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Balance training in 70-year-old women

Gun Johansson and Gun-Britt Jarnlo

The aim of this study was to discover whether or not the balance of a group of older women could be improved using nine simple, clinical balance tests before and after a training period. A total of 34 healthy 70-year-old women volunteered for the study and they were randomised into two groups: the first received 1 hour's training twice a week for 5 weeks; the second – the control group – did not receive any training. The tests included: standing on one leg (a) with or without visual feedback and (b) with or without rotation of the neck; walking along a beam; walking in a figure-of-eight; and walking as fast as possible. The balance of the training group improved significantly in six out of the nine tests, whereas no such improvement was seen among the controls. We conclude that healthy women aged 70 years are able to improve their balance both when standing and walking.

INTRODUCTION

The number of elderly people is increasing in the West. About one-third of all those who live at home sustain falls each year (Campbell et al, 1981; Kellogg International Working Group, 1987; Tinetti et al, 1988), although less than 10% sustain a fracture (Kellogg International Working Group, 1987; Tinetti et al, 1988). Hip fractures are the most serious, and these make heavy demands on the caring professions both in and out of the hospital setting. The number of hip fractures has doubled in the last 20 years. According to Zetterberg et al (1984) and Jarnlo et al (1989), only about 20–40% of this increase can be attributed to the increasing number of elderly people. It has been suggested that there may be a further doubling of the number of hip fractures by the year 2000.

One explanation for this increase may be the physical inactivity of the elderly. As they become less active, their capacity for daily activities such as standing and walking diminishes. Åström et al (1987) have shown that those who have suffered a hip fracture are more sedentary than those who have not.

Hip fractures among the elderly are associated with a combination of factors: bone fragility, illness and a fall (Alffram, 1964). Tinetti et al (1988) have shown that a fall is a multifactorial problem among the elderly. Many studies have pointed to a reduced capacity for balance as a background factor for falls (Overstall et al, 1977; Campbell et al, 1981; Brocklehurst et al, 1982; Fernie et al, 1982; Tinetti et al, 1988).

In clinical settings, balance capacity has been measured as the time a patient is able to maintain a standing position, either on one or both legs (Galley and Forster, 1987). Gabell and Simons (1982) introduced a balance coding system,

G. Johansson and **G.-B. Jarnlo**, Department of Physical Therapy, University of Lund, S-220 05 Lund, Sweden

(Reprint requests to G-BJ)

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whereby clinicians can check for imbalance among the elderly whether they are sitting or standing. With increasing age, the capacity to stand on one leg diminishes (Bohannon et al, 1984). Mathias et al (1986) have shown a correlation between gait speed and balance tests measured as a score on a special test or as a sway path on a force platform. They have also shown correlations between these scores and laboratory measures of gait, such as length of step, width of stride, etc.

The capacity for balance while standing or walking is a prerequisite for most daily activities. Although balance capacity diminishes with increasing age, Era (1988) has shown that balance may be trainable. Elderly men were trained for 1 hour twice a week over a period of 8 weeks. The subjects were split into three groups. The first group received isometric and dynamic exercises for increasing the muscle strength of their limbs and trunk. The second group received more traditional gymnastics for the elderly, such as weightbearing, flexibility and rhythmic exercises. The third group – the controls – were measured, but they did not undertake any training. The results of this study indicated diminished body sway among those who had undertaken training. The balance measurements were taken using a special force platform.

According to Fansler et al (1985), the mental practice of a physical task improved the balance of a group of elderly women. Although walking speed has been shown to diminish with increasing age (Lundgren-Lindquist et al, 1983), subjects up to 80 years of age can be trained in muscle function and oxygen uptake (Aniansson et al, 1984).

Although physical therapists believe that the capacity for balance can be improved by training, few studies have been undertaken. If the capacity for balance both when standing and walking could be improved among the elderly, it is possible that the number of falls and fractures could be reduced. Therefore, we undertook a training programme, with a special emphasis on balance performance, to see whether healthy elderly women improved their performance on some simple clinical tests and their walking speed.

SUBJECTS AND METHODS

A total of 34 healthy women aged 70 years who lived at home volunteered for the study. Women with neurological disease, amputation or severe pain in the legs were excluded. The women were randomised into two groups: the training group ($n=18$) and the control group ($n=16$).

On the same day as the first balance test, the women were asked to complete a questionnaire. Before testing commenced, the women in both groups were matched for vision, hearing, dizziness, physical activity, injuries or pain in the lower extremities, and use of walking aids. Five women in each group undertook organised callisthenics each week. One women in each group had sustained a fall in the previous 12 months.

All of the women undertook the balance tests before training under the supervision of three specially trained therapists. However, only 33 of the 34 women performed the balance tests after training, because one of the subjects had sustained a fall the day before the second testing.

The nine tests the women performed were:

Tests 1–6. The women were asked to stand on one leg (first the right and then the left leg) with and without visual feedback. They wore no shoes. In order to provoke the vestibular system and the neck receptors, the subjects were then asked to rotate their necks repeatedly and rapidly with their eyes open while standing on one leg. For all of these tests, the subject's hands were held together on the sacrum. Each test was halted either after the subject had moved from the standardised position or after 30 seconds. Times were recorded in seconds. Three trials were undertaken and the highest value recorded.

Test 7. Wearing their normal shoes, the subjects were asked to walk along a beam (0.11 metres wide, 0.05 metres high and 8 metres long) situated on the floor in time with a metronome. The test was halted when the subject stepped off the beam, and the distance in metres was measured. Three trials were undertaken and the greatest distance recorded.

We tested 10 of the women and found them to have a step frequency of 52 steps per minute when walking at a comfortable speed. The

with their eyes closed was found to be too difficult (i.e. the mean values were very low for both groups). Bohannon et al (1984) also reported that 70-year-old women found it difficult to stand on one leg with their eyes closed for more than a few seconds.

Our results are in line with those of Lee and Lishman (1975), who also found that the capacity for balance is dependent on visual feedback. Over a period of 5 weeks, we were able to improve balance performances dependent on vision. However, we do not expect training to affect the function of the proprioceptive and vestibular system.

The women in the training group reported feeling much better – both mentally and physically – after training and expressed a desire to continue the exercises. The selection of the music may have helped to influence the results, because music makes people happy and gives them a feel for the movements. Finally, the supervisors may have influenced the subjects' performances.

The time between the end of testing and the present has not been long enough to evaluate the frequency of falls by these women. We are uncertain as to which of the tests are most important when trying to decide which women are most at risk of falling. We need to address this problem in the future. This study was designed to describe those tests that are feasible in clinical practice and for which expensive equipment is not necessary.

Further studies may show more advanced methods for measuring the capacity for balance in both men and women. Our results may have implications for exercise classes conducted outside the clinical setting. Callisthenics for the elderly, for example, could place more emphasis on balance performance. If it is possible to train healthy women, it may also be possible to train those with disabilities.

Finally, we found that 70-year-old women improved their performance significantly when standing on one leg and were able to walk faster after a 5-week training period. Those women who had the lowest scores before training showed the most pronounced improvement.

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