UCD Institute of Food & Health

Smart Science ~ Good Food

Role of nutrition and exercise interventions for sarcopenia in fallers

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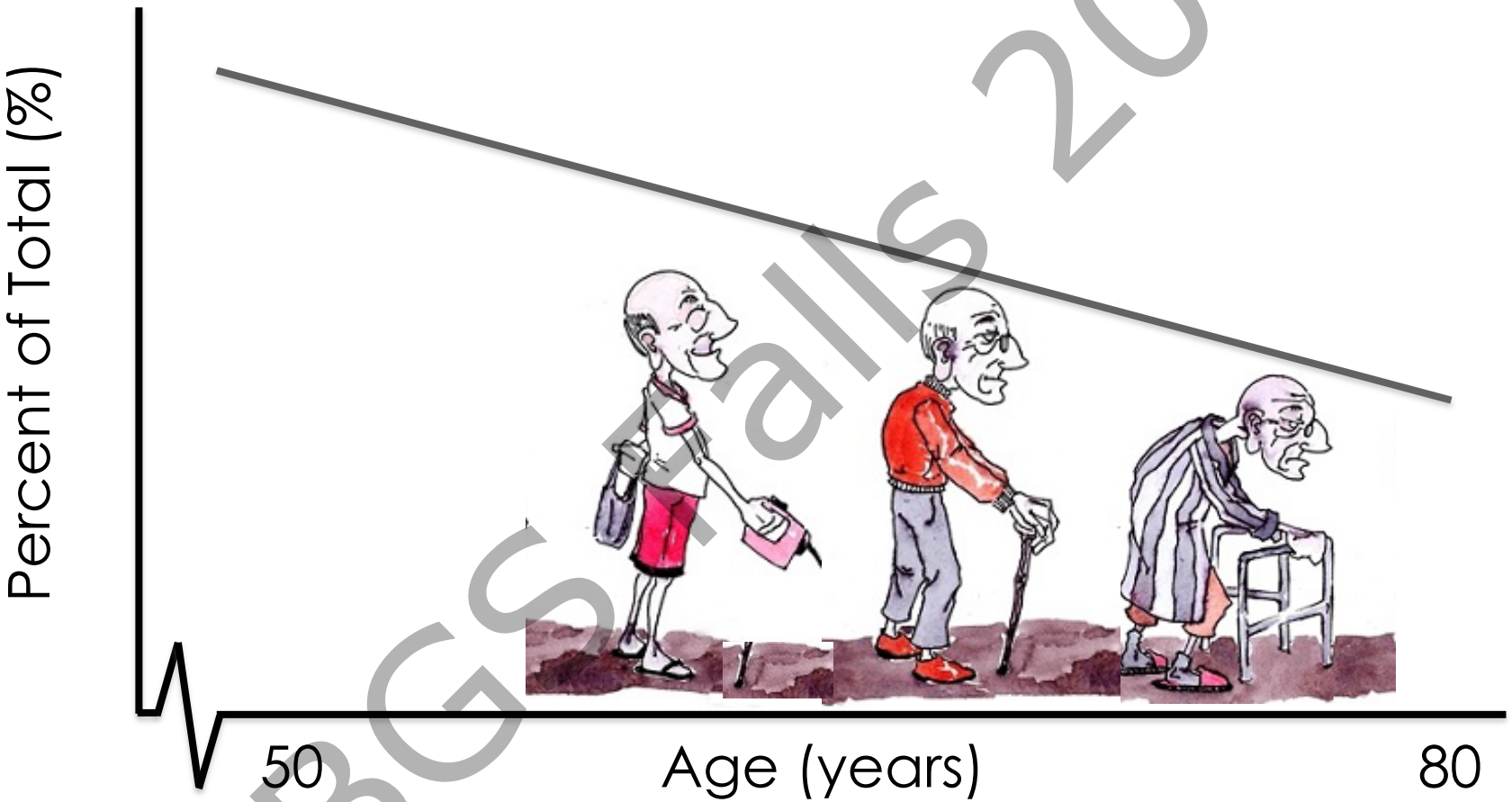
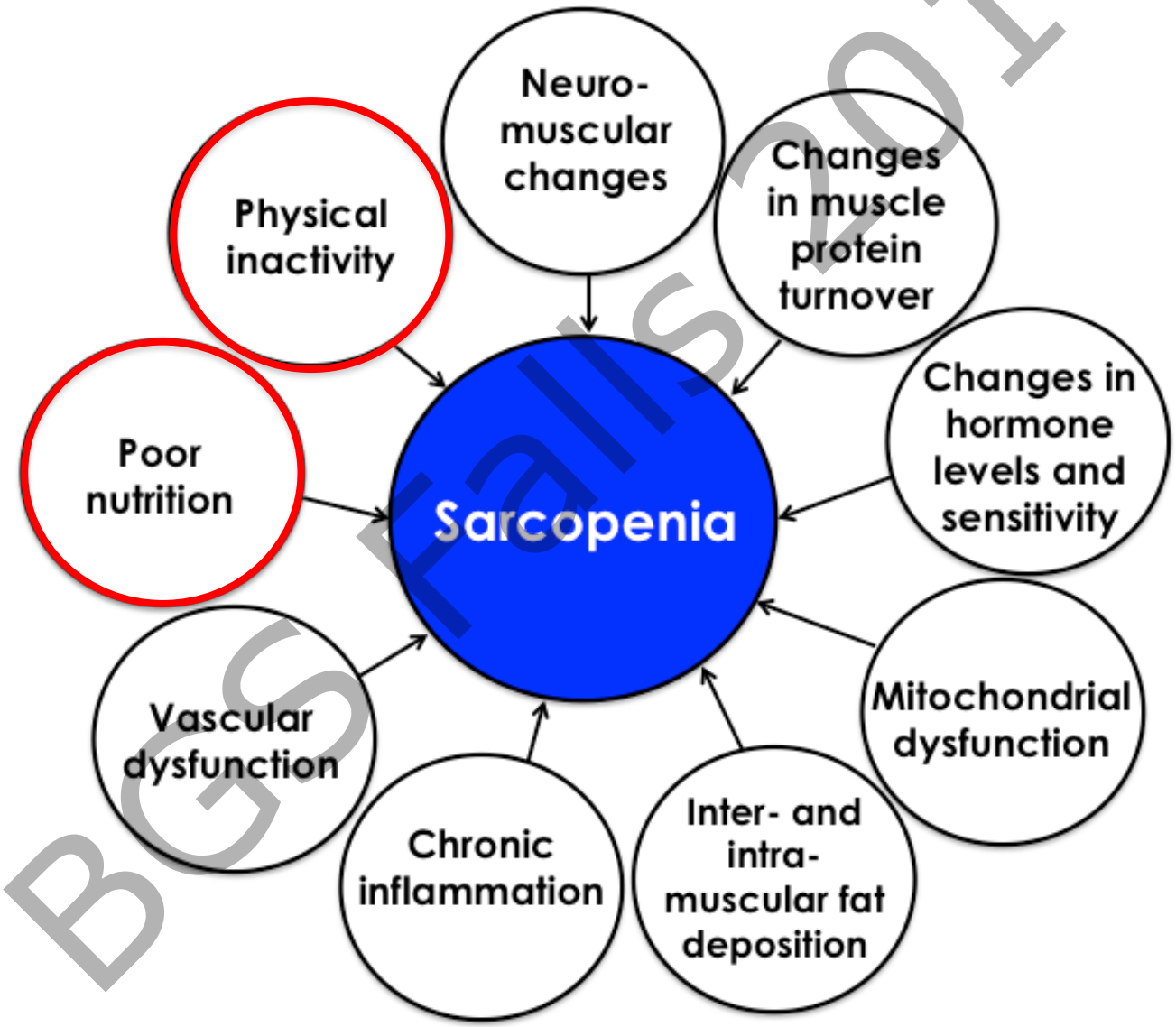
www.ucd.ie/foodandhealth

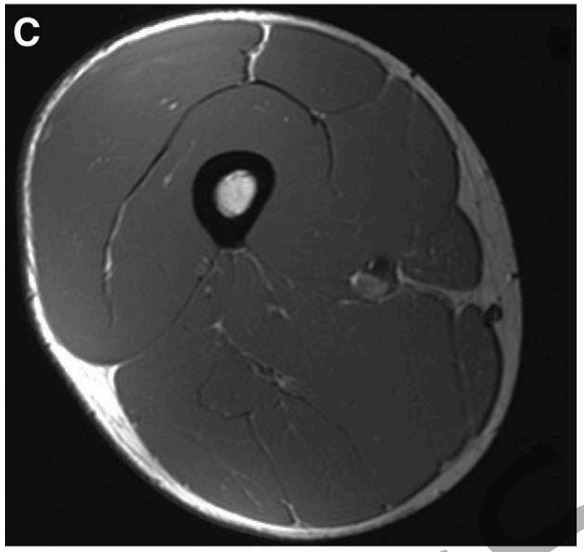
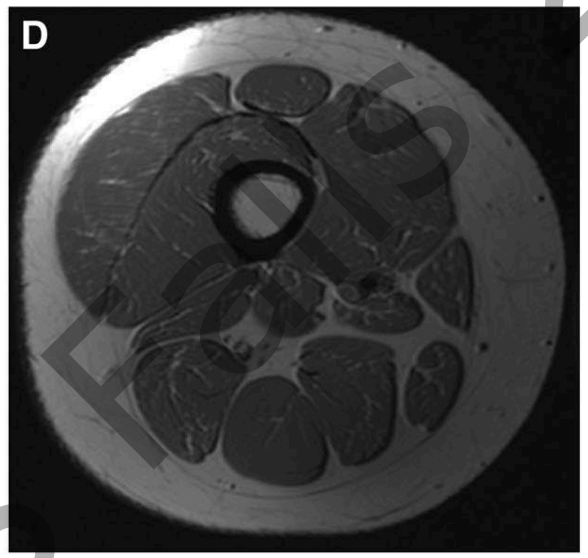
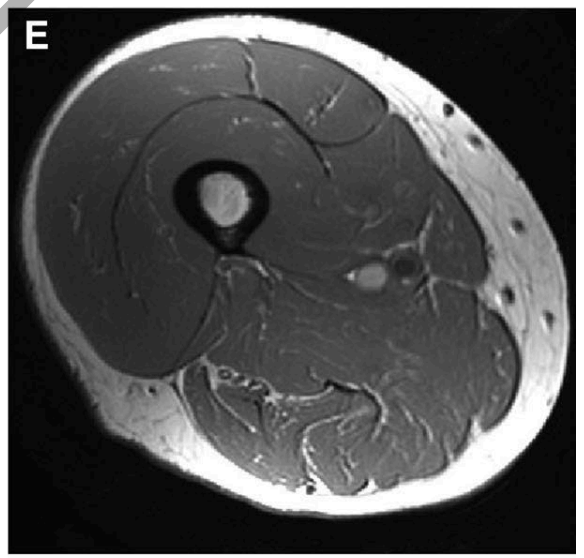
Sarcopenia



