

The HIFE Program



THE HIGH-INTENSITY FUNCTIONAL EXERCISE PROGRAM

Second edition



English version



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Background

The High-Intensity Functional Exercise Program (the HIFE Program) was developed 2001–2002 for the Frail Older People – Activity and Nutrition Study in Umeå (the FOPANU Study) at Umeå University, Sweden. The program was revised for the Umeå Dementia and Exercise Study (UMDEX) 2011.

The objective of the HIFE Program is to improve the participant's lower-limb strength, balance, and mobility.

Criteria for the exercises:

- Carried out in functional weight-bearing positions.
- Applicable without access to special exercise facilities.
- Adaptable for older persons with different functional capacity, including independent walkers and those needing help with all mobility.
- Possibility to exercise progressively, either by increasing the difficulty in a specific exercise or by changing to another, more challenging, exercise.

39 exercises are included in the collection of exercises, distributed over five categories:

- A – Static and dynamic balance exercises in combination with lower-limb strength exercises
- B – Dynamic balance exercises in walking
- C – Static and dynamic balance exercises in standing
- D – Lower-limb strength exercises with continuous balance support
- E – Walking with continuous balance support

Static balance exercises: Fixed base of support

Dynamic balance exercises: Changing base of support



Instructions

For the initial selection of exercise categories during the exercise period, a hierarchical model based on walking ability has been developed. The model should be seen as a guide for the physical therapist (PT) in the choice of specific exercise categories. The participant's need for personal support is estimated when walking a short distance (5-10 meter) without walking aid.

Model for selection of exercise categories

Physical function group	Recommended categories in the collection of exercises
1. Walking without any physical support or supervision	<p>A. Static and dynamic balance exercises in combination with lower-limb strength exercises</p> <p>B. Dynamic balance exercises in walking</p>
2. Walking with supervision or minor physical support from one person	<p>A. Static and dynamic balance exercises in combination with lower-limb strength exercises</p> <p>B. Dynamic balance exercises in walking</p> <p>C. Static and dynamic balance exercises in standing</p>
3. Walking with major physical support or not able to walk	<p>C. Static and dynamic balance exercises in standing</p> <p>D. Lower-limb strength exercises with continuous balance support</p> <p>E. Walking with continuous balance support</p>

Within each exercise category, the PT selects exercises for each participant according to her or his functional deficits. The PT decides for each participant how much time within the session will be spent on each exercise category. It is recommended that the participant performs at least two lower-limb strength exercises and two balance exercises in two sets each session. In order to maximize the number of exercises during a session, the participants should not rest more than necessary. The exercises are preceded by a five-minute warm-up for upper and lower extremities while sitting.



The intensity of the exercise is self-paced, although the participant is encouraged by the PT to exercise progressively with a high intensity. The exercises are adjusted for each session according to changes in health and functional status.

Definition of high intensity:

- 1) strength exercises in sets of 8-12 repetition maximum (RM)
- 2) balance exercises performed near the limits of maintaining postural stability

For the first two weeks, 13-15 RM is recommended for the strength exercises, as a build-up period.

The collection of exercises includes examples of how the PT can increase the load in the strength exercises and the difficulty in the balance exercises. The load of the leg-extensor muscle groups is increased by adjusting the performance of the exercise, for example, by deeper squats or doing step-ups on to a higher step board, or by using a weighted belt worn around the waist, loaded with a maximum of 12 kg. The load should not be increased if this significantly impairs the quality of the movement during the exercise. The aim is that the exercise is performed in a controlled manner throughout the entire range of movement, including the eccentric phase, e.g. when sitting down. The difficulty of each balance exercise is increased, for example, by standing or walking with a narrower base of support, or on a more challenging surface, e.g. a soft mattress.

For safety reasons, the participant uses a belt with handles worn around the waist so that the PT can more easily prevent the participant from falling when challenging the postural stability. It is important that the participant does not get balance support unnecessarily.



Intensity scales

The intensity scales have been developed to describe the intensity in the exercises. The intensity for each participant is estimated by the PT for lower-limb strength exercises and balance exercises separately, as an average for each exercise session.

