RESEARCH REPORT

Training Functional Ability in Old Age

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Key Words

Training, strength, aged, activities of daily living, exercise physiology.

Summary

The aims of this study were to determine the feasibility and acceptability of an exercise class run by health care professionals, and whether an eight-week period of moderate intensity exercise could improve the strength, flexibility, balance and selected functional abilities of women aged 74 years and over. Twenty women were matched for age and randomly assigned to either a control or a training group. At the end of the first eight-week period the control group undertook training.

Pre- and post-training measurements were obtained from nine women (median age 81 years) and pre- and post-control and post-training results obtained for nine women (median age 81 years). Strength, anthropometry, flexibility, balance and functional ability were measured.

Training comprised one supervised session (one hour) and two unsupervised home sessions (supported by an exercise booklet) per week for eight weeks. The training stimulus was one to three sets of four to eight repetitions of each exercise, using elastic tubing, tin cans or sponge balls for resistance. There were training-associated improvements of 9-55% in quadriceps and handgrip strength, flexibility, balance and selected tests of functional ability.

We conclude that repeated moderate intensity exercise which involves the practice of functional tasks and mobility can produce substantial increases in strength, balance, flexibility and selected tests of functional ability.

Introduction

Cross-sectional studies have shown that, even in health, men and women across the age range 65 to 89 years have differences in isometric knee extensor strength, isometric elbow flexor strength and handgrip strength, consistent with losses of 1-2% per annum (Skelton *et al*, 1994; Aniansson *et al*, 1983). Disability is disproportionately more common in women (Katz *et al*, 1983; Green *et al*, 1989) and, therefore, women should be the initial target for intervention to help maintain the ability to perform everyday tasks and activities.

More than 40 exercise training studies have considered one or more measures of strength, in older subjects. Only a quarter of these have been randomised and controlled, and even fewer have considered functional ability or balance. A recent randomised and controlled study, which considered strength, power and functional ability in women aged 75 to 93 years, demonstrated considerable increases in strength (quadriceps and biceps) and power (strength × speed), but only minimal improvements in functional ability (Skelton *et al*, 1995). The training regimen was aimed at increasing muscle strength and power of the muscles considered necessary for the functional tasks (Skelton *et al*, 1995). It might be more beneficial to train for strength using movements which closely mirror everyday activities rather than train to increase the strength and power of individual muscle groups *per se*.

Recent interest in 'exercise prescription', where general practitioners send their patients to local gymnasia for regular exercise to help in the management of their condition, tends to ignore the older age range of patients (ie over 75 years). The aims of this study were, therefore, to determine the feasibility and acceptability of an exercise class run by health care professionals and to assess the effects of eight weeks of strength training and the practising of functional tasks on strength, functional ability, flexibility and balance in women aged over 74 years.

Methods

Exclusion Criteria and Subjects

Volunteers were recruited through a local general medical practice with the help of one of the practitioners and the practice nurse. The general practitioner 'prescribed' the exercise class (by discussing its potential benefits and giving them a leaflet explaining what the class involved) to the first 25 women (aged over 75, and having minor or major functional or mobility difficulties) who came into her surgery. This constitutes only 6% of women aged over 75 who are patients of the practice. The only exclusion criteria were any disease or condition that would be adversely affected by exercise. Five subjects could not take part in the classes because of other commitments (the classes only ran one day a week). Four subjects were taking medication to control blood pressure, four have controlled heart failure, one has controlled thyroid disease, one has angina, two have multiple sclerosis, one has early Parkinsonism, one has a history of transient ischaemic attacks and current vertebrobasilar insufficiency and two have had lower limb joint replacements.

Twenty women were matched by age (full years) (median age 81, range 74 to 89 years) and then randomly allocated into the first training (1TG) or the control group (1CG). After the 1TG completed the eight weeks of training, the 1CG underwent training (2TG) and were their own controls. One woman joined the 1CG group for training and so only pre- and post-training results were obtained for her, not pre-control.

Ethics

This study was approved by the local research ethics committee, Ealing Hospital NHS Trust, and all subjects gave written informed consent.