Aetiology of sarcopenia



Physical (in)activity: a key regulator of muscle mass

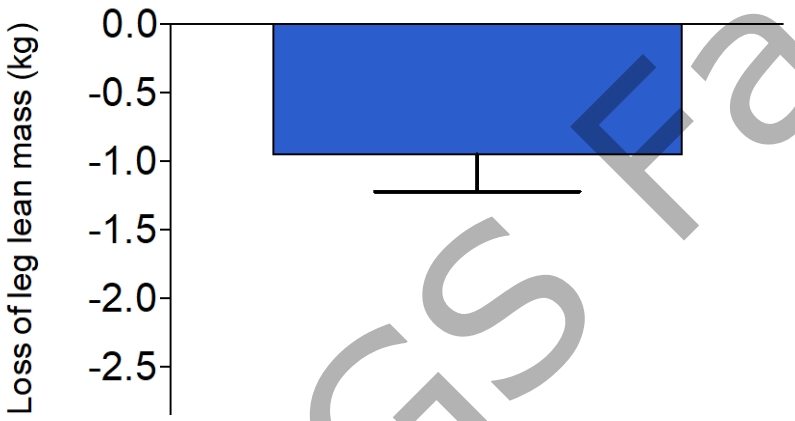
Young	Old	Old active
		
Male – 24 yrs Body mass – 76kg Fat mass – 10kg Fat free mass – 57kg	Male – 66 yrs Body mass – 81kg Fat mass – 57kg Fat free mass – 13kg Average daily steps = 3141 PA >3MET per/day = 22mins	Male – 66 yrs Body mass – 79kg Fat mass – 34kg Fat free mass – 36kg Average daily steps = 12445 PA >3MET per/day = 130mins

McLeod et al. (2016) Biogerontology 17:497–510

Periods of **muscle disuse** accelerate sarcopenia

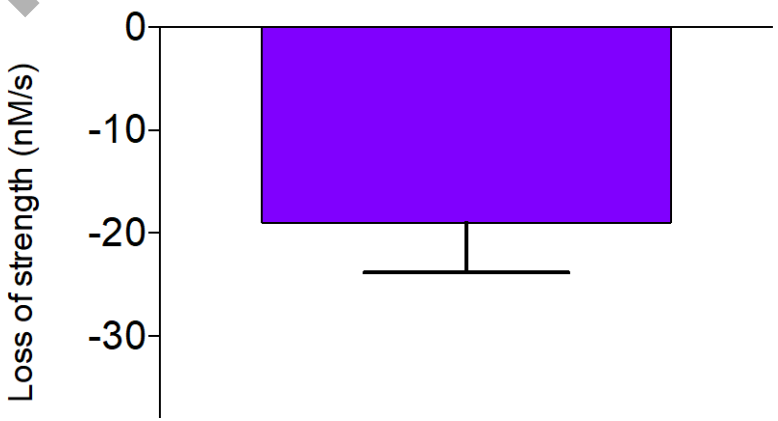
10 d bed rest

↓ Leg lean mass



6% of total leg lean mass

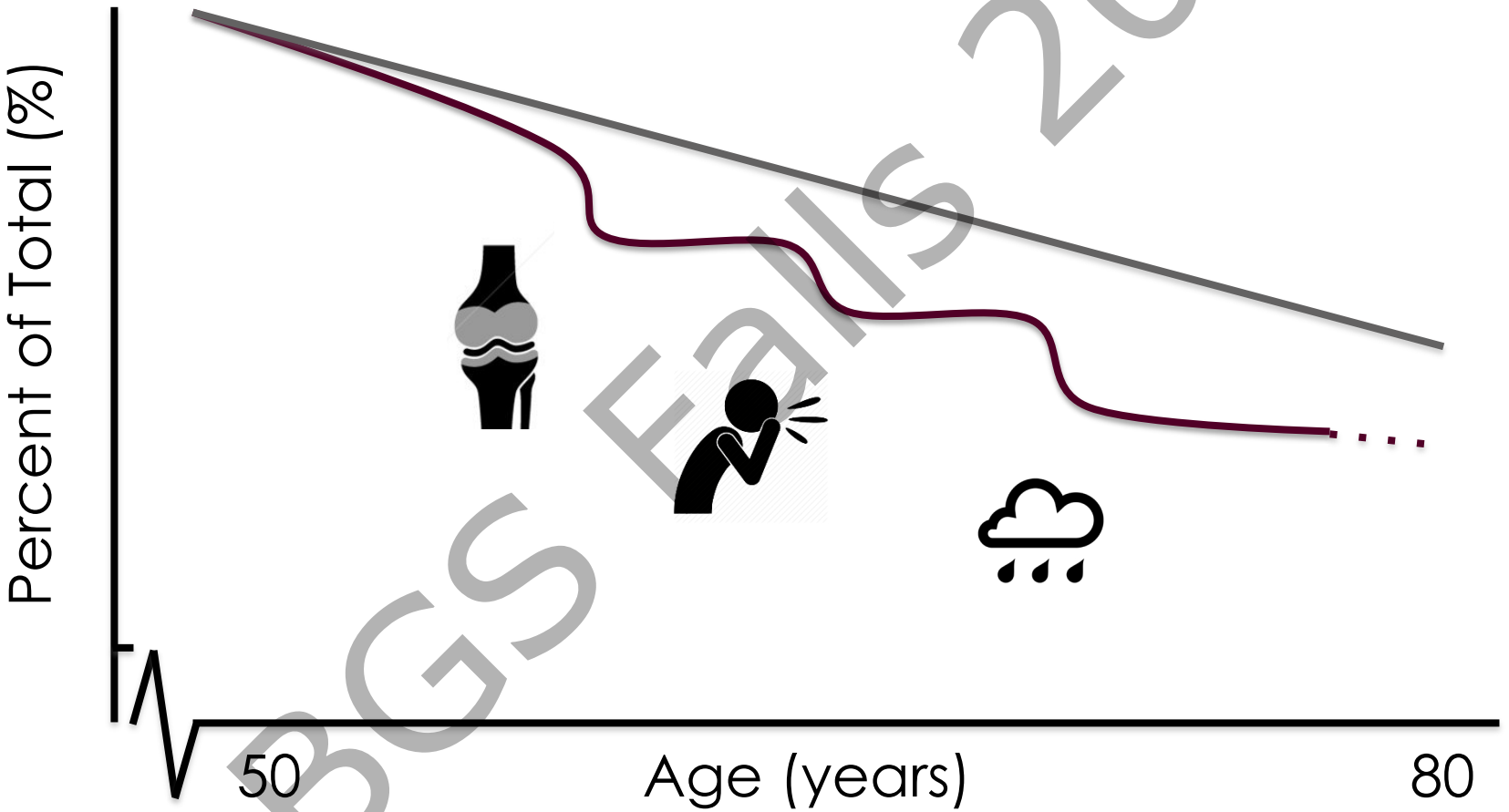
↓ Strength



16% decline in strength

Kortebein (2007) JAMA 297(16):1772-4

Periods of **muscle disuse** accelerate sarcopenia



English and Paddon-Jones (2010) Curr. Opin. Nutr. Metab. Care;13,34-39

Resistance exercise improves muscle mass, strength and physical performance in older adults

Med Sci Sports Exerc. 2011 Feb;43(2):249-58. doi: 10.1249/MSS.0b013e3181eb6265.

Influence of resistance exercise on lean body mass in aging adults: a meta-analysis.

Peterson MD[1], Sen A, Gordon PM.

Ageing Res Rev. 2010 Jul;9(3):226-37. doi: 10.1016/j.arr.2010.03.004. Epub 2010 Apr 10.

Resistance exercise for muscular strength in older adults: a meta-analysis.

Peterson MD[1], Rhea MR, Sen A, Gordon PM.

Cochrane Database Syst Rev. 2009 Jul 8;(3):CD002759. doi: 10.1002/14651858.CD002759.pub2.

Progressive resistance strength training for improving physical function in older adults.

Liu CJ[1], Latham NK.

