

# Multicomponent exercise training in older adults: application and evaluation

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# What is Multicomponent Training (MCT)?

- Training designed to improve **‘multiple components’** of physical fitness delivered **within the same exercise session**
- Usually consisting of **aerobic / endurance** activities, **strength** training activities and often includes **balance** and **flexibility** exercises too
- Often 2-3 sessions per week of 60-75 minutes duration
- Aiming to induce improvements in multiple physiological systems, to ultimately improve **functional performance**
- Also referred to as combined or concurrent training

# Effectiveness of MCT

- Improves **CV fitness** (Wood et al., 2001)
- Improves **muscle strength**: *lower body 1RM* (Cadore et al., 2010; Cadore et al., 2012)
- Improves **muscle power** (Cadore et al., 2013)
- Improves **functional performance**: *chair stand, up and go* (Carvalho et al., 2009; Toroman & Sahin, 2004)
- **Lipid profiles** (Carvalho et al., 2010)

How big is the effect from performing this type of training – our **progress meta-analysis** should give us some idea of this as well as an understanding of the impact of **training variable** manipulation

# MCT: An appealing strategy for older adults

Ageing is associated with declines in multiple components of physical fitness, including but not limited to:

- **Cardiorespiratory fitness**
- Muscular strength
- Muscular power
- Gait speed
- Balance

However, **muscular power is possibly the most important predictor of functional limitation** in older adults (Izquierdo et al., 1999; Sayers et al., 2003; Reid & Fielding, 2012) and **it declines at a faster rate** than muscle strength

# Assessment of lower body muscle power

## Nottingham Leg Extensor power rig

- A functional method for the assessment of leg extensor power. Similar muscle groups and joint angles to those used in stair climbing and rising from a chair (Basseley & Short, 1990).
- Sit-to-stand influenced by a number of physiological factors (Lord et al., 2002) suggesting it is a 'composite measures' of fitness. Leg rig offers something different – particularly for evaluating training interventions.



## Evaluation of reliability:

- 72 participants (50-85yr), 5 trials
- **Reliable** both **short-term** and **long-term** (12 weeks) as a method of assessing lower body muscle power

# An alternative MCT strategy – High-intensity Interval training

- **HIT** in general: **substantial improvements** in CV fitness with **effects greater in the less fit** (Milanovic et al., 2015; Weston et al., 2014)
- Improvements in health related quality of life and aerobic exercise capacity (**CV fitness**) (Knowles et al., 2015)
- Improvements in **muscular power** (Sculthorpe et al., 2015)
- Improvements in **functional performance** (Sit-to-stand, get-up-and-go) (Adamson et al., 2014)

# Novel application of HIT

- Traditionally HIT has been confined to the **laboratory**
- Exercise mode has tended to be cycle ergometry or treadmill
- Creative, **novel approaches** to performing HIT are welcomed to provide an alternative exercise option
- Examples starting to appear (Buckley et al., 2015) which use different modes of exercise and variation in exercise programming

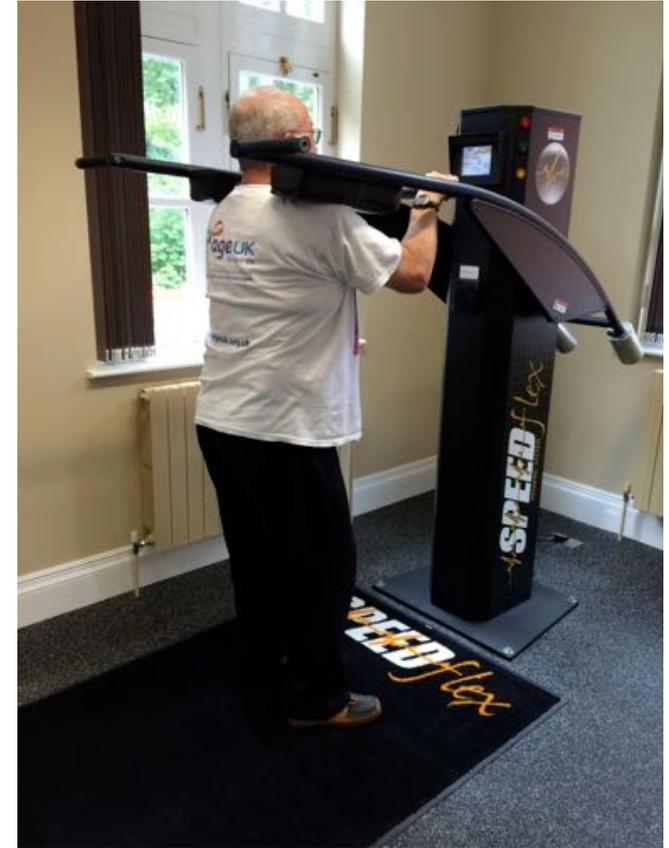
# Our novel approach

## Speedflex:

- A, novel double-concentric, multi-joint exercise device with potential to elicit a high-intensity physiological response (Taylor et al., 2014)
- Users apply force throughout the entire exercise as the resistance is set in both directions; thus training more than one muscle group per exercise
- Appealing strategy in an older population:
  1. “Arms” of the machine can act as a balance aid
  2. Variable resistance to accommodate individual abilities