Measurements

All tests were performed in the same order, allowing rests to avoid fatigue, at AM's practice. All measurements on an individual were made on the same day and pre- and post-study measurements were made at the same time of day and by the same observers without reference to the baseline values but not blind to the group in which the subject participated. Measurements were made within one week before training and within one week after training, and took approximately 1½ hours to perform.

Lifestyle and Anthropometry

Each subject completed three questionnaires before and after training. They completed a 'human activity profile' (HAP) which included 94 questions on their current capability to perform very easy to very strenuous physical tasks (Fix and Daughton, 1988). The HAP scoring allows calculation of a maximum activity score (MAS) which gives an estimate of a subject's highest level of energy expenditure and calculation of an adjusted activity score (AAS) which is an estimate of the subject's average level of energy expenditure (a measure of usual daily activities). They also completed the anglicised version of the Philadelphia Geriatric Centre morale scale (PGCMS) which contains 17 questions with yes/no answers (Lawton, 1975; Morris and Sherwood, 1975), and the geriatric depression scale (GDS) which has 15 questions with yes/no answers (Yesavage *et al*, 1983). Pre- and post-training measurements were made of height (freestanding stadiometer), weight (heavy clothing and shoes removed), upper arm circumference and triceps skinfold thickness (Weiner and Lourie, 1981).

Strength

Bilateral isometric knee extensor strength (IKES), isometric elbow flexor strength (IEFS) and handgrip strength (HGS) were measured as previously reported (Skelton *et al*, 1994). Voluntary isometric knee extension strength (IKES) was measured as the force applied at the ankle, with the subject seated in an adjustable straight backed chair, the lower leg unsupported and the knee flexed to 90°. Isometric elbow flexor strength (IEFS) was measured as the force applied at the wrist, with the subject seated and the shoulder and elbow flexed at 90°. Handgrip strength (HGS) was measured with a Takei Kiki Kogyo hand-grip mechanical dynamometer. The best of at least three attempts for each measurement was recorded. Repeatability of strength measurements, by this method, in elderly subjects is good and has been reported elsewhere (Greig *et al*, 1994).

Functional Ability Tests

Functional Reach

The subjects were asked to stand with their feet slightly apart and then reach forward as far as they could without taking their heels off the floor, and without using the other arm for support (Duncan *et al*, 1990). They were asked to reach three times and the longest reach was recorded.

Chair Rise

The subjects were asked to rise, with their arms folded and at a comfortable pace, from a stool with a level seat 0.42 metres from the floor (Skelton *et al*, 1994) (British Standards Institution (BSI) recommended height for a toilet pedestal plus an amount added for a toilet seat). The test was performed once and the time recorded. The subjects were then asked to rise, with their arms folded, ten times consecutively at their own comfortable pace and the time was recorded (Csuka and McCarty, 1991).

Timed 'Up and Go' Test

The subjects were asked to rise from a chair (without using their arms for support) and walk 3 metres, turn and return to the chair and sit down, at their own comfortable pace (Podsiadlo and Richardson, 1991). The whole movement was timed.

6.1 Metre Walk

The subjects were asked to walk 6.1 m as fast as possible (Bassey *et al*, 1992); the movement was timed and the number of steps taken recorded.

Lifting a Bag on to a Shelf

Subjects were asked to lift a bag of sugar (2 kg), on to a 1.34 metre high shelf (1.3 m is the BSI recommended height of the bottom of a wall unit), but standing 0.3 m away from the shelf (BSI recommended width of a base unit in a kitchen).

The test was performed once using each arm, with the result for each arm recorded.

Floor Rise

Subjects started the test from lying on their side on the floor. They were asked to rise to standing in their own time without the use of a hand hold. The test was performed twice and the faster rise recorded.

Stair Walking

The subjects were asked to walk up and over a small staircase (three steps of 20 cm up and three steps of 15 cm down) without stopping, at a comfortable pace without using the handrail as support. The task was timed and the assessor recorded if the subjects hesitated or used the handrails.