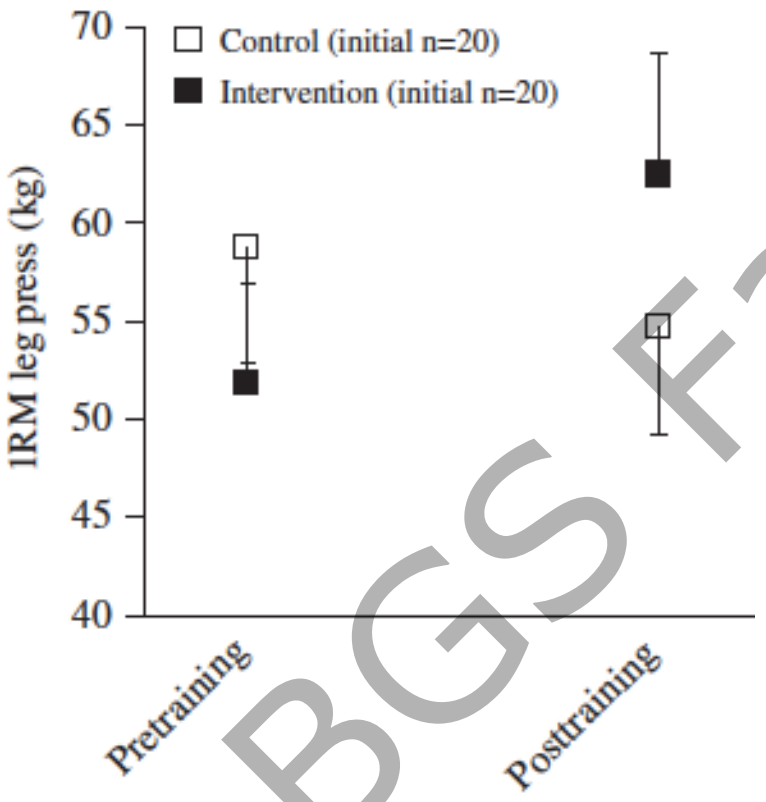
Disabil Rehabil. 2011;33(2):87-97. doi: 10.3109/09638288.2010.487145. Epub 2010 May 17.

Can progressive resistance strength training reduce physical disability in older adults? A meta-analysis study.

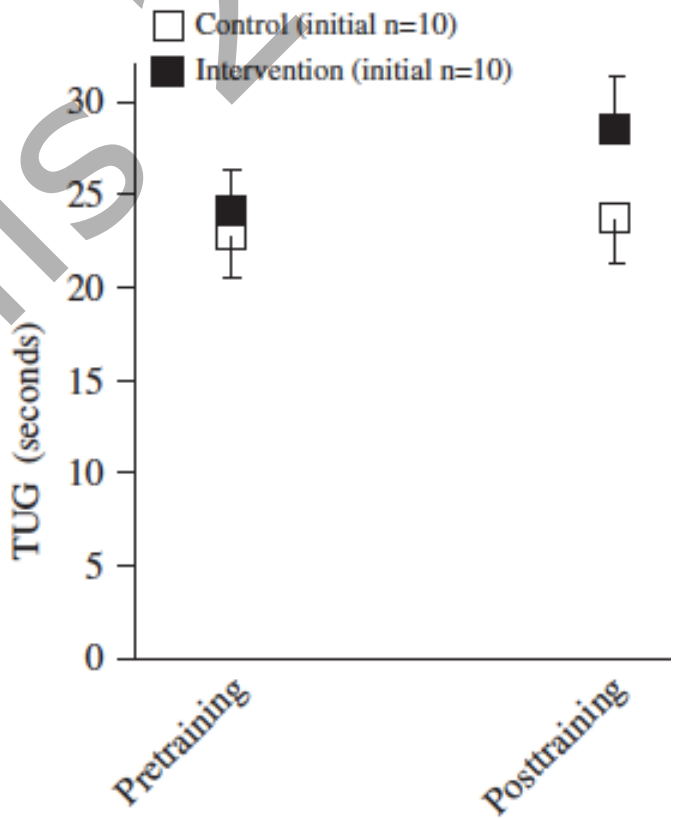
Liu CJ[1], Latham N.

Resistance exercise works, even in the oldest old

Leg strength



Timed up and go



Serra-Rexach et al. (2011) J Am Geriatr Soc 59:594–602

Resistance exercise to **treat** sarcopenia?

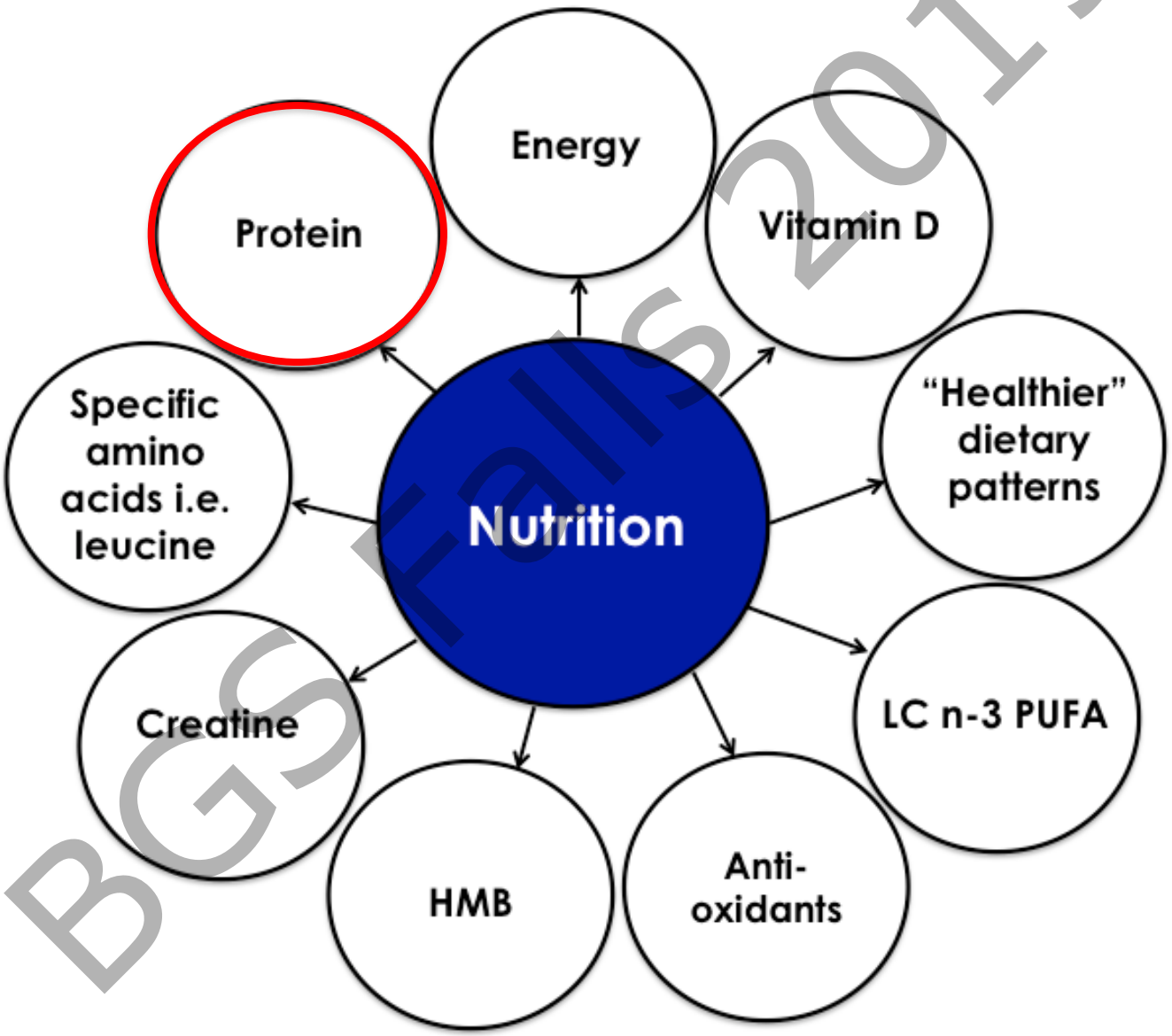
J Nutr Health Aging. 2018;22(10):1148-1161

INTERNATIONAL CLINICAL PRACTICE GUIDELINES FOR SARCOPENIA (ICFSR): SCREENING, DIAGNOSIS AND MANAGEMENT

Recommendation 3: Physical Activity (Resistance-Based Training)