	High intensity	Medium intensity	Low intensity
Lower-limb strength exercises	Sets of 8-12 RM	Sets of 13-15 RM	Sets of >15 RM
Balance exercises	Postural stability fully challenged*	Postural stability not fully challenged or fully challenged in only a minority of the exercises	Postural stability in no way challenged

**Postural stability fully challenged = balance exercises performed near the limits of maintaining postural stability*

Warm-up

The participants perform the exercises, while sitting, for approximately five minutes.

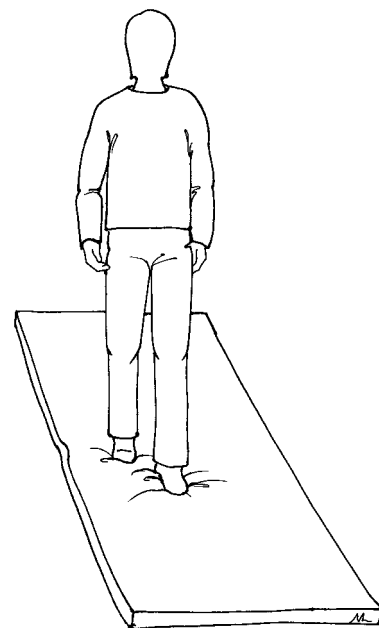
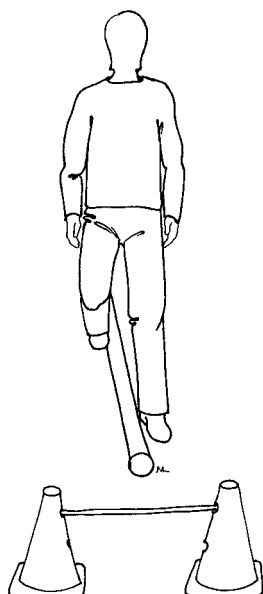
Examples of exercises:

- Walking on the spot
- Opposing arm-swings at the side of the body
- "Sewing-machine" steps
- "Picking apples" in various directions (upwards, sideways, downwards)
- Knee stretches with right and left leg alternately
- Steps to the side and back with right and left foot alternately

Equipment

All exercise equipment is portable.

- Stackable step boards of various heights, minimum 5 cm
- Weighted belts with loads from 1 kg and upwards
- Chair cushions of various heights, minimum 5 cm
- Soft mattresses or pads
- Obstacles for use in walking training, such as cylinders, sticks, etc
- Soft balls
- Bean bags
- Belts with handles
- Chairs without arm supports



Collection of exercises

For all exercises, increasing the difficulty regarding balance is achieved by providing less assistance and performing the exercises on different surfaces, such as a softer one. The exercises in categories A and D can be performed with a weighted belt in order to increase the strength intensity.

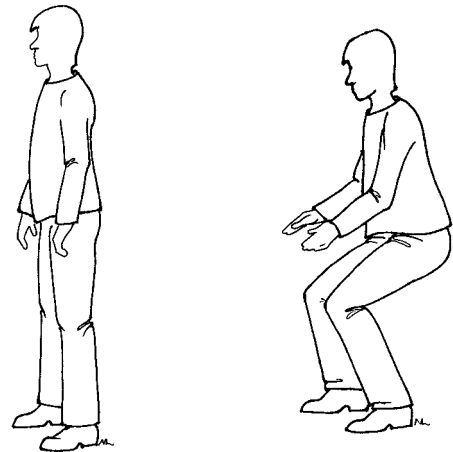
A - Static and dynamic balance exercises in combination with lower-limb strength exercises

A1 Squats in a parallel stance

Stand with feet parallel to one another, shoulder-width apart, and bend-straighten knees and hips.

