

DAIRY PROTEIN AND MUSCLE MASS MAINTENANCE

preventing sarcopenia

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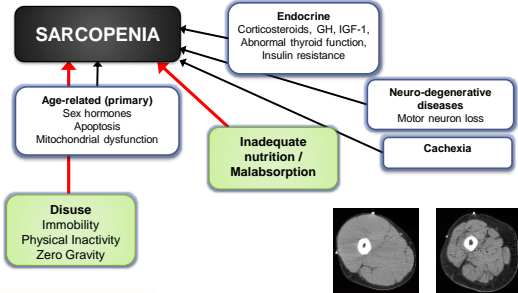
Skeletal muscle

- 50% of body weight
- Major factor in mobility / physical performance
- Major metabolic organ
- Highly adaptive tissue
 - hypertrophy
 - atrophy



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Proposed mechanisms sarcopenia



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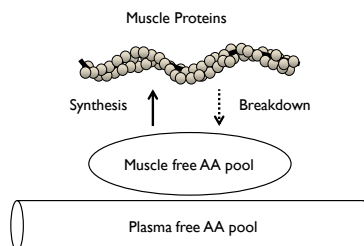
Adapted from Cruz-Jentoft et al, Age Aging, 2010

What regulates skeletal muscle mass



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Muscle protein balance



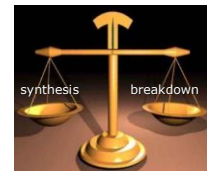
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Burd et al., Exerc Sport Sci Rev, 2013

Muscle protein synthesis and breakdown

1-2 % per day

(0.04 – 0.14 %h⁻¹)



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Main anabolic stimuli

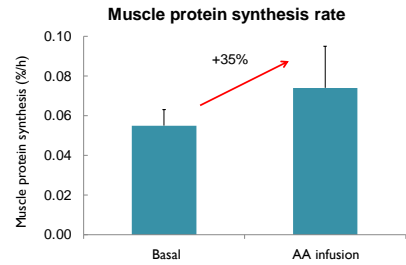


Food/protein intake

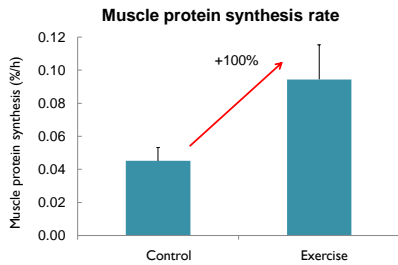


Physical activity

Post-prandial muscle protein synthesis



Post-exercise muscle protein synthesis

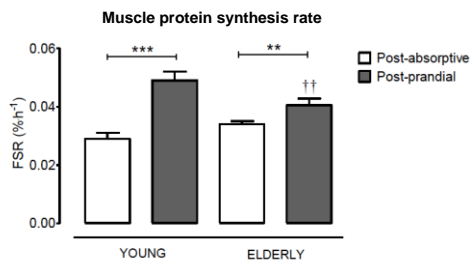


Sarcopenia

- Inadequate nutrition
- Physical inactivity
- Anabolic resistance??



Anabolic resistance



Maximize muscle protein synthesis rate



- source of protein



- amount of protein



- timing and mode of administration



- macronutrients



- food compounds

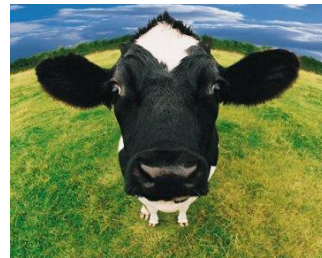
**Prevent muscle loss and/or
improve muscle mass and function**

M3 research group



Muscle protein synthesis rate

Intrinsically labelled milk protein



Intrinsically labelled milk protein



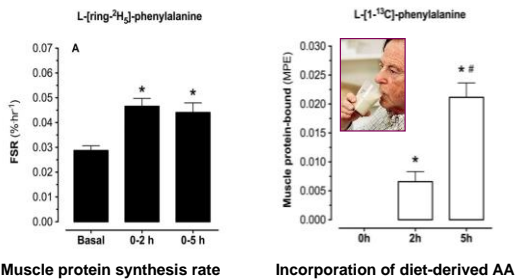
van Loon et al., *J Dairy Sci*, 2009, Pennings et al., *J Dairy Sci*, 2010, Burd et al., *PLoS One*, 2013

