from the beginning to the end of the study.

Some non-participating subjects did show improvement in balance ability, however, no improvement in self-perceived balance ability. This was likely caused by "learning to the test," knowing what the test consisted of and having experience with the test following the pre-test. Another factor that could have been responsible for improvement was how the subject felt that day. When the body is sick senses may be compromised, therefore an increase in performance may have been seen if a subject was not feeling well on the pre-test day, but felt better on the post-test day. Lastly, subjects may have self-trained themselves knowing that they would again be tested on balance, which could therefore lead to increased performance and/or skewed results.

More testing is necessary, including more information on subject health, different balance tests, and with larger populations in order to further support or refute and research the effect of structured balance training on subject balance and balance self-efficacy.

References

1. Martin F C (2011) Falls Risk Factors: Assessment and Management to Prevent Falls and Fractures. Canadian Journal on Aging 30: 33-41.
2. Delbaere K, Close J, Heim J, Sachdev P S, Brodaty H et al. (2010) A Multifactorial Approach to Understanding Fall Risk in Older People. Journal of the American Geriatrics Society 58: 1679-1685.
3. Gschwind Y J, Kressig R W, Lacroix A, Muehlbauer T, Pfenninger B, et al. (2013) A Best Practice Fall Prevention Exercise Program to Improve Balance, Strength/Power, and Psychosocial Health in Older Adults: Study Protocol for a Randomized Controlled Trial. Bio Med Central 13: 105.
4. Poe S S, Cvach M M, Gartrell D G, Radzik B R, Joy T L (2005) An Evidence-based Approach to Fall Risk Assessment, Prevention, and Management. Journal of Nursing Care Quality 20: 107-116.
5. Halvarsson A, Franzen E, Stahle A (2014) Balance Training with Multi-task Exercises Improves Fall-related Self-Efficacy, Gait, Balance Performance and Physical Function in Older Adults with Osteoporosis: A Randomized Controlled Trial. Clinical Rehabilitation 29: 365-375.
6. Jacobsen B H, Thompson B, Wallace T, Brown L, Rial C (2010) Independent Static Balance Training Contributes to Increased Stability and Functional Capacity in Community-dwelling Elderly People: A Randomized Controlled Trial. Clinical Rehabilitation 25: 549-556.
7. Steadman J, Donaldson N, Kalra L (2003) A Randomized Controlled Trial of and Enhanced Balance Training Program to Improve Mobility and Reduce Falls in Elderly Patients. American Geriatrics Society 51: 847-852.
8. Yamada M, Tanaka B, Koutatsu N, Aoyama T, Ichihashi N (2010) Trail-walking Exercise and Fall Risk Factors in Community-dwelling Older Adults: Preliminary Results of a Randomized Controlled Trial. The American Geriatrics Society 58: 1946-1951.
9. Morrison S, Colberg S R, Mariano M, Parson H K, Vinik A R (2010) Balance Training Reduces Falls Risk in Older Individuals with Type-II Diabetes. Diabetes Care 33: 748-750.
10. Gardner M M, Robertson M C, Campbell A J (2000) Exercise in Preventing Falls and Fall Related Injuries in Older People: A Review of Randomized Controlled Trials. Br J Sports Med 34: 7-17.