The difficulty can be increased by:

- making deeper squats
- reducing the base of support
- increasing the load in the weighted belt

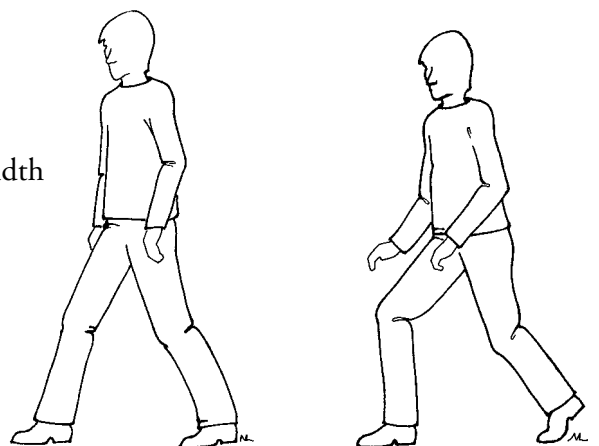


A2 Squats in walking stance

Stand with one foot in front of the other, shoulder-width apart, and bend-straighten knees and hips.

The difficulty can be increased by:

- making deeper squats
- reducing the base of support
- increasing the load in the weighted belt

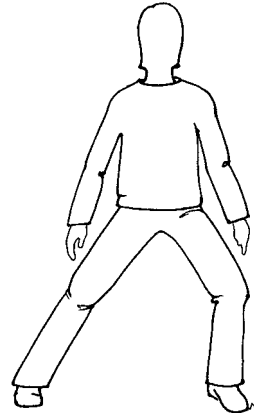


A3 Body-weight transfer in a parallel stance

Stand with feet parallel, slightly wider apart than shoulder width, and transfer body weight back and forth to each leg on a bent knee.

The difficulty can be increased by:

- making deeper squats
- increasing the load in the weighted belt

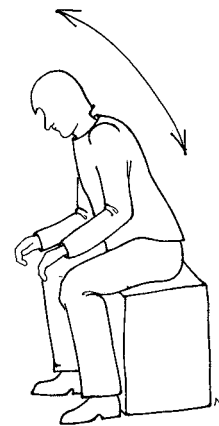


A4 Standing-up from sitting in a parallel stance

Stand up and sit down on a chair with feet parallel.

The difficulty can be increased by:

- reducing the height of the chair
- reducing the base of support
- increasing the load in the weighted belt

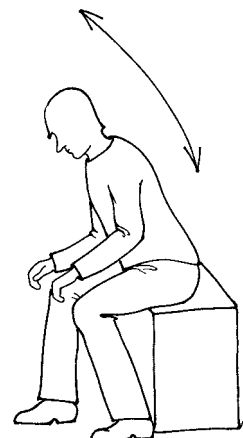


A5 Standing-up from sitting in a walking stance

Stand up and sit down on a chair with one foot in front of the other.

The difficulty can be increased by:

- reducing the height of the chair
- reducing the base of support
- increasing the load in the weighted belt

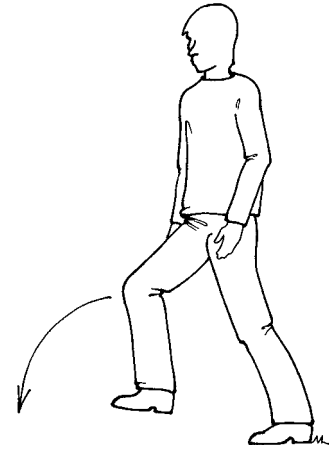


A6 Forward lunges

Stand with feet shoulder-width apart and take steps forward and back, with alternate feet, bending the forward knee, then shooting back to the start position.

The difficulty can be increased by:

- making deeper squats
- lunging further forward
- increasing the speed of the movements and the change of feet
- increasing the load in the weighted belt

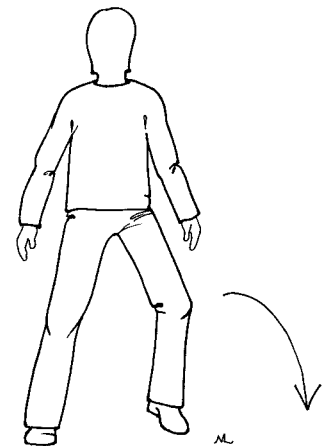


A7 Side lunges

Stand with feet shoulder-width apart and take steps to the side and back, bending the knee that steps out, then shooting back to the start position.