Post-prandial protein synthesis



Muscle protein synthesis rate
Incorporation of diet-derived amino acids

Post-prandial protein synthesis



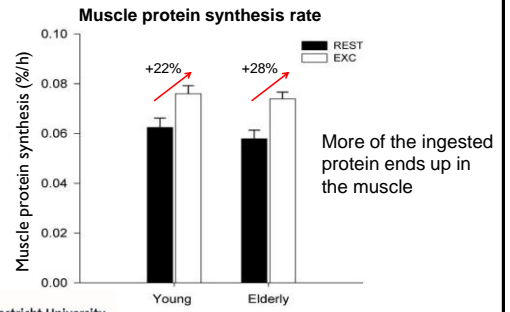
'You are what you just ate'

Synergy between anabolic stimuli



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Physical activity before protein intake



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Penningts et al, AJCN 2010

Physical activity before protein intake

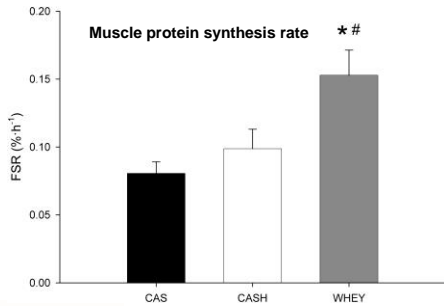
'You are more of what you just ate'

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So **what** should you eat?

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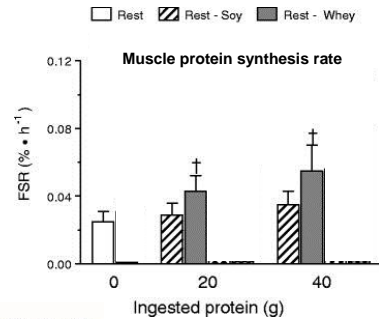
Whey vs casein in elderly



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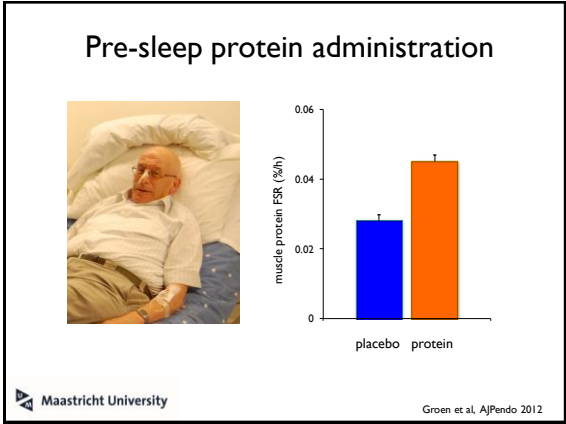
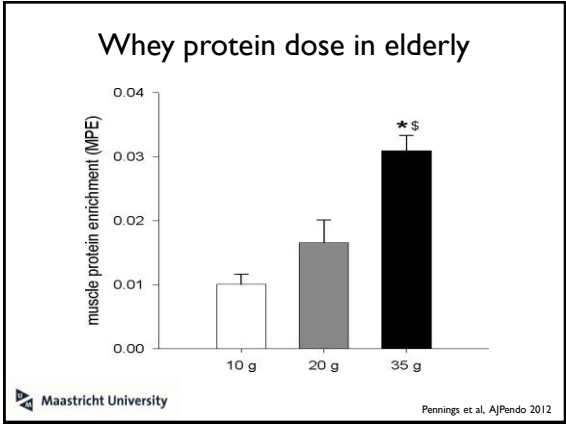
Penningts et al, AJCN 2011