Getting Into and Out of a Bath

Parallel bars, a 10 cm and a 20 cm step, and a bath seat were used to simulate a bath. The rails were set at 60 cm in height, with the 10 cm step on the outside of the 'bath' and the 20 cm step inside (with a bath seat secured on top), so that there was a rise of 50 cm into the 'bath', which is acceptable to elderly people (Grandjean, 1973). The subjects were asked to get into the bath, sit on the bath seat, rise and get out of the bath, in their own comfortable time. They were given the option to use the rails for support if needed. The whole movement was timed and the assessor noted whether they used the rails or hesitated during the movement.

Balance

The subjects were asked to stand on one (preferred) leg, with the eyes open and then the eyes closed (Iverson *et al*, 1990). Both tasks were timed from the moment one leg was lifted off the floor until balance was lost or the foot placed on the floor again. Practice was given before the actual measurement was taken. The subjects were also asked to walk backwards and the number of steps taken before hesitation (or loss of balance) was recorded.

Flexibility

Shoulder flexibility was assessed by internal rotation with elbow flexion, with the subject asked to reach up the spine as far as possible (right arm). The distance up the spine was graded on a four-point scale (from the bottom of the buttocks to between the shoulder blades). Shoulder flexibility was also assessed as external rotation with elbow flexion, with the subject asked to reach behind the neck and head (right arm). The distance along the spine was graded on a four-point scale (from between the shoulder blades to the top of the head). Hip extension was measured using a goniometer, with the subject facing the wall with both anterior superior iliac spines in contact with the wall at all times to minimise lumbar spine movement. Hip flexion was also measured using a goniometer, but with the subject standing with buttocks and shoulders in contact with the wall at all times to minimise lumbar spine movement. Ankle plantarflexion and dorsiflexion were also measured, using a goniometer, with the subject seated.

Interventions

Control Group

No active or placebo intervention was prescribed for the 1CG. They were asked to perform no more or less activity than before the study. After the first group of exercisers finished training, the control group (2TG) underwent training.

Training Group

These subjects attended one exercise class a week, at the practice of the physiotherapist (AM), for eight weeks. They were also asked to complete two unsupervised 'home sessions' per week, following an exercise prescription. Each participant was given an illustrated exercise booklet explaining the exercises and an exercise diary to record the number of sets and repetitions achieved for each exercise during the home sessions.

Exercise Class

Each class involved a ten-minute warm-up and stretch, covering the main muscle groups being trained. The 30- to 40-minute strengthening component of the class involved exercises chosen for their expected effectiveness, safety and ease of learning. These included exercises which mimicked the functional ability tasks and balance tests. The major muscle groups trained were shoulder and hip abductors, adductors, flexors and extensors, elbow flexors and extensors, knee flexors and extensors. Particular attention was placed on mobility and flexibility of the joints, dynamic movement of the joints and the mimicking of the functional tasks being tested (ie floor exercises, getting up off the chair and walking).

Following a typical progressive resistance protocol, each exercise was performed as one to three sets of four to eight repetitions using for resistance body weight, tin cans (250 g), sponge balls or elastic tubing (three resistances – Medipost Ltd, 100 Shaw Road, Oldham, Lancs OL1 4AY). Initially, resistances were chosen so that the subjects could almost complete three sets of four repetitions. As soon as a subject could complete three sets of eight repetitions of an exercise, the resistance was increased (with the use of a harder resistance Theraband) and the number of repetitions reduced. Subjects progressed through the different resistances of elastic tubing at different rates. A ten-minute 'warm-down' component was included at the end of the class.

Most of the exercises used are in a booklet entitled *Exercise for Healthy Ageing* published by Research Into Ageing (Baird House, 15/17 St Cross Street, London EC1N 8UN, £3). Details of the exercises used in the class may be obtained from the authors.

Statistical Analysis

Preliminary work indicated that a training group size of 18 would give an 80% probability of detecting a 20% decrease in chair rise and kneel rise time and a 10-15% increase in isometric knee extensor and elbow flexor strength ($\alpha < 0.05$, two-tailed). Results are expressed, unless otherwise stated, as means and standard deviations, and all calculations were made using the bilateral mean of the subject's strength. Any data that were not continuous in nature or were not normally distributed had median percentage changes calculated.