The difficulty can be increased by:

- making deeper squats
- lunging further to the side
- increasing the speed of the movements and the change of feet
- increasing the load in the weighted belt

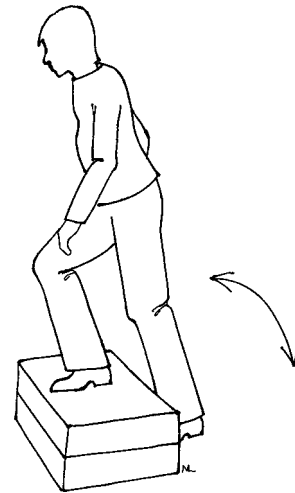


A8 Step-up

The step board is placed either in front of or to the side of the participant. Step up and down from the step board by straightening the knee and hip.

The difficulty can be increased by:

- increasing the height of the board
- keeping one foot in place on the board all the time
- increasing the load in the weighted belt



A9 Stair-walk

Walk up and down some stairs.

The difficulty can be increased by:

- increasing the load in the weighted belt



A10 Heel-raises

Heel-raises.

The difficulty can be increased by:

- performing with one leg at a time
- reducing the base of support
- increasing the load in the weighted belt



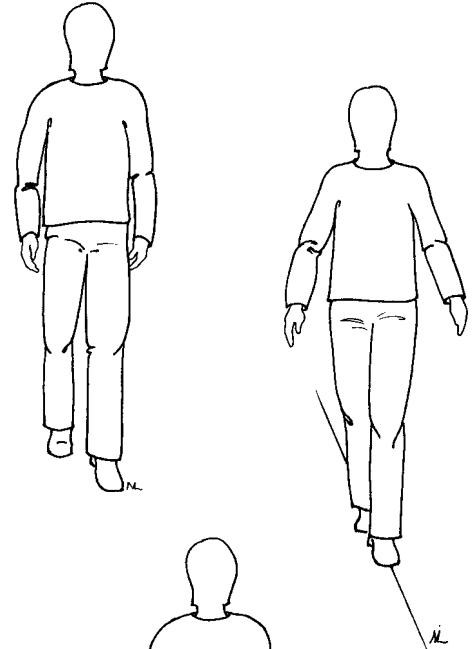
B - Dynamic balance exercises in walking

B1 Walking forward on a flat surface

Walk forward on a flat surface.

The difficulty can be increased by:

- increasing or varying walking speed
- walking with a narrower base of support, for example on a line

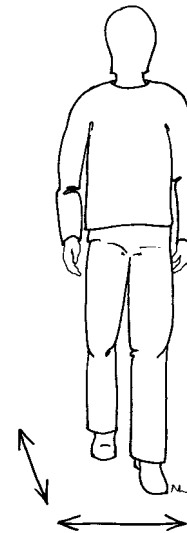


B2 Walking in various directions

Following the instructions of the PT, walk forwards, backwards, or sideways.

The difficulty can be increased by:

- increasing or varying the walking speed
- varying the direction more often

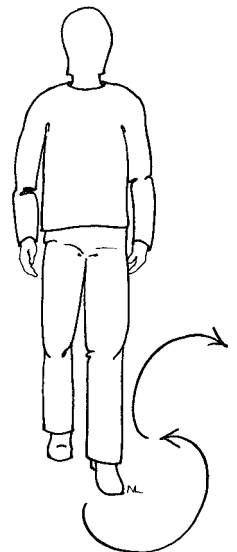


B3 Walking with numerous turns

Following the instructions of the PT, walk forward and frequently change direction by 180 degrees.

The difficulty can be increased by:

- increasing the speed of the changes in direction
- changing directions more often

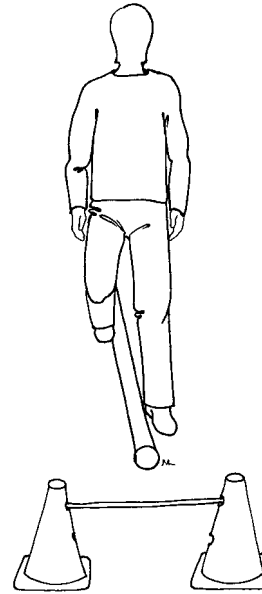


B4 Walking over obstacles

Walk forward or sideways, stepping over obstacles, for example sticks or step boards.