# Speedflex

- The device utilises hydraulic, variable resistance determined by user force
- Free-motion bar helps to provide stability during movement
- Can perform both single- and multi-joint exercise
- Resistance set in a similar way to rowing machine (1-10)



# A potential training strategy?

Stage 1

- 1) Is multicomponent training an effective strategy in older adults for improving functional fitness and quality of life?
- 2) Is the leg extensor power rig a reliable method to evaluate lower body muscle power in older adults

Stage 2

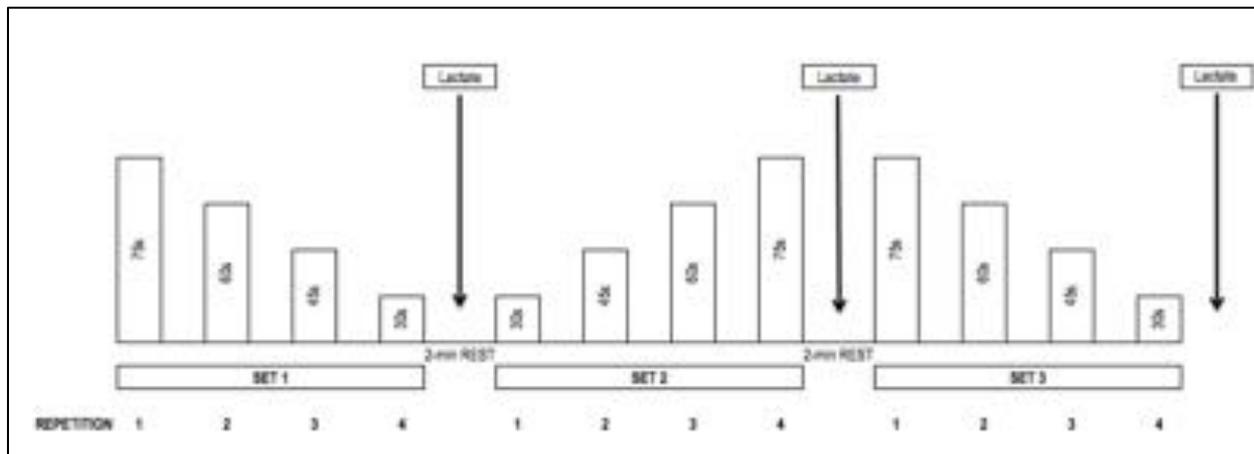
Can we use the Speedflex machine to provide; (1) an aerobic training stimulus, (2) a strength training stimulus in older adults?

Stage 3

What are the effects of 12 weeks of Speedflex training on measures of functional fitness and quality of life in older adults?

# Can we use Speedflex as a novel method to perform HIT in older adults?

- 20 healthy older adults (10 males;  $63 \pm 6$  yr)
- Participants performed a cycle ergometer incremental  $\text{VO}_{2\text{peak}}$  test
- HIT protocol performed using two different exercise modes: cycle ergometer and Speedflex machine in a counterbalanced order



# Results: acute comparison

Variable	Cycle mean	Speedflex mean	Mean difference (95% CL)*
Mean HR (% of max)	81.7 (±8.2)	82.5 (±7.2)	-0.8 (±3.1)
Peak HR (% of max)	89.7 (±7.3)	90.1 (±6.7)	-0.4 (±2.6)
Peak VO <sub>2</sub> (% of max)	84.5 (±10.6)	82.8 (±11.2)	1.7 (±5.6)
Lactate (mmol)	5.5 (±1.7)	5.3 (±1.7)	0.2 (±0.9)
(±SD)			
*Cycle minus Speedflex			

The Speedflex machine elicited a high-intensity physiological response and the response was consistent across both exercise mode, suggesting that Speedflex is a viable mode of HIT in older adults

# The effects of 12-weeks of novel, high-intensity interval training on fitness in older adults

## Aims:

1. To evaluate the effects of 12-weeks of novel, high-intensity interval training on measures of physical fitness in older adults.
2. Can we impact on multiple components of physical fitness simultaneously training like this?
3. Does this training impact on the measures of physical fitness which are related to functional performance and ultimately, quality of life?