All comparisons between or within groups were made with single factor analysis of variance (Minitab, 1989). Where only two samples are involved, the t-distribution has been traditionally used to test significance. The t-test, however, does not take into account variations or trends within groups or between groups, only significant differences. Single factor analysis of variance tests that there is no difference between the groups and is based on a comparison of the observed variation between the groups (ie between their means) with that expected from the observed variability between subjects. In other words, it takes into consideration the fact that the control group data may change over the control period. The samples do not all have to be the same size.

The two randomised groups were compared at baseline (1TG (n=10) *vs* 1CG (n=10)). The control group (1CG) was compared at baseline with post-study measurements (n = 9). The 1TG (n = 10) was compared with 2TG (n =10) at baseline. If there was no difference in 1CG over the first eight weeks and 1TG and 2TG were not different at baseline then the 1TG (8 weeks-0 weeks, n = 9) and 2TG (16 weeks-8 weeks, n = 10) results were combined to see the effect of eight weeks of training on strength, flexibility, balance and functional ability.

Results

One woman (1CG) was excluded after baseline measurements but before training began because her blood pressure caused concern to the practitioner. Two women dropped out (one 1TG and one 2TG) during the study, for reasons not associated with the exercise. Their results were included in baseline measurement comparison. One woman joined the 2TG group for training but did not have pre-control measurements. Results are reported from the 19 exercisers (nine 1TG and ten 2TG) and nine 1CG subjects who completed the study.

Compliance

Fourteen out of a total 19 exercisers attended all classes and performed all home sessions. No one attended fewer than six class sessions. According to the exercise diaries no one performed fewer than 11 home sessions (range 11-16 classes). Apart from the first two weeks of the study when a number of people felt stiff after training, the exercises caused no discomfort. One woman, with a history of hypertension and on multiple medications, fainted owing to a temporary arrhythmia during one of the classes. The practitioner agreed that she could continue the classes.

Analysis of variance confirmed that there was no difference between the pre-training baseline measurements between 1CG and 1TG, or between 1TG and 2TG (table 1). 1CG did not differ from their baseline measurements over the control period. Analysis of variance was, therefore, carried out on the combined 1TG and 2TG data (n = 19).

Lifestyle, Anthropometry, Strength, Flexibility, Balance and Functional Ability

There was no training-induced change in weight, height, arm muscle circumference, physical activity as assessed by MAS and AAS or score on the PGCMS scale (table 2). The 8% reduction in depression score did not reach statistical significance but may have been biologically important.

There were training-induced improvements in IKES ($F = 5.26$, $p = 0.03$, 95% CI = 5.1 to 33.8%), IKES/kg ($F = 6.24$, $p = 0.03$, 95% CI = 4.0 to 32.4%) and HGS ($F = 4.90$, $p = 0.04$, 95% CI = 2.4 to 35.8%) but the 8% improvement in IEFS was not statistically significant ($p = 0.50$, 95% CI = –4.6 to 29.2%) (figure 1).

All subjects could lift a 2 kg bag of sugar on to a shelf with one arm (left or right) before training so no data analysis was performed. There were no training-induced improvements in functional

Table 1: Pre-training anthropometry, lifestyle, strength, balance, flexibility and functional ability results