The difficulty can be increased by:

- stepping over higher or longer obstacles
- varying the direction more often

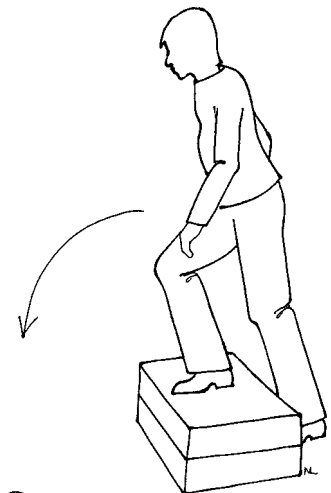


B5 Step-over

Walk forward and step up onto the step board, and step down to the other side.

The difficulty can be increased by:

- increasing the board height

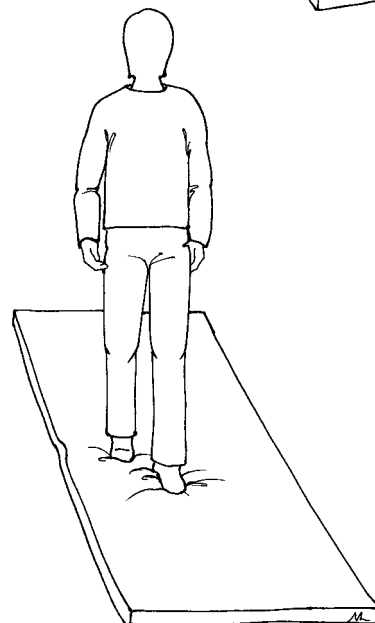


B6 Walking on a soft surface

Following the instructions of the PT, walk on a soft surface forwards, backwards, or sideways.

The difficulty can be increased by:

- walking on a thicker surface
- increasing or varying walking speed
- varying direction

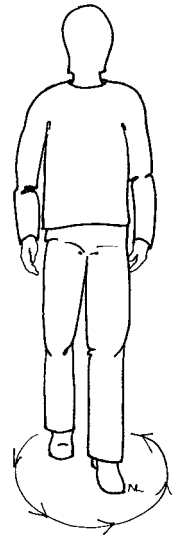


B7 Walking in a circle on the spot

Walk in a circle on the spot then change direction.

The difficulty can be increased by:

- increasing the speed



C - Static and dynamic balance exercises in standing

C1 Maintaining stance with feet parallel or in a walking position

Stand with feet shoulder-width apart parallel or in a walking position.

The difficulty can be increased by:

- reducing the base of support
- transferring body weight in various directions, within the fixed base of support
- closing the eyes

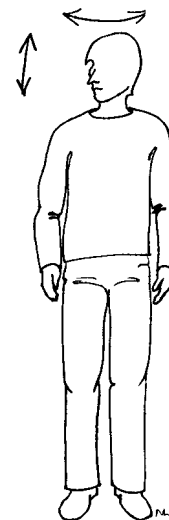


C2 Turning head in various directions- sideways, up, down

Stand with feet shoulder-width apart and turn the head to the right, to the left, look up to the ceiling, and down to the floor.

The difficulty can be increased by:

- reducing the base of support
- increasing the degree of the turn
- increasing the speed of movements



C3 Squats in a parallel stance

Stand with feet parallel to one another, shoulder-width apart, and bend-straighten knees and hips. The exercise is performed without distinct components of lower-limb strength exercises. In case of distinct lower-limb strength exercising, see the corresponding exercise in category A.

The difficulty can be increased by:

- reducing the base of support

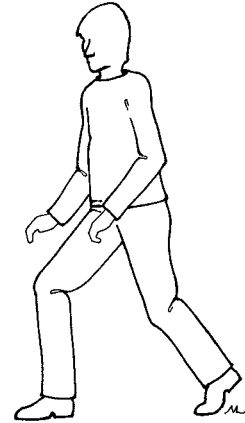


C4 Squats in walking stance

Stand with feet parallel to one another, shoulder-width apart, and bend-straighten knees and hips. The exercise is performed without distinct components of lower-limb strength exercises. In case of distinct lower-limb strength exercising, see the corresponding exercise in category A.

