EFFECTS OF ACITIVITIES OF DAILY LIVING TRAINING ON BALANCE IN ELDERLY PEOPLE

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ABSTRACT

As people age they are at increased risk for deteriorating health, declining function and high health care. The aim of this study was to investigate the effects of a six-week programme consisting of activities of daily living exercises on balance in elderly people. A total of 16 participants from a local social club for elderly people were recruited, aged between 55 and 65 years. They were randomly allocated to the treatment group, who received training for six weeks, or to the control group. A pre-test, post-test design was used to evaluate balance, which was measured by a static one-leg stand test and a functional-reach test. There was a significant improvement ($p<0.05$) in both balance scores for the treatment group, with no significant changes in the control group over the training period. It is therefore recommended that elderly people should include structured activities of daily living as part of their daily routine in order to enhance their muscle strength and to improve balance and to help reduce the risk of falling.

KEYWORDS: **ADLs, Elderly, Balance**

INTRODUCTION

Most elderly people wish to remain independent and functional for as long as possible, and do not want to have to rely on others for their daily care (Brody, Johnson, Fried, Carder, & Perrin, 2002). Senile sarcopenia, the loss of muscle mass associated with ageing, is one in a degenerating cycle of weakness and disuse, hence the avoidance of activities that are uncomfortable or difficult to perform (Cruz-Jentoft et al., 2010). The ability to perform activities of daily living (ADLs) is crucial to successful ageing (Clemson, Munro, & Singh, 2014).

Balance, flexibility, strength, and coordination are all central to successful ageing. Exceptional ability in one area, such as muscle strength, may adequately compensate for a deficiency in another, such as balance, but when multiple domains are deficient, the risk of frailty increases (Madureira et al., 2007;
Mitnitski, Graham, Mogilner, & Rockwood, 2002; Sullivan, Robertson, Smith, Price and Bopp, 2007). These physical skills are progressively lost with ageing, with balance deteriorating once muscles begin to weaken. Balance is required for maintaining static posture, stabilising dynamic movements, performance of daily activities and moving around safely in the community. As balance is lost in elderly people their fear of falling steadily increases, limiting socialisation and performance of ADLs (Brill, 2004).

Balance is usually classified as either static or dynamic. Static balance occurs when the person's base of support is stationary, whereas dynamic balance occurs when the base of support is changing and the person's centre of body mass is moving. The problem of retaining balance whilst moving is controlled by the central nervous system in the body with the purpose of supporting the body against gravity and other external forces, maintaining the centre of body mass over the base of support, and stabilising parts of the body while other parts are moving (Carr & Shepherd, 2003).

Studies have shown that the most effective interventions for preventing falls are based on balance training and lower limb muscle strengthening. Cumming (2002) reported that exercise can help to prevent falls, but the best type of exercise was not well established. In 2007, De Bruin and Murer showed that high-intensity strength training enhanced balance in older adults. Ishigaki, Ramos, Carvalho and Lunardi (2014), in a review of literature, reported that the exercise activities which showed the best results are Tai Chi, intensive strength and endurance training, and home-based exercises prescribed by a physical therapist.

Thus the aim of this study was to investigate the effects of a six-week training programme consisting of ADLs on balance in elderly people.

METHODS

This study incorporated a pre-test, post-test design with a six-week intervention. Males and females, aged between 50 and 65 years, were recruited from a local Social Club for elderly members of the community. Exclusion criteria included a rapidly progressive or terminal illness, acute or unstable chronic illness, any cardiopulmonary disease or insulin-dependent diabetes, or fractures of the lower extremity six months prior to the beginning of the study. Sixteen participants volunteered to take part in the study and signed informed consent was requested prior to inclusion.

The participants were randomly assigned to the treatment group (n=8), who received ADL training for six weeks, or to the control group (n=8). The treatment group participated in two 45-minute training sessions per week for six weeks. Exercise programmes were composed of a warm-up, the main ADL exercises, and a cooling-down period. Stretching sessions were used for the warm-up and cooling-down exercises.

The static balance test used, (Liao, Mao & Hwang, 2001), involved the participant balancing on one leg with their eyes open for as long as possible. They received two trials per leg and the best scores were recorded. The functional-reach test involved measurement of the maximum distance that the participant could reach with their hand (shoulder flexed to 90 degrees) along a wall, without taking a step or losing balance (Duncan, Weiner, Chandler, & Studenski, 1990). The functional reach score was recorded as the maximal difference between the participant's arm length and maximal forward reach, using a fixed base of support.