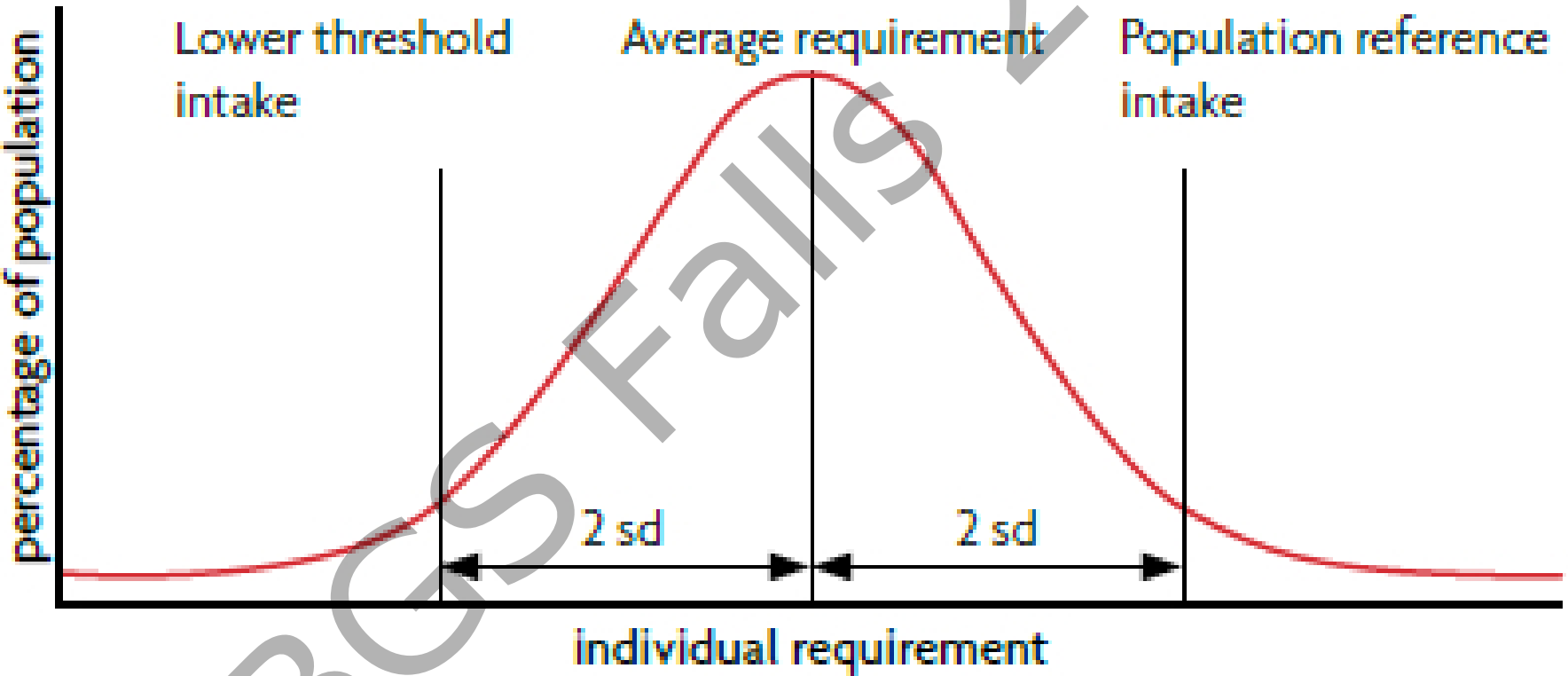
In patients with sarcopenia, prescription of resistance-based training can be effective to improve muscle strength, skeletal muscle mass and physical function. (Grade: strong recommendation, moderate certainty of evidence)

Nutrition and sarcopenia

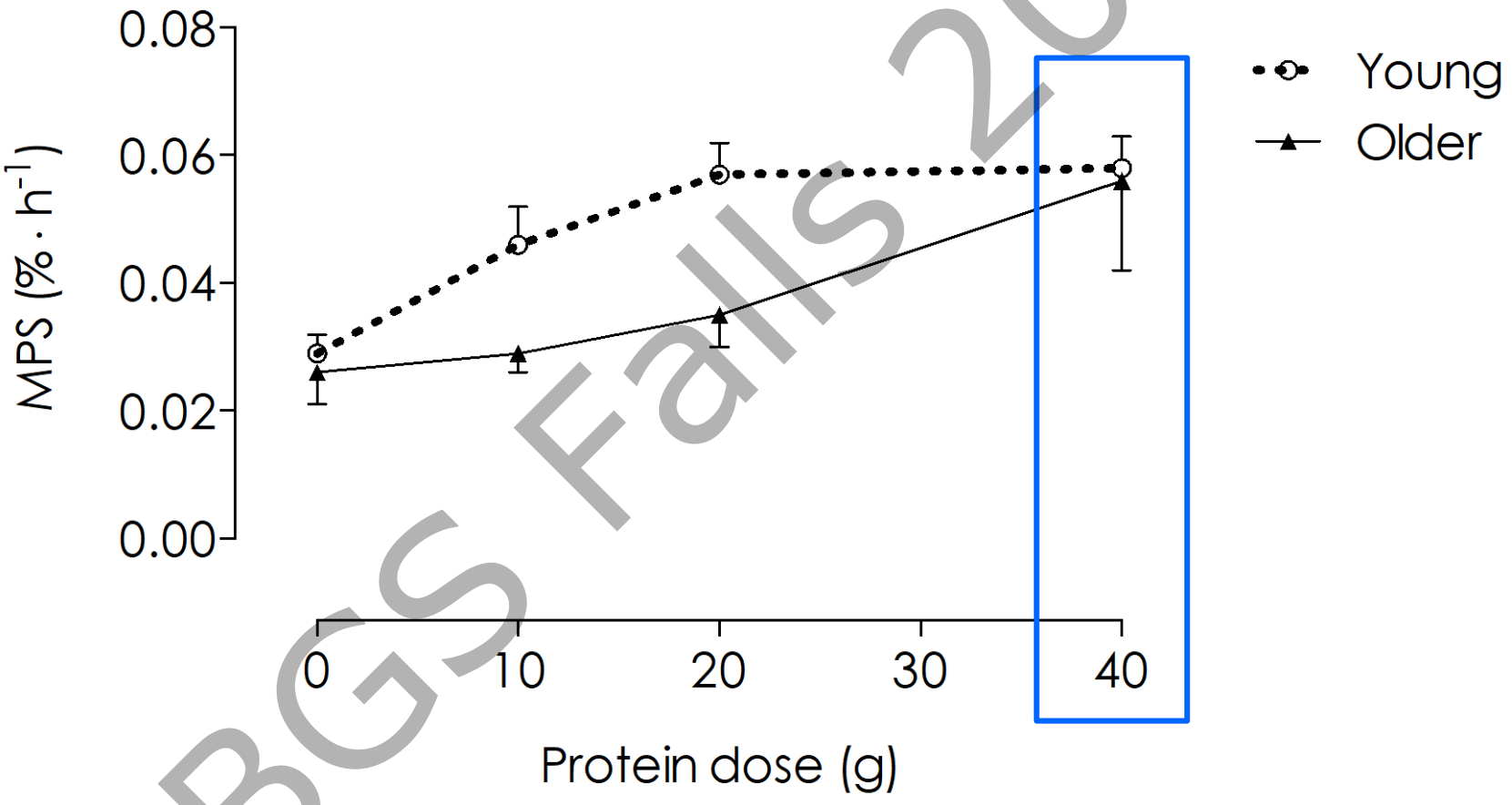


Dietary protein: Recommended Daily Allowance (RDA)