The difficulty can be increased by:

- reducing the base of support

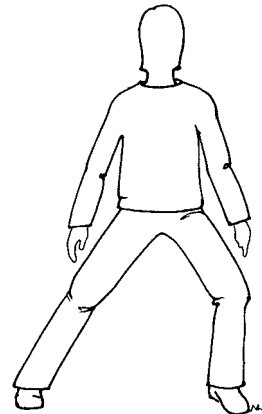


C5 Body-weight transfer in a parallel stance

Stand with feet parallel and transfer body weight back and forth to each leg on a bent knee. The exercise is performed without distinct components of lower-limb strength exercises. In case of distinct lower-limb strength exercising, see the corresponding exercise in category A.

The difficulty can be increased by:

- increasing the degree of movement

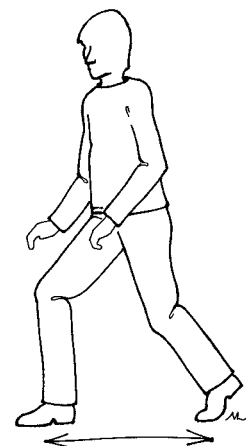


C6 Body-weight transfer in a walking stance

In a walking stance, feet shoulder-width apart, transfer weight between each leg forward and backward on a bent knee. The exercise is performed without distinct components of lower-limb strength exercises.

The difficulty can be increased by:

- increasing the degree of movement

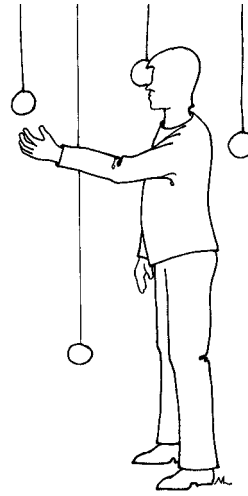


C7 Reaching for an object in various directions

Stand with feet shoulder-width apart and reach for and grasp objects and move them in various directions. The objects could be held by the PT or, for example, be placed on a table.

The difficulty can be increased by:

- reducing the base of support
- increasing the distance to the object
- increasing the variation in direction
- increasing the weight of the object

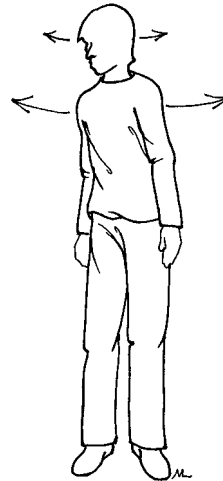


C8 Trunk rotation

Stand with feet shoulder-width apart and rotate trunk and head to the right and then to the left.

The difficulty can be increased by:

- reducing the base of support
- increasing the degree of rotation
- increasing the speed of rotation

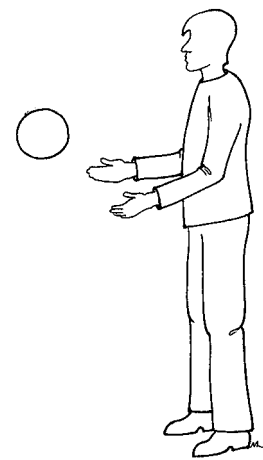


C9 Throwing and catching a ball

Catch a ball and throw it back to the PT.

The difficulty can be increased by:

- PT throwing the ball faster or to varying points

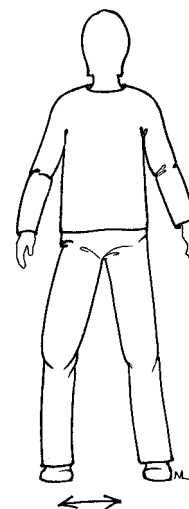


C10 Side step and return

Starting with feet shoulder-width apart, take one step to the side, then return to the starting position. Weight should be on a bent knee of the leg that is moved before it is returned to the starting position. The exercise is performed without distinct components of lower-limb strength exercises.