	1CG		*1TG*		*2TG*	
Weight (kg)	59	(10)	63	(8)	61	(10)
Height (m)	154.7	(6.7)	154.3	(7.5)	154.8	(6.6)
Arm muscle circumference (cm)	22.6	(3.2)	24.0	(2.2)	23.0	(1.8)
Maximum activity score¶|	70	(60-82)	70	(55-76)	68	(46-82)
Adjusted activity score¶†	54	(43-67)	60	(40-70)	51	(40-70)
Philadelphia GCMS†	10	(3–15)	13	(9-16)	11	(4-16)
Geriatric depression score†	12	(5-14)	14	(11-15)	11	(4-15)
Isometric knee extensor strength (N)	188.3	(51.1)	238.7	(67.3)	196.7	(51.0)
Isometric knee extensor strength (N/kg)	3.3	(1.1)	3.9	(1.3)	3.3	(1.0)
Isometric elbow flexor strength (N)	134.5	(25.1)	128.4	(38.0)	139.3	(20.5)
Handgrip strength (N)	138.4	(46.1)	139.2	(56.6)	143.0	(42.3)
Balance – eyes open (sec)†	4.7	(1.0-16.3)‡	6.7	(1.5-15.9)	5.1	(2.6-11.8)§
Balance – eyes closed (sec)†	2.0	(0.6-4.0)‡	2.0	(0.7–3.0)	1.5	(1.0-2.6)§
Walking backwards (steps)|	9.5	(5-18)	12	(5-19)	9	(6-20)§
Shoulder internal rotation (score)†	3	(2-4)	3	(1-4)	3	(2-4)
Shoulder external rotation (score)†	3	(3-3)	3	(2-3)	3	(3-4)
Hip extension (°)†	15	(10-18)	15	(10-17)	15	(12-17)
Hip flexion (°)|	90	(64-90)	90	(80-90)	90	(75-90)
Ankle plantarflexion (°)†	160	(135-180)	180	(150-180)	170	(140-180)
Ankle dorsiflexion (°)†	90	(60-90)	90	(80-90)	90	(80-90)
Functional reach (cm)	95.6	(7.3)	97.1	(6.9)	90.4	(6.0)
Chair rise (sec)†	1.0	(0.8-1.8)	1.1	(0.7-1.2)	0.9	(0.7-2.9)
Chair rise × 10 (sec)|	33.1	(15-56)	27.5	(16-38)	29.4	(15-56)
Timed up and go (sec)†	10.1	(6.9-26.3)	11.7	(8.3-17.5)	8.4	(6.2-25.2)
6.1 m walk (sec)†	5.1	(4.2-12.9)	4.4	(2.8-6.9)	4.5	(3.7-13.0)
Step rate (steps)†	10	(6-13)	10	(7-12)	10	(9-18)
Floor rise (sec)|	6.9	(2.4-22.9)‡	6.6	(2.0-11.2)	6.7	(3.6-23.5)§
Stair walking (sec)†	6.6	(5.1-9.6)	8.0	(3.8-18.4)	6.5	(4.5-10.0)
Getting into a bath (sec)†	16.2	(8.4-25.2)‡	16.0	(7-40)	16.7	(9.6–27.3)‡

Notes to table 1

Results are expressed as mean (sd) except | median (range).

n = 9 for 1CG and 1TG, n = 10 for 2TG, except §n = 9, ‡n = 8.

2TG baseline measurements = 1CG post-study measurements plus one subject who joined 2TG after the control period.

¶ Maximum Activity Score and Adjusted Activity Score from the 'Human Activity Profile' (Fix and Daughton, 1988).

Philadelphia GCMS = Philadelphia Geriatric Centre morale scale.

Balance testing was performed on one leg.

Shoulder internal and external rotation are on a scale of 1-4.

Bag lift results are not given as all subjects could perform the task before and after training

Table 2: Training-induced changes in anthropometry, activity, depression and morale

	F value	*p value*	*% change*
Weight (kg)†	0.03	0.87	−0.5
Height (m)†	0.44	0.51	0.9
Arm muscle circumference (cm)†	0.00	0.99	0.1
Maximum activity score	0.94	0.34	0
Adjusted activity score	0.72	0.40	3.9
Philadelphia GCMS	0.04	0.85	−6.9
Geriatric depression score	2.36	0.13	−7.7

Data from 1TG (8 weeks – 0 weeks) and 2TG (16 weeks – 8 weeks). F and p values obtained from single factor analysis of variance. % change = median, except † mean

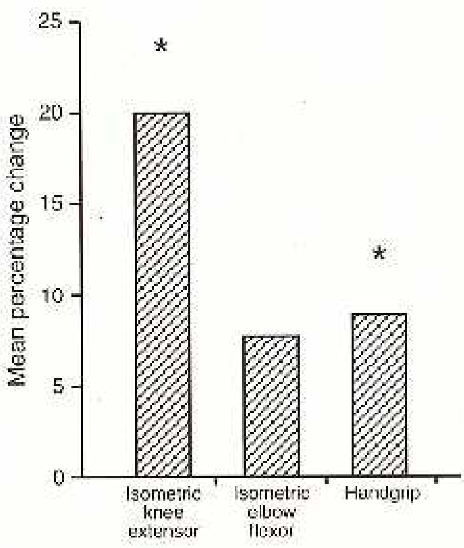

Fig 1: Training-induced improvements in strength, measured in newtons. * p ≤ 0.05, n = 19. p values obtained from single factor analysis of variance