0.8 g/kg/d

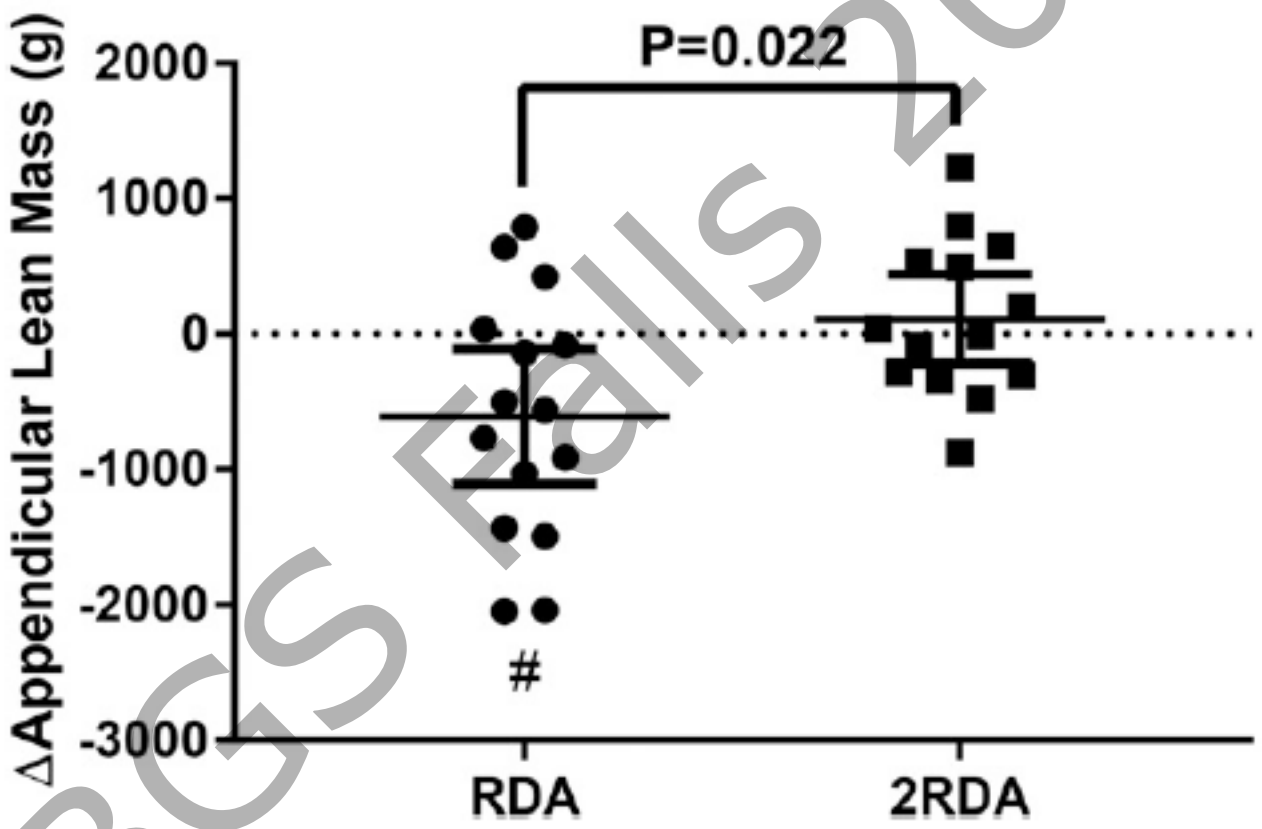


Dietary protein intake and MPS dose response



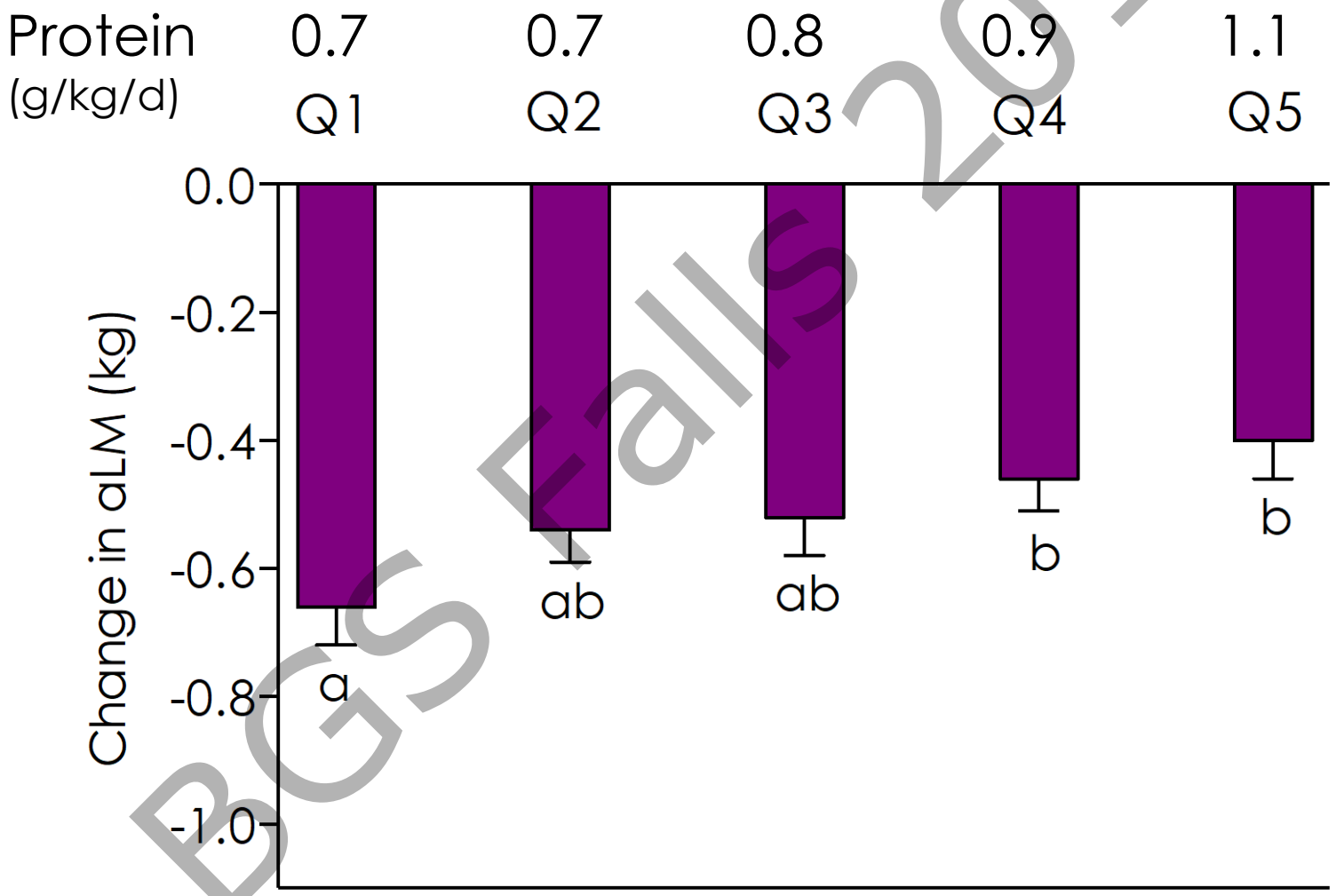
Adapted from Moore *et al.* (2015) *J Gerontol A Biol Sci Med Sci*. 70(1):57-62

RCT: 10-wk consuming RDA (0.8 g protein/kg/d) resulted in appendicular lean mass loss in older adults



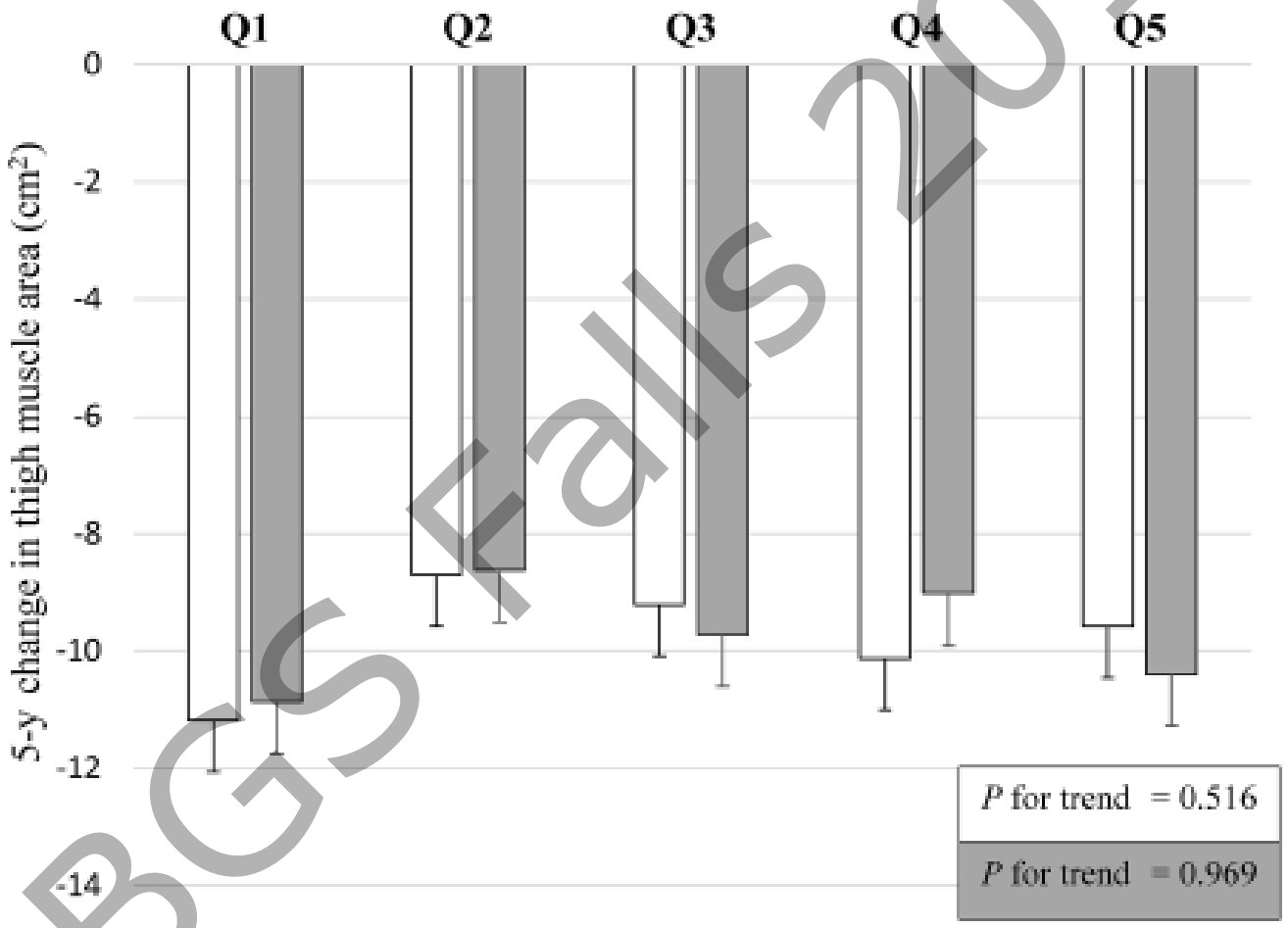
Mitchell et al. (2017) Am J Clin Nutr 106:1375–83

Observational study: Older adults consuming higher protein intakes lost less lean mass over 3-y follow-up



Houston et al. (2008) *Am J Clin Nutr* 87:150 –5

Observational study: Protein intake not associated with 5-y change in mid-thigh muscle cross-sectional area by CT in older adults



Verreijen et al. (2019) *Am J Clin Nutr* 109: 535-543

JAMDA

journal homepage: www.jamda.com

Special Article

Evidence-Based Recommendations for Optimal Dietary Protein Intake in Older People: A Position Paper From the PROT-AGE Study Group

Jürgen Bauer MD[a,*], Gianni Biolo MD, PhD[b], Tommy Cederholm MD, PhD[c], Matteo Cesari MD, PhD[d], Alfonso J. Cruz-Jentoft MD[e], John E. Morley MB, BCh[f], Stuart Phillips PhD[g], Cornel Sieber MD, PhD[h], Peter Stehle MD, PhD[i], Daniel Teta MD, PhD[j], Renuka Visvanathan MBBS, PhD[k], Elena Volpi MD, PhD[l],

1.0 – 1.2 g protein/kg/d in healthy older adults
1.2 – 1.5 g protein/kg/d acute or chronic illness
1.5 – 2.0 protein g/kg/d severe illness/injury/malnourishment

ESPEN endorsed recommendation

Protein intake and exercise for optimal muscle function with aging: Recommendations from the ESPEN Expert Group

Nicolaas E.P. Deutz[a,*], Jürgen M. Bauer[b], Rocco Barazzoni[c], Gianni Biolo[c], Yves Boirie[d], Anja Bosy-Westphal[e], Tommy Cederholm[f,g], Alfonso Cruz-Jentoft[h], Zeljko Krznariç[i], K. Sreekumaran Nair[j], Pierre Singer[k], Daniel Teta[l], Kevin Tipton[m], Philip C. Calder[n,o]

Dietary protein in **treatment** of sarcopenia?