Soy versus whey protein in elderly



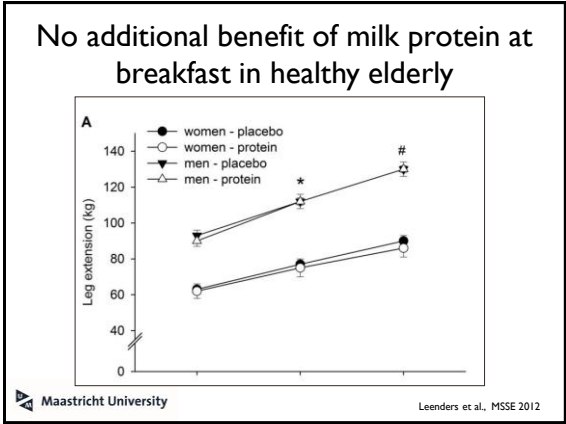
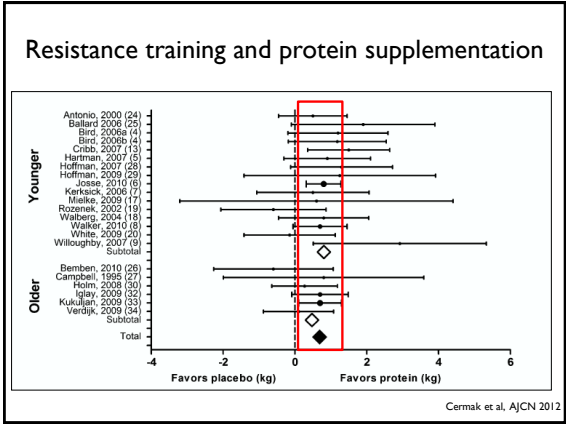
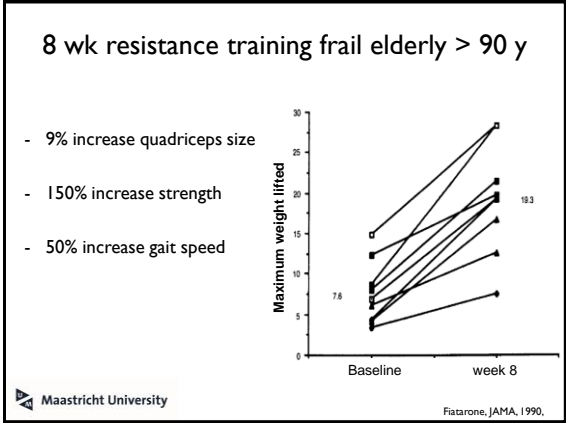
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Yang et al, Nutr Metab 2012

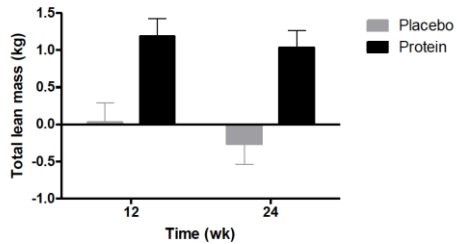


Long-term interventions to counteract sarcopenia

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Additional benefit of milk protein at breakfast and lunch in frail elderly

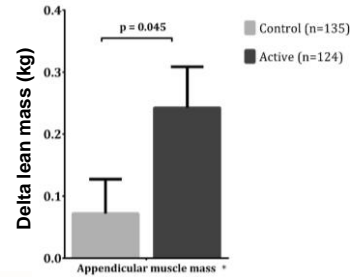


4-5% increase in protein group only

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Tieland et al. JAMDA 2012

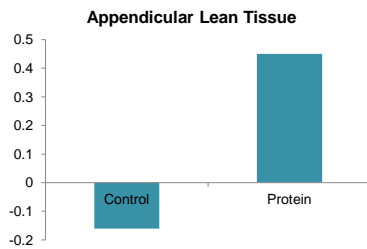
Some benefits of whey+ at breakfast and lunch in sarcopenic subjects



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Bauer et al. JAMDA 2015

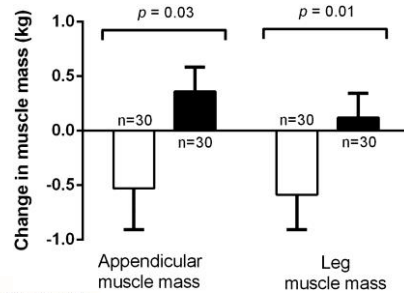
Some benefits of milk protein at breakfast and lunch in healthy older subjects



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Norton et al. J Nutr 2015

Benefits of whey+ at breakfast in obese older subjects on weight loss+exercise



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Verreijen et al. AJCN 2015

Conclusions

Muscle tissue remains responsive to anabolic effects of protein and exercise throughout life, but tailored approach is likely needed:

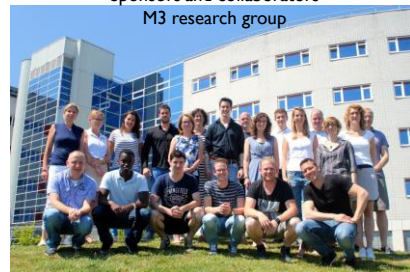
- Protein dose requirements for maintaining and increasing muscle mass and function are increased in elderly
- Ingesting 1.2 – 1.5 g/kg body mass per day
- Ingesting 25 – 30 g with each main meal
- Ingesting high quality protein (EAA / leucine)
- Ingesting protein close to physical activity and / or before sleep

Protein supplementation can have isolated benefits for muscle mass and/or function

Combining protein with exercise provides strongest stimulus for maintenance and even improvement of muscle mass and function.

Acknowledgements

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