reach (F = 0.15, p = 0.70), time to rise out of a low chair ten times (F = 0.03, p = 0.89), time to get in and out of a bath (F = 0.81, p = 0.37) or time to walk 6.1 m (F = 0.09, p = 0.77). There were significant improvements in chair rise time (p = 0.04), timed 'up and go' (p = 0.02), time to walk up and down a staircase (p = 0.04), time to rise from the floor (p = 0.01) and step rate over a 6.1 m course (p = 0.05) (fig 2). One woman (1CG/2TG) was unable to rise from the floor or get in and out of the bath unaided before training but was able to do so without help after training. Although time to get in and out of a bath did not improve, 12 exercisers who hesitated on getting into or out of the bath did not hesitate afterwards (compared to one control) and four exercisers stopped using the rails for support (compared to one control).

Only one woman (1CG) was unable to balance on one leg or walk backwards (both before and after training). There was a training-induced improvement in one-legged stance (eyes closed) (F = 6.63, p = 0.02), but not in walking backwards (p = 0.14) (fig 3). Although the improvement in one-legged stance (eyes open) was median 42%, this was not statistically significant (p = 0.23).

There were training-induced improvements in ankle plantarflexion (F = 5.32, p = 0.03), hip extension (F = 8.47, p = 0.01) and shoulder internal rotation (F = 14.66, p = 0.0001) (fig 3). There were no significant improvements in ankle dorsiflexion (p = 0.08), hip flexion (p = 0.85) or shoulder external rotation (p = 0.26) but the baseline data gave little room for improvement.

Discussion

Even in health, the age-related decline in strength and power means that there is a narrowing of safety margins between normality and the threshold values for functionally important activities (Young, 1988). Cross-sectional data suggest that muscle strength is lost at 1-2% a year in women over the age of 65 (Skelton *et al*, 1994, and for review – Young, 1988). This brings older people perilously close to the point where even a small further decline in strength (perhaps caused by immobility due to illness) may render some everyday task impossible to perform. The eight weeks of progressive resistance strength, postural and functional task training, in this study, increased quadriceps strength by approximately 20% in these elderly women. It is likely that after training the subjects were stronger than they had been for many years, perhaps as many as eight to 12 years on average, and will have greater reserves of strength if needed.

Strength may be an important limiting factor in the maintenance of an independent lifestyle and also in the prevention of falls. Falls account for 82% of all accidental deaths in the home in the over-75s (Wallis, 1991). There are countless possible reasons for an increased incidence of falling in old age. Patients with recent hip fracture were found to be 40% weaker and 70% less powerful than healthy women of the same

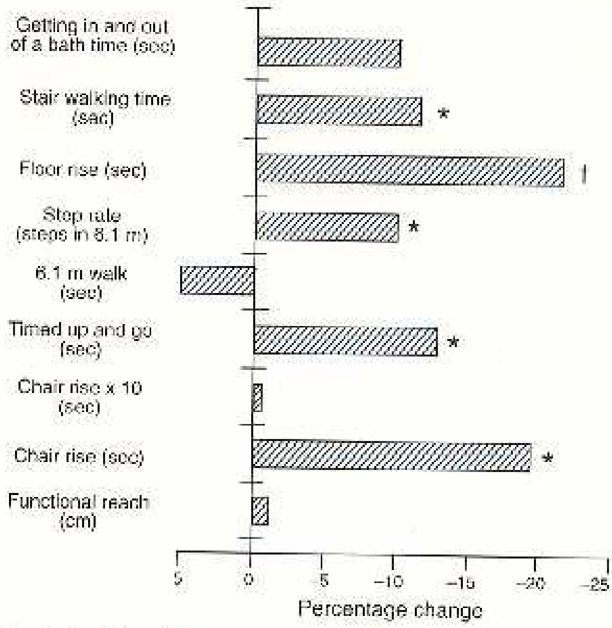

Fig 2: Training-induced improvements in functional ability. All median % changes, except functional reach (mean % change). * p ≤ 0.05, † p < 0.01. n = 19 except for floor rise where n = 18. p values obtained from single factor analysis of variance. Negative changes in time and number of steps denote a reduction (improvement) in time taken (or steps taken) to perform a task