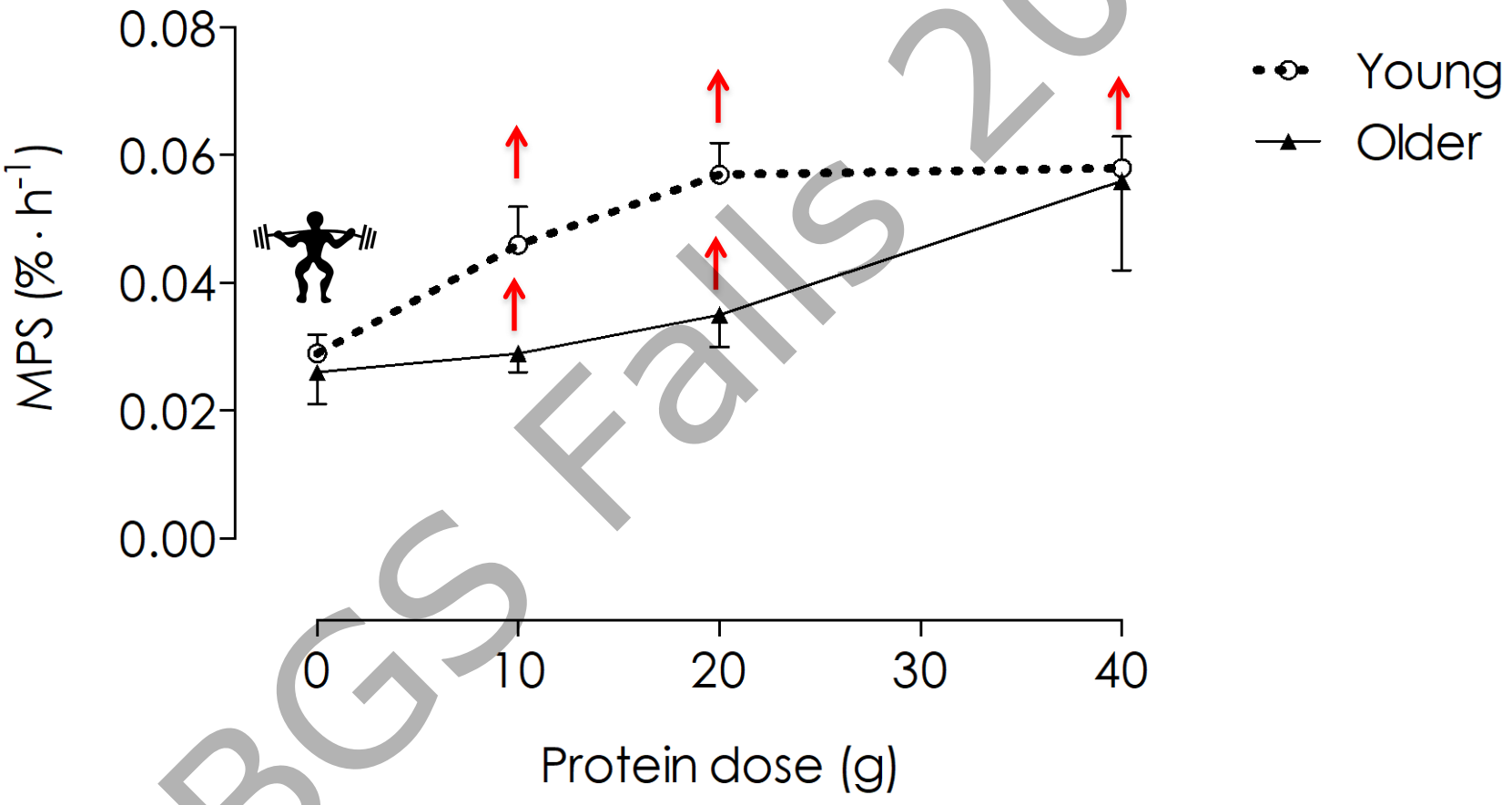
J Nutr Health Aging. 2018;22(10):1148-1161

INTERNATIONAL CLINICAL PRACTICE GUIDELINES FOR SARCOPENIA (ICFSR): SCREENING, DIAGNOSIS AND MANAGEMENT

Recommendation 4: Protein Supplementation

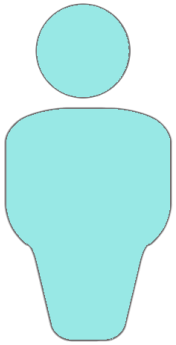
We recommend that clinicians consider protein supplementation/a protein-rich diet for older adults with sarcopenia (Grade: conditional recommendation; low certainty of evidence)

Resistance exercise **sensitises** muscle to protein intake



Adapted from Moore *et al.* (2015) *J Gerontol A Biol Sci Med Sci*. 70(1):57-62

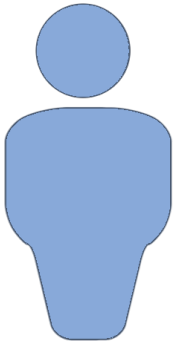
Higher protein intake during resistance training in older adults



n = 47

1.1 g protein/kg/d

4 months



1.3 g protein/kg/d

n = 53

Daly et al. (2014) *Am J Clin Nutr* 99:899-910

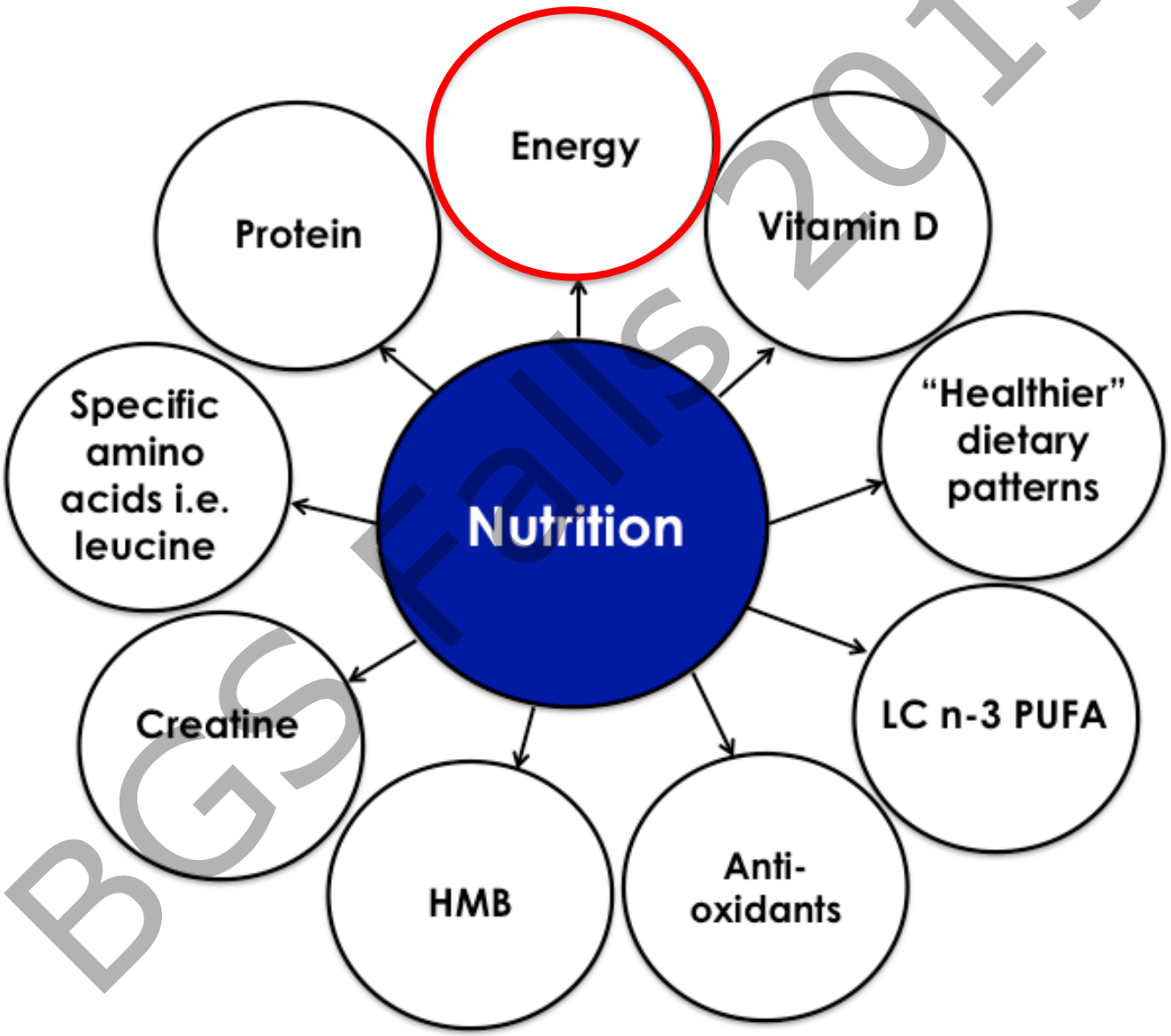
Combined dietary protein and resistance training in **treatment** of sarcopenia