The exercise programme, conducted in a controlled environment at the university, consisted of three sets of 10-repetitions of the following activities: Sit-to-stand, Get-up-and-go, Pick-up-a-crate, Pick-up-a-crate-and-walk, and an exercise which involved the participant reaching across their body to pick-up an object off a chair. Progressive resistance was added to the above activities over the weeks, according to the individual's progress, by adding weights and/or resistive bands. The sit-to-stand activity involved the participant standing from a seated position whilst holding a 2.5 kg weight and returning to the seated position. The get-up-and-go activity required the participant to stand up from a chair and walk against a resistance band as far as they could, without losing good walking posture, at which point they turned around and returned to the chair. The pick-up-a-crate exercise involved bending the knees and hips with a straight back to pick up a crate off the floor, using the legs, and to return it to the floor. Weight was added to the crate as strength progressed. The pick-up-a-crate-and-walk activity started with picking up a crate, using the knees, and walking 5m, then placing it on the floor. Lastly, the balance exercise required the participant to stand next to a chair on their toes, supporting themselves with the back of a chair, whilst they reached across their body to pick up an object from the chair seat, to which they then

replaced it. An ANOVA was used to analyse the data with the level of significance being $p<0.05$.

RESULTS

The average age of the participants was 58.3±5.5 for the treatment group and 57.3±3.49 for the controls, with one male per group, the rest being females. There was no significant difference between the ages of the two groups. The results for the two balance tests are presented in Table 1. As can be seen, the treatment group improved significantly on the one-leg stand balance test, for both legs, as well as their functional reach for both arms, whereas there was no significant change noted for the control group over the same period for any outcome measures. This indicates a significant treatment effect.

** Insert Table 1 here

DISCUSSION

These results clearly suggest that training using ADLs significantly ($p<0.05$) enhances balance and functional reach in elderly people. The effects of these training exercises, all of which simulated typical physical activities which a person would undertake in their daily lives, suggest that elderly people should engage in home programmes consisting of ADLs on a weekly basis. This enhanced the ability to balance and would reduce their risk of falls and allow for greater functional independence (Steadman, Donaldson & Kalra, 2003).

There is no clear evidence in the literature to suggest that one mode of training is better than another. Tai Chi training has been recommended for older people with strength and balance deficits (Skelton & Beyer, 2003; Taylor et al., 2012; Taylor-Piliae et al., 2014) as well as intensive strength training (De Bruin & Murer, 2007; Schwenk et al., 2014) and, more recently, whole body vibrations (Osugi, Iwamoto, Yamazaki, & Takakuwa, 2014; Sievänen, Karinkanta, Moisio-Vilenius, & Ripsaluoma, 2014) and home-based exercises (Clemson et al., 2014; Ishigaki et al., 2014). No literature could be found specifically on training using ADLs and the effects on balance. Hence this study contributes to the knowledge of physical training for the elderly.

Clemson et al. (2014) suggest that elderly people probably would not perform a rigid set of exercises for a set number of times, but would do them if they were incorporated into their daily activities, e.g. doing a half-squat every time something is lifted from below the waist. In this way, many half-squats could be performed in a day. The idea is to embed strength and balance exercises into their daily tasks and routines. This is an excellent approach and one which

was not followed in this study, which is a limitation. In this study, the authors tried to control the activities undertaken so that they were measurable and controlled, but the approach suggested by Clemson et al. (2014) to exercise training would be a recommendation for future research.

CONCLUSION

These findings suggest that ADL training for six weeks is sufficient to elicit a significant improvement in balance, as measured by a one-leg balance test for the lower body and a forward reach test for the upper body. Thus it can be concluded that elderly people should engage in a structured, weekly programme of activities of daily living in order to reduce the loss of muscle function and balance as they age, thereby reducing the risk of falling, which is of practical and clinical importance.

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Table 1: Differences in Balance Scores for Treatment and Control Groups

Variables	Pre-test Mean ± SD (n = 8)	Post-test Mean ± SD (n = 8)	Difference	p-value
ONE-LEG STAND (s)				
Right Leg				
Treatment Group	34.5 ± 10.91	63.9 ± 14.19	29.4	0.032*
Control Group	47.5 ± 11.97	47.9 ± 10.53	0.4	
Left Leg				
Treatment Group	31.5 ± 10.46	57.7 ± 09.88	26.2	0.005*
Control Group	46.2 ± 14.83	46.9 ± 14.01	0.7	
FUNCTIONAL REACH (cm)				
Right Side				
Treatment Group	36.5 ± 12.14	39.9 ± 13.05	3.4	0.018*
Control Group	35.0 ± 10.11	34.7 ± 11.22	-0.7	
Left Side				
Treatment Group	35.9 ± 08.45	39.2 ± 07.58	9.3	0.040*
Control Group	37.5 ± 05.19	37.0 ± 05.20	-0.5	

** Significant at p<0.05*