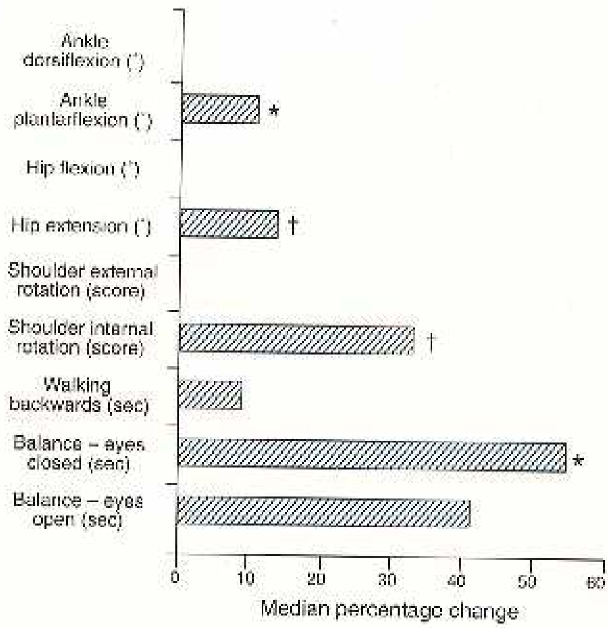

Fig 3: Training-induced improvements in balance and flexibility. * p ≤ 0.05, † p ≤ 0.01, n = 19 except for measures of balance where n = 18. p values obtained from single factor analysis of variance. There was no change in ankle dorsiflexion, hip flexion and shoulder external rotation

age (Levy *et al*, 1994). Whipple *et al* (1987) have documented that nursing home dwellers with a history of falls only had 62% of the quadriceps strength of fellow residents not experiencing falls, and only 37% of the strength of community dwellers. An intervention which would increase strength and balance might help in the prevention of falls. With only 11% of physiotherapists and 21% of occupational therapists teaching elderly people at risk of falling how to get up safely from the floor (Simpson and Salkin, 1993) there is a need for such tasks to be practised in a safe environment, that is on a uniformly covered, non-slip surface with solid chairs available for support. Initially subjects need advice and encouragement in a teaching situation before attempting to practise at home.

In our training groups, balance (time to stand on one leg with eyes open and closed) improved considerably, although the decrease in eyes-open time was not significant. In the literature, the effects of exercise on balance are equivocal. Some studies have shown no improvement in postural sway after exercise training (McMurdo and Rennie, 1993; Crilly *et al*, 1989; Rikli and Edwards, 1991). Binder *et al* (1991) showed improvements in standing balance time in 62% of participants after eight weeks of exercise, and Judge *et al* (1993) showed a 17% improvement in the mean displacement of the centre of pressure in single stance after six months. People may become wary of venturing outdoors if their balance is bad or they have a history of falls and so they may reduce their mobility in a spiral of disuse. The reported increase in strength and balance in this group of women may help to encourage prevention of this vicious circle.

Few studies have considered muscle strength and functional ability changes after training in elderly people. Only one has considered more than two functional tasks at once (Skelton *et al*, 1995). It appears that the type of training used is very important when considering improvements to relevant functional tasks. Skelton *et al* (1995) showed only minimal improvements in two out of 12 functional ability tests (stepping up and time to rise from kneeling on the floor) despite significant increases in strength and muscle power. However, the training exercises in that study were task independent, so that although the exercise was specific to increasing the strength of the major muscle groups it avoided any exercises that mimicked the functional tasks being assessed. The study was designed to see if an improvement in strength alone could allow the re-crossing of a functionally important threshold of strength and power.