J Nutr Health Aging. 2018;22(10):1148-1161

INTERNATIONAL CLINICAL PRACTICE GUIDELINES FOR SARCOPENIA (ICFSR): SCREENING, DIAGNOSIS AND MANAGEMENT

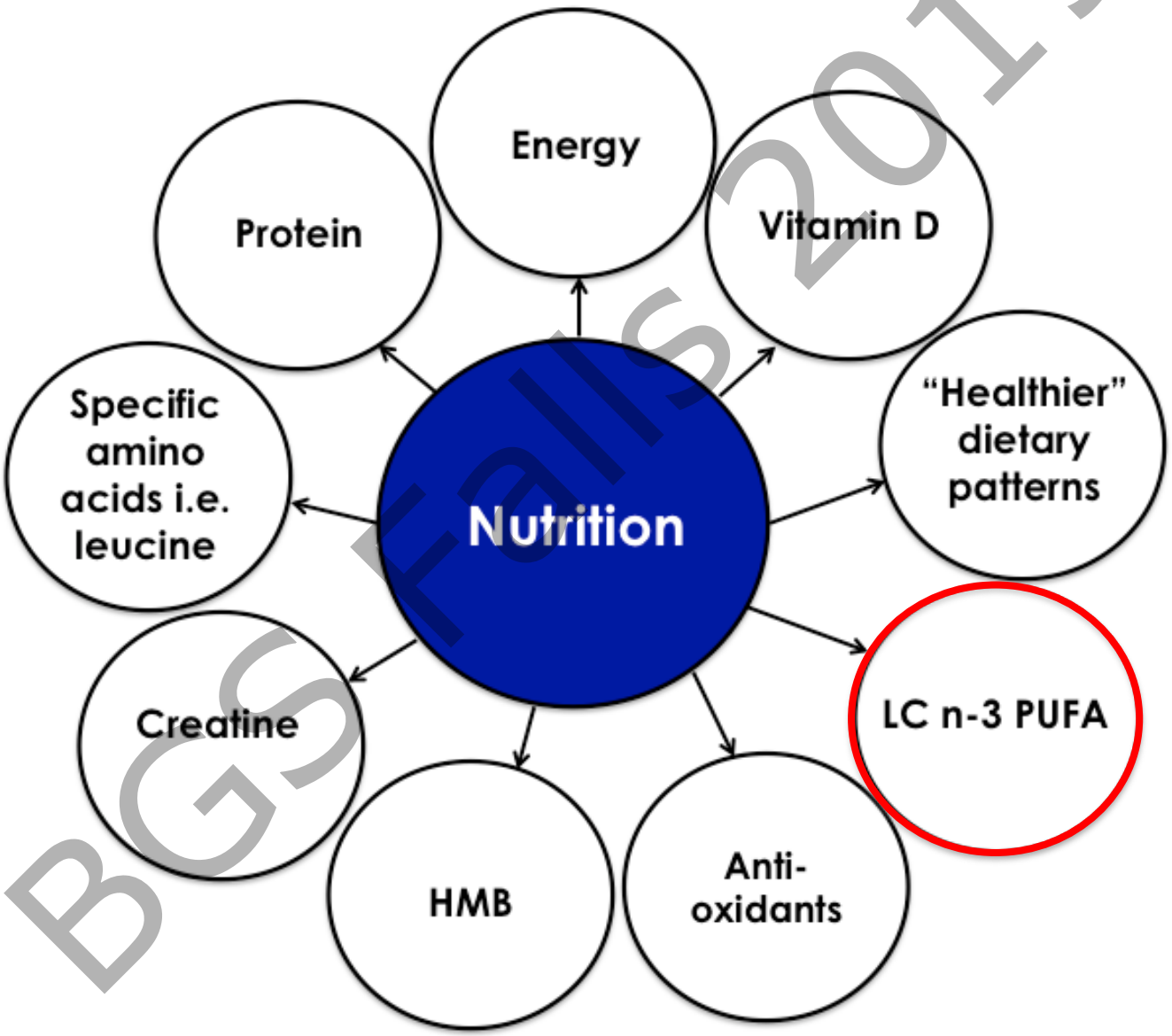
Nutritional (protein) intervention should be combined with a physical activity intervention (Grade: conditional, low certainty of evidence)

Nutrition and sarcopenia

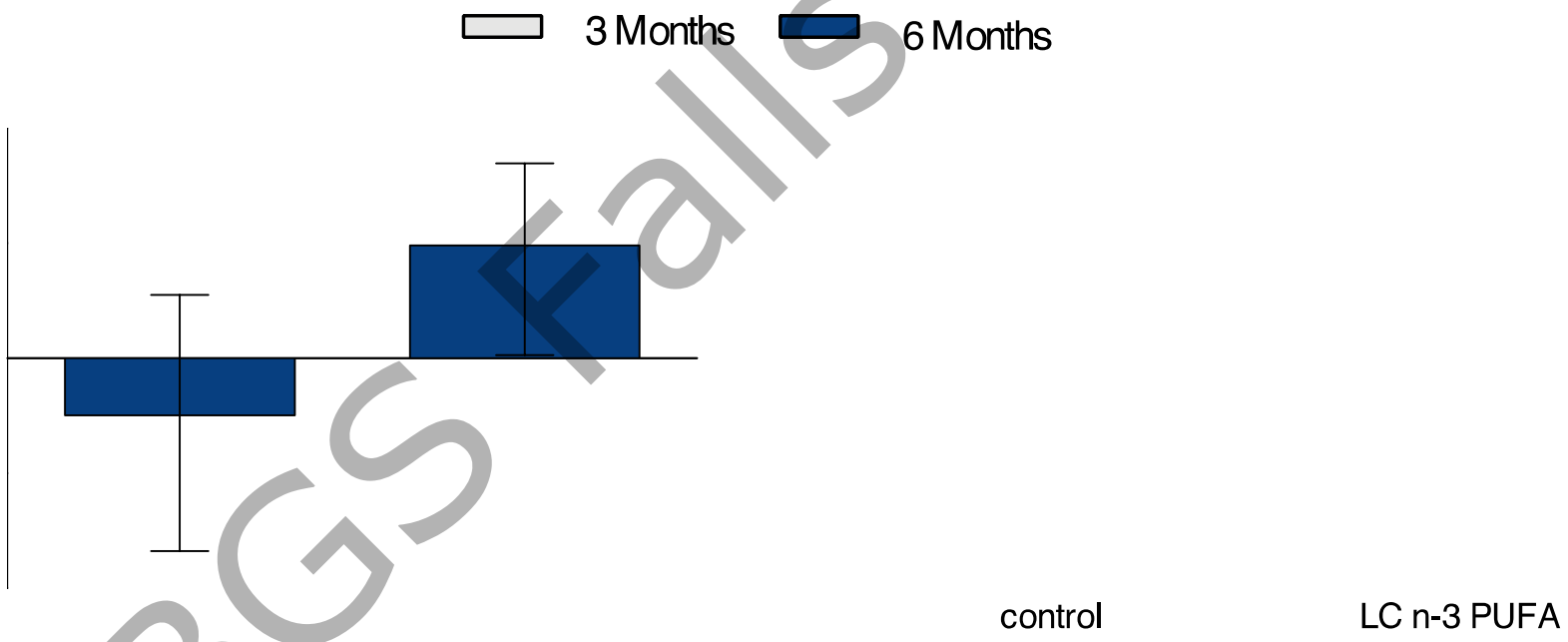


Energy intake and sarcopenia

Nutrition and sarcopenia



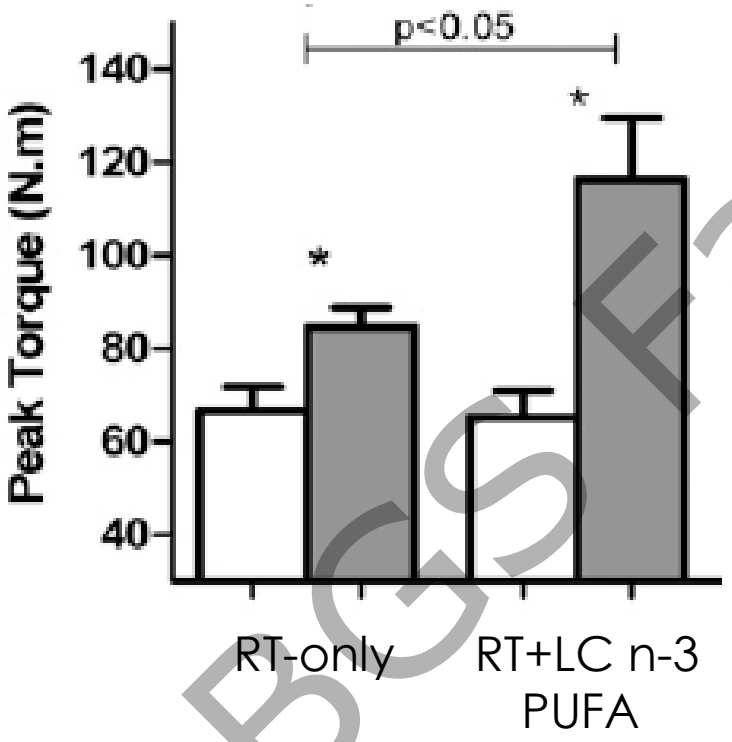
RCT: **LC n-3 PUFA** improves muscle mass, strength and function in sedentary older adults



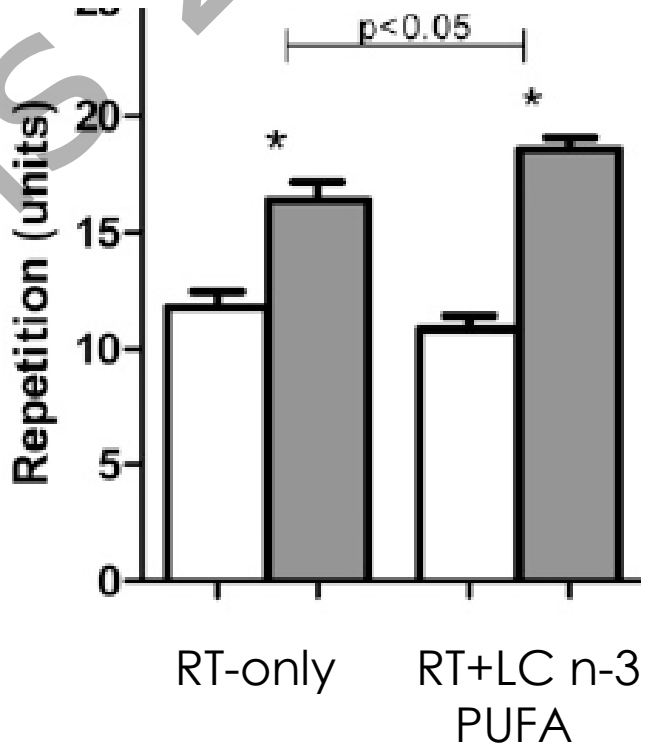
Smith et al. (2015) Am J Clin Nutr 102:115–22.