The difficulty can be increased by:

- reducing the base of support at the start
- increasing the distance the leg is moved to the side
- increasing the speed of the changeover from leg to leg



C11 Forward step and return

Stand with feet shoulder-width apart and take one step forward, then return to the starting position. Weight should be on a bent knee of the leg that is moved before it is returned to the starting position. The exercise is performed without distinct components of lower-limb strength exercises.

The difficulty can be increased by:

- reducing the base of support at the start
- increasing the distance the leg is moved forward
- increasing the speed of the changeover from leg to leg



C12 Step up and down with one foot

Stand with a step board in front and put one foot up on the board, then return to the starting position.

The difficulty can be increased by:

- increasing the height of the board
- increasing the speed of the changeover from leg to leg
- stepping up and down with each leg alternately





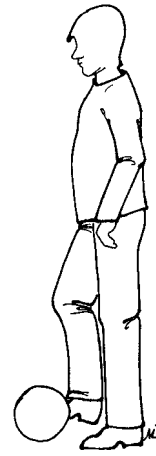
C13

Kicking a ball

Stop a ball and kick it back to the PT.

The difficulty can be increased by:

- PT kicking the ball faster or in different directions



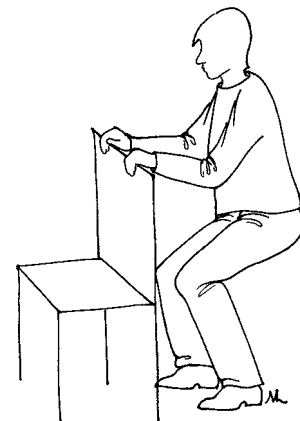
D - Lower-limb strength exercises with continuous balance support

D1 Squats in a parallel stance

Stand with feet parallel to one another, shoulder-width apart, and bend-straighten knees and hips. Continuous balance support is provided by the PT or a steady object.

The difficulty can be increased by:

- making deeper squats
- increasing the load in the weighted belt



D2 Squats in walking stance

Stand with one foot in front of the other, shoulder-width apart, and bend-straighten knees and hips. Continuous balance support is provided by the PT or a steady object.

The difficulty can be increased by:

- making deeper squats
- increasing the load in the weighted belt

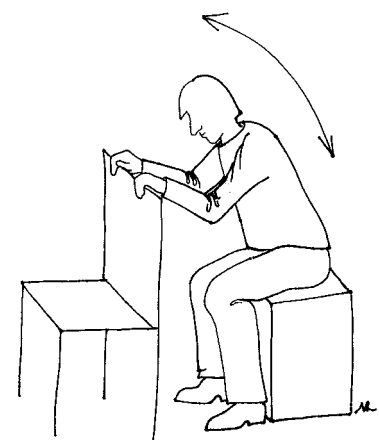


D3 Standing-up from sitting in a parallel stance

Stand up and sit down on a chair with feet parallel. Continuous balance support is provided by the PT or a steady object.

The difficulty can be increased by:

- reducing the height of the chair
- increasing the load in the weighted belt



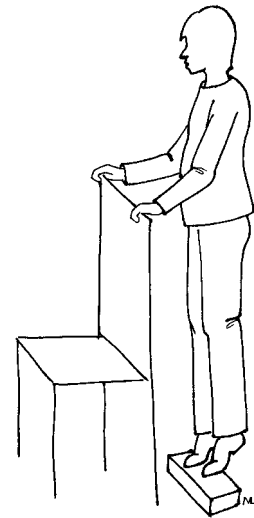


D4 Heel-raises

Heel-raises with balance support. Continuous balance support is provided by the PT or a steady object.

