Keeping active with a healthy diet

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OLD AGE

by: Crates

These shrivelled sinews and this bending frame, The workmanship of Time's strong hand proclaim; Skilled to reverse whate'er the gods create, And make that crooked which they fashion straight. Hard choice for man, to die -- or else to be That tottering, wretched, wrinkled thing you see: Age then we all prefer; for age we pray, And travel on to life's last, lingering day; Then sinking slowly down from worse to worse, Find heaven's extorted boon our greatest curse.
Physiological adaptations to ageing

- Ageing brings about a gradual decline in all physiological systems,

- This results in generalised weakness, loss of mobility as well as poor endurance and decreased functional balance

→ FRAILTY
Sarcopenia
Is sarcopenia the sole responsible factor?

- Activation capacity
- Single muscle fiber properties
- Whole muscle internal architecture
- Tendon mechanical properties
Muscles work jointly with tendons
Ageing affects tendons

...but inconsistency of results:

1) Ageing makes tendons stiffer
2) Ageing makes tendons more extensible
3) Ageing has no effect

Maturation ≠ Ageing!

Also stiffening of joints with ageing often mistaken for tendon stiffening
However, the \textit{in vivo} interactions between human muscles and tendons in relation to ageing has never been studied before.
Study Aims

- Investigate the *in vivo* effects of ageing not only on muscles but also on tendons
- Assess the physiological relevance of these changes to whole body function in relation to frailty in old age
Research focus

- Activation capacity: by electrical stimulation
- Muscle size and architecture: by ultrasound and MRI
- Tendon properties: by ultrasound & dynamometry
- Balance ability: via force platform outputs
- Stairs & chairs negotiation: via motion analysis
- Functional ability tests: using time-related performances
Study design

- Cross-sectional comparison of data from three age groups: Young, Middle-aged and Older
- Quantification of the relation between muscle & tendon characteristics and whole body performance
Experimental set-up
In vivo Imaging

Images of tendon displacement during ramped contractions

MRI – Moment arm

MRI – Muscle cross-sectional area
Effect of ageing on tendons

Onambele et al, 2006
Effects of ageing on muscle architecture

- Ageing makes muscles not only smaller but also shorter
Whole body function testing
Impairment in whole body performance

1. Postural Balance ✓
2. Stair negotiation capacity ✓
3. Sit-to-stand transitions ✓
4. Walking ✓
Recap

1. Muscle weakness in ageing is not only due to sarcopenia and neural activity changes …

2. ….but also to changes in muscle architecture and in tendon mechanical properties

3. The above alterations are associated with impairment in whole body performance

4. Rehabilitation and even prevention is therefore key
Is exercise effective at reversing the deteriorating effect of ageing on the skeletal-muscle-tendon complex?

The beneficial effects of resistance training as a means of delaying age-related sarcopenia and associated problems have been demonstrated.

Outcomes include positive effects on muscle strength, power and cross-sectional area, alterations in fibre type, reductions in body fat, increased tendon stiffness, increased neural activation capacity and improved functional ability.
Future directions

- From observation we know that muscles can get better with appropriate loading.

- However in spite of the obvious advantages there appears to be an obligatory loss in muscle strength/power with ageing.

- The mechanism of response to training interventions is not clearly understood. This would be necessary to help optimise regimes.

- Need to disentangle the effects of ageing from those of disuse. i.e. when identifying biological markers of ‘ageing’ we need to account for the influence of lifestyle (nutritional status or genetic background for instance).
OBJECTIVES: The SPARC funded will elucidate appropriate nutritional/exercise interventions targeted specifically at individuals aged 65+

METHODS: Assessment of functional, physiological and hormonal profiles in 65+, as well as determining any link with psychometric measures of quality of life.

INTERVENTIONS: Nutritional advise, Exercise, timed protein plus carbohydrate supplementation
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- MSc student: L. Breen

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Old age isn't so bad when you consider the alternative.

--- Maurice Chevalier