Randomised trial: **LC n-3 PUFA** improves RT-induced gains in strength and function in older women

Knee extensor peak torque



Chair-rise repetitions



Rodacki et al. (2012) Am J Clin Nutr 95:428–36.

NUTRIMAL nutrition intervention study

Placebo

Leucine-enriched Protein

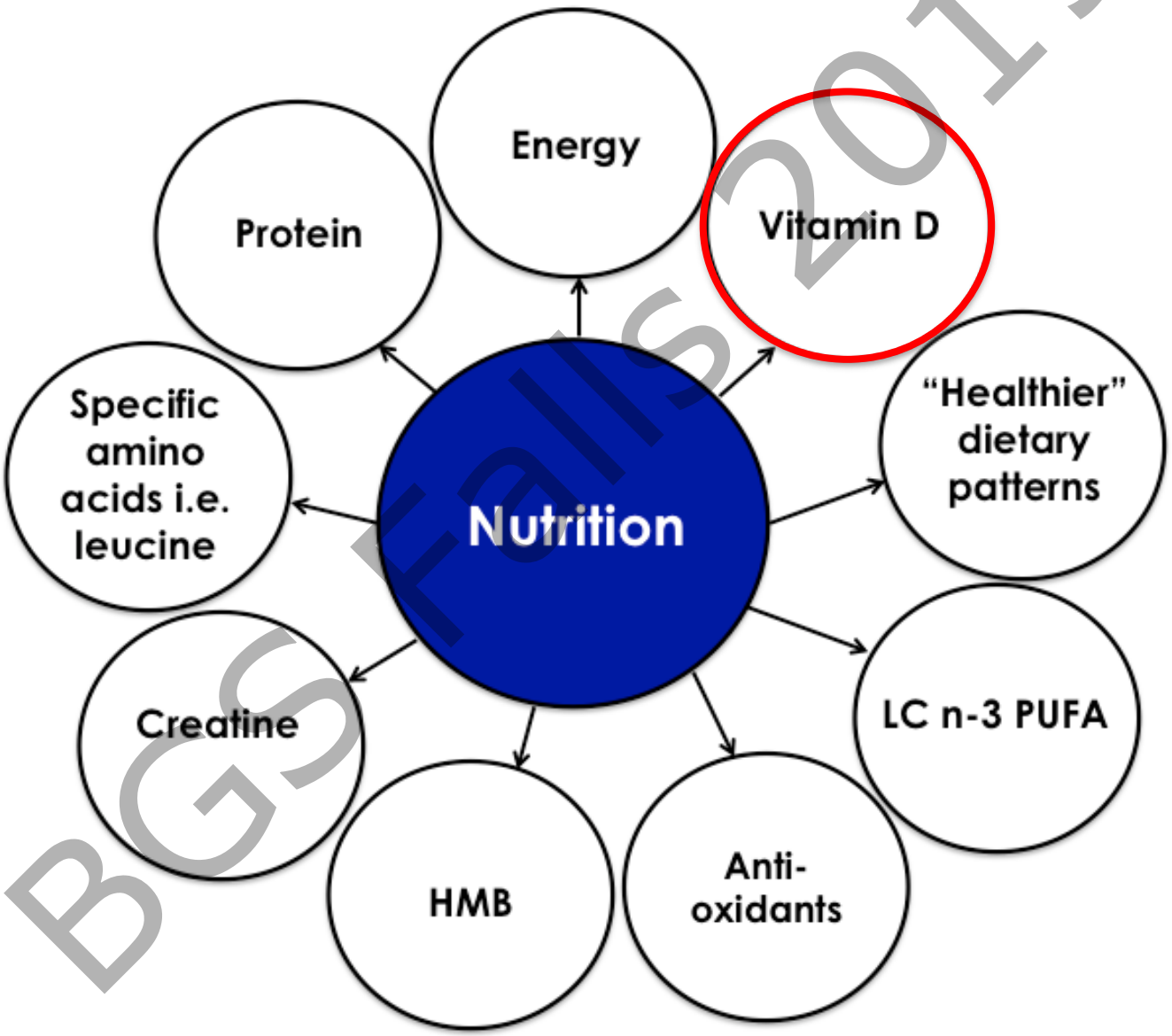
+ LEU PepForm™ Leucine Peptides

Leucine-enriched Protein + LC n-3 PUFA

+ LEU PepForm™ Leucine Peptides +

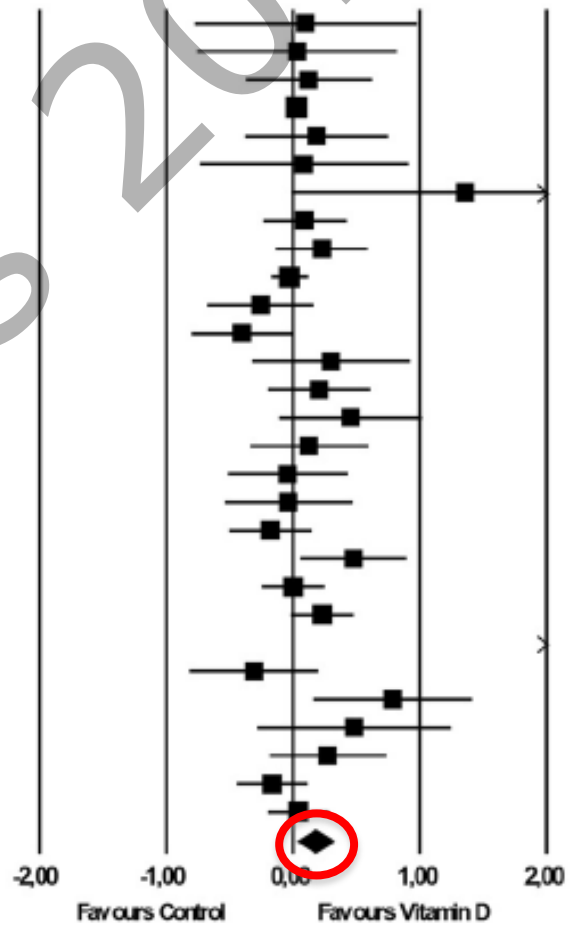
Murphy et al. unpublished

Nutrition and sarcopenia



Meta-analysis: vitamin D supplementation improves strength

	Std diff in means	Lower limit	Upper limit	p-Value
Barker et al. 2012	0,099	-0,778	0,976	0,824
Binder E. 1995	0,030	-0,759	0,820	0,940
Bischoff et al. 2003	0,123	-0,376	0,622	0,629
Brunner et al. 2008	0,026	-0,055	0,107	0,526
Bunout et al. 2006	0,183	-0,384	0,750	0,527
Carrillo et al. 2012	0,087	-0,738	0,911	0,837
Close et al. 2012	1,353	-0,021	2,727	0,054
Dhesi et al. 2004	0,093	-0,240	0,425	0,585
El-Hajj Fuleihan et al. 2006	0,226	-0,138	0,589	0,224
Glendenning et al. 2012	-0,028	-0,178	0,122	0,715
Goswami et al. 2012	-0,257	-0,682	0,167	0,235
Grady et al.	-0,403	-0,803	-0,003	0,048
Gupta et al. 2010	0,300	-0,324	0,923	0,346
Hara et al. 2013	0,203	-0,203	0,609	0,328
Hornicxx et al. 2012	0,455	-0,113	1,022	0,116
Janssen et al. 2010	0,126	-0,343	0,595	0,599
Kampman et al. 2012	-0,042	-0,518	0,434	0,863
Kenny et al. 2003	-0,038	-0,544	0,469	0,884
Knutsen et al. 2014	-0,179	-0,504	0,146	0,280
Kukuljan et al. 2009	0,476	0,055	0,897	0,027
Latham et al. 2003	0,000	-0,251	0,251	1,000
Pfeifer et al. 2009	0,228	-0,025	0,480	0,078
Sato et al. 2005	2,741	2,183	3,298	0,000
Smedshaug et al. 2007	-0,308	-0,818	0,202	0,237
Songpatanasilp et al. 2009	0,786	0,158	1,414	0,014
Verhaar et al. 2000	0,481	-0,285	1,246	0,218
Ward et al. 2010	0,273	-0,191	0,737	0,249
Wood et al. 2014	-0,166	-0,446	0,115	0,248
Zhu et al. 2010	0,038	-0,205	0,281	0,759
	0,170	0,031	0,310	0,017



Beaudart et al. (2014) J Clin Endocrinol Metab 99(11):4336–4345

Vitamin D to **treat** sarcopenia?

J Nutr Health Aging. 2018;22(10):1148-1161

INTERNATIONAL CLINICAL PRACTICE GUIDELINES FOR SARCOPENIA (ICFSR): SCREENING, DIAGNOSIS AND MANAGEMENT

Recommendation 5: Vitamin D

Insufficient evidence exists to determine whether a Vitamin D supplementation regime by itself is effective in older adults with sarcopenia (Grade: no recommendation; very low certainty of evidence)

Take home points

- Resistance training is the most effective strategy to prevent and treat sarcopenia
  - Strong recommendation ICFSR
- Periods of inactivity may contribute to the development and progression of sarcopenia
  - Physical activity levels decline dramatically during hospitalisation
- Aim for energy balance (unless weight loss intentional)

Take home points

- Adequate protein intake essential for prevention and treatment of sarcopenia
  - Combine with physical activity
- Emerging evidence for role of LC n-3 PUFA and adequate vitamin D
- The quality of supporting evidence for the management of sarcopenia was low
  - Research needed!

Thank you!