The difficulty can be increased by:

- performing one leg at a time
- increasing the load in the weighted belt

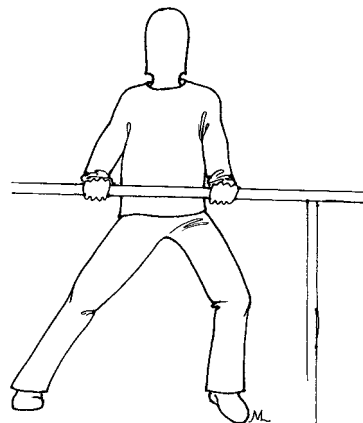


D5 Body-weight transfer to the side

Stand with feet slightly wider apart than shoulder-width, and transfer weight to each leg alternately, bending at the knee each time. Continuous balance support is provided by the PT or a steady object

The difficulty can be increased by:

- making deeper squats
- increasing the load in the weighted belt

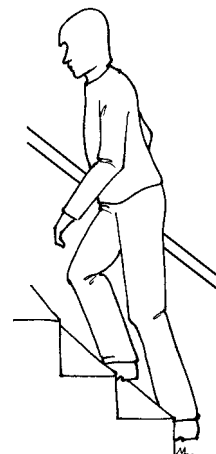


D6 Stair-walk

Walk up and down some stairs using the PT or the banister as continuous balance support.

The difficulty can be increased by:

- increasing the walking speed
- increasing the load in the weighted belt



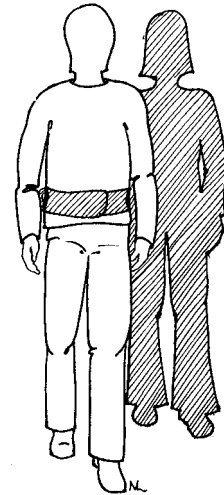
E - Walking with continuous balance support

E1 Walking forward on a flat surface

Walk forward on a flat surface with continuous balance support provided by, for example, the PT or a walking aid.

The difficulty can be increased by:

- increasing or varying walking speed

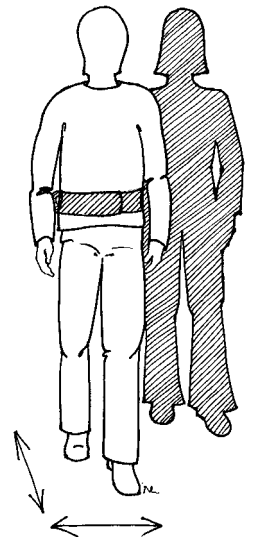


E2 Walking in various directions

Following the instructions of the PT, walk forwards, backwards, or sideways using continuous balance support.

The difficulty can be increased by:

- increasing or varying walking speed
- varying the direction more often

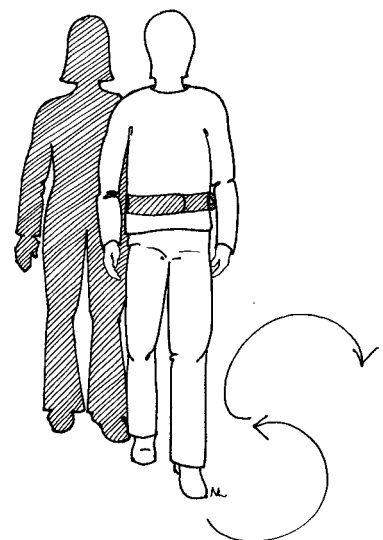


E3 Walking with numerous turns

Following the instructions of the PT, walk forward and frequently change direction by 180 degrees using continuous balance support.

The difficulty can be increased by:

- increasing the speed of the changes in direction
- changing directions more often



Publications

Original articles, peer-reviewed

Rosendahl E, Lindelöf N, Littbrand H, Yifter-Lindgren E, Lundin-Olsson L, Håglin L, Gustafson Y, Nyberg L. High-intensity functional exercise program and protein-enriched energy supplement for older persons dependent in activities of daily living; a randomised controlled trial. *Aust J Physiother* 2006; 52:105-13.

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Lindelöf N, Karlsson S, Lundman B. Experiences of a high-intensity functional exercise programme among older people dependent in activities of daily living. *Physiother Theory Pract* 2012; 28:307-16.

Lindelöf N, Rosendahl E, Gustafsson S, Nygaard J, Gustafson Y, Nyberg L. Perceptions of participating in high-intensity functional exercise among older people dependent in activities of daily living (ADL). *Arch Gerontol Geriatr* 2013; 57:369-376

