Supplementary Materials

Dietary Protein and Muscle in Aging People: The Potential Role of the Gut Microbiome

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1. Supplementary Table 1: Measures of Muscle Mass

Muscle Mass	
Measure	**Studies**
DXA measurements *[lean body mass, leg lean mass, total lean mass, appendicular lean mass]*	(Ferrando *et al.*, 1996; Bunout *et al.*, 2001; Binder *et al.*, 2005; Cuthbertson *et al.*, 2005; Kortebein *et al.*, 2007; Houston *et al.*, 2008; Verhoeven, 2009; Dillon *et al.*, 2009; Kemmler *et al.*, 2010; Tieland *et al.*, 2012; Stout *et al.*, 2013; Deutz *et al.*, 2013; Gregorio *et al.*, 2014; Kerstetter *et al.*, 2015; Tanner *et al.*, 2015; Zhu *et al.*, 2015; Isanejad *et al.*, 2016; Norton *et al.*, 2016; Farsijani *et al.*, 2016; Mitchell *et al.*, 2017; Daly *et al.*, 2017; Dulac *et al.*, 2018)
Bioimpedance analysis	(Björkman, Finne-Soveri and Tilvis, 2012; Kim *et al.*, 2012; Okada *et al.*, 2013; Bo *et al.*, 2018)
Calf circumference	(F Landi *et al.*, 2017; Francesco Landi *et al.*, 2017; Marzetti *et al.*, 2018)
Mid-arm muscle circumference	(Ferrie *et al.*, 2016; F Landi *et al.*, 2017; Francesco Landi *et al.*, 2017)
Thigh muscle CSA at 50% femur length of the dominant leg (CT)	(Campbell *et al.*, 2001; Daly *et al.*, 2017; Mitchell *et al.*, 2017)
Quadriceps CSA (MRI)	(Verhoeven, 2009; Kilgour *et al.*, 2013; Drummond *et al.*, 2014)
Quadriceps volume (MRI)	(Greig *et al.*, 2011)
Forearm muscle thickness (US)	(Ferrie *et al.*, 2016)
Rectus femoris CSA (US)	(Ferrie *et al.*, 2016)
Calf muscle CSA (CT)	(Zhu *et al.*, 2015)
Free fat mass using labelled water	(Bonnefoy *et al.*, 2003)
Body weight minus fat mass (skin folds)	(Rydwik *et al.*, 2008)
Femur muscle density	(Daly *et al.*, 2015)
Type I and type II muscle fibre CSA (muscle biopsy)	(Cermak *et al.*, 2012)

Abbreviations: DXA: Dual-energy X-ray absorptiometry; CSA: cross sectional area; CT: Computed Tomography; MRI: Magnetic Resonance Imaging; US: ultrasound

2. Supplementary Table 2: Measures of Muscle Strength

Muscle Strength	
Measure	**Studies**
Handgrip strength	(Scognamiglio *et al.*, 2005; Björkman, Finne-Soveri and Tilvis, 2012; Tieland *et al.*, 2012, 2017; Stout *et al.*, 2013; Gregorio *et al.*, 2014; Zhu *et al.*, 2015; Ferrie *et