McMurdo and Rennie (1993), studying elderly people in residential homes and using targeted exercise, showed an increased ability to rise from a low chair after training, but did not measure lower limb strength. To improve functional ability, perhaps training must be more specific to the tasks that need improving, just as athletes have to be specific in training for their particular sport. In this study, where the relatively shorter period of eight weeks included the mimicking of functional tasks during training, there were significant improvements in chair rise, timed 'up and go', stair climbing time and floor rise time. These tasks are vital for maintenance of an independent life. The following tasks did not improve: rising from a chair ten times, functional reach, time to walk 6.1 m and time to get in and out of a bath. However, the number of steps taken in 6.1 m did decrease, suggesting an improved gait, and there was a decrease in the use of a hand rail and less hesitation when getting into or out of the bath.

Another important aspect of mobility and maintenance of function is flexibility. There is little loss of range of movement in healthy elderly joints but arthritis is so common in old age that disabling limitations of joint motion are not unusual. In addition to arthritis, other conditions which may lead to pain, both from the muscles and/or the movement of the joints themselves, may limit movement by direct effect so that the joint cannot be moved through its full range or by a voluntary reduction in the range of movement to avoid pain or discomfort. Whether voluntary or involuntary, the effect of a reduction in use of a joint throughout its full range of movement could lead a person into a further spiral of disuse so that flexibility declines even more. Physical training has been reported to decrease the age-related decline in flexibility (McMurdo and Rennie, 1993). The changes seen in flexibility over the training period in this study varied. Hip extension (vital for mobility) improved significantly, internal shoulder rotation (essential for dressing and bathing) and ankle plantar-flexion (essential for using the stairs) also improved. There were no changes in ankle dorsiflexion, hip flexion, or external shoulder rotation, but the pre-training measurements gave little room for improvement.

PGCMS and GDS questionnaire scores did not change over the eight-week period in our subjects. GDS did improve after 32 weeks of training in one randomised, controlled study (McMurdo and Burnett, 1992), and perhaps a longer time is needed to elicit improvement. After training many women reported subjective benefits. These included being able to dress and bathe more easily (n = 5), less arthritic pain (n = 2), less cramp (n = 2), an improved ability to rise from the floor (n = 1), and one woman who is now able to play football with her grandson.

The enthusiasm of the volunteers for the exercise classes was apparent from their expressed hope that the programme could be continued. In light of the improvements seen in this study and the recent interest in 'exercise prescription', the general practitioner, AM and DS have now set up 'Fit Folk', a weekly class, near the surgery, for the subjects and other patients. Its main aims are to improve the physical and mental well-being of men and women over 75, to maintain mobility and independence, and to reduce drug use and need for primary and secondary health care services.

Regular exercise helps prevent conditions that are common in old age, such as osteoporosis, non-insulin dependent diabetes mellitus, peripheral vascular disease, hypertension, ischaemic heart disease and probably stroke (Young and Dinan, 1994). Patients with chronic asthma or angina may avoid physical activity because of their symptoms during exercise and incorrect perceptions by themselves or by their GP. But the loss of fitness that results from decreased physical activity can result in the occurrence of symptoms at progressively lower levels of exercise intensity, even if the physical impairment due to the disease is unchanged. Exercise in the treatment of depression can help not only in the prevention of anxiety and boredom but also by providing informal psychological support from the people around. Many disabled people owe their disability to some form of arthritis. Muscle weakness is often seen in the presence of joint disease and may contribute to further joint injury. Isometric exercises prescribed by physiotherapists can increase muscle strength. In addition to its effects on health, exercise also provides important social contacts that older people often lack. Confidence is seen to improve and as a result older people are achieving beyond their previous limits. There has been recent interest in GP exercise prescriptions for local gymnasia, although there has been little mention of the applicability for over-75s. The setting up of local exercise classes, either in conjunction or in collaboration with a general practitioner, may be one way of extending the exercise prescription so that it will include those older people who do not feel comfortable visiting a gymnasium, would prefer being with people of their own age, and would benefit from specific exercises to improve functional ability. Teachers need to be trained in cardiopulmonary resuscitation and safe relevant exercise for older people. Input from GPs requires only recruitment and occasional monitoring. Guidelines on safety and programming of exercise classes for older people and qualifications of teachers are published (Young and Dinan, 1994).

We conclude that a 'simple-to-follow' programme of progressive resistance strengthening, flexibility, balance and functional task-specific exercise can produce substantial increases in selected tests of functional ability, balance, flexibility and strength. This contributes to an improvement in quality of life for older people.

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