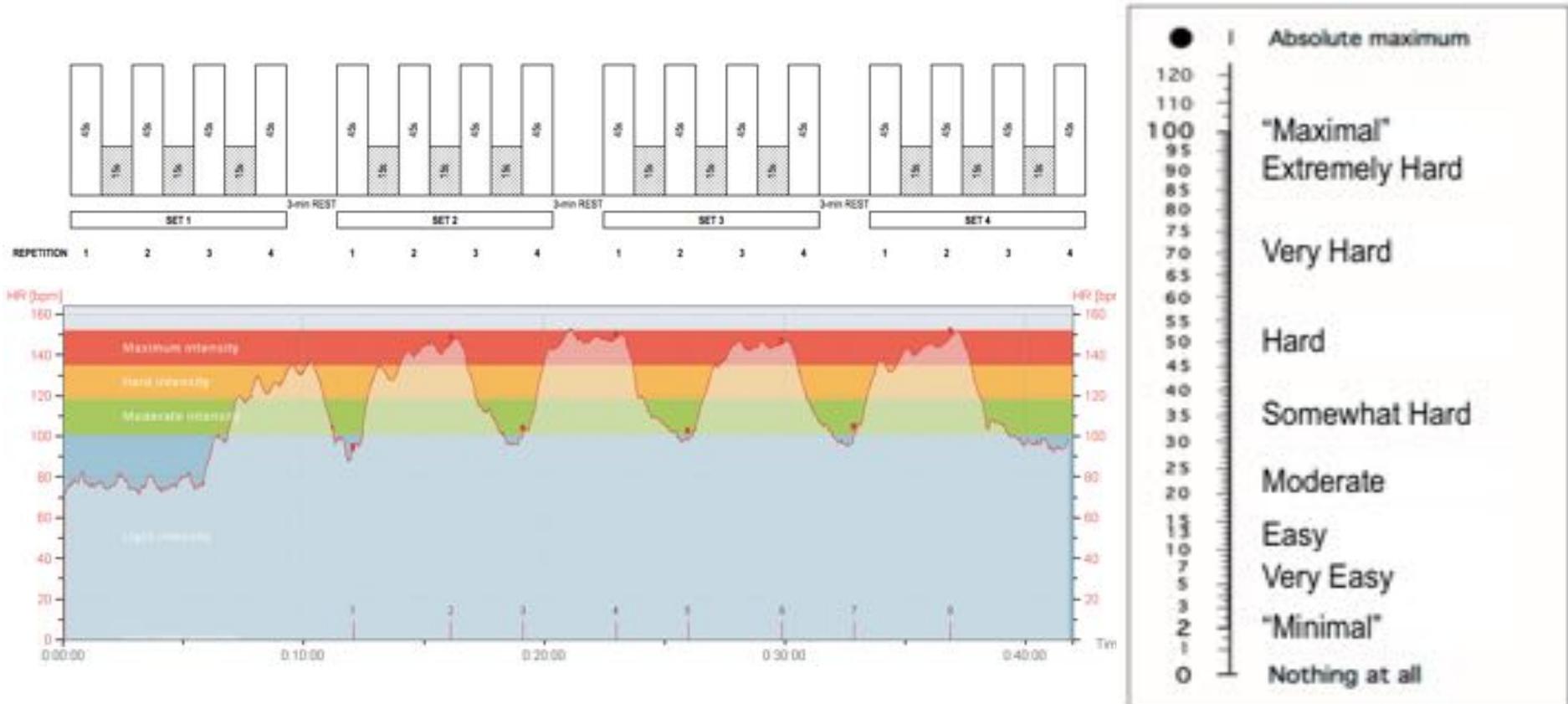
**Participants:** 40 healthy adults aged >50 years

**Protocol:** 2 x training sessions (25-33 min) per week for 12 weeks of high-intensity aerobic interval training

## Outcome measures:

- Lower body muscular power (Leg extensor power rig)
- CV / aerobic fitness
- Handgrip strength
- Quality of life

# Intervention evaluation



# Summary & wider context

- Multiple physiological systems need attention to maintain functional independence and QoL
- Novel exercise approaches needed in this population
- Is Speedflex a time efficient method for improving multiple components of fitness (i.e adaptation / minute, rather than absolute time commitment)
- Is this exercise protocol transferrable to other modes of exercise?
- High-intensity interval training - one more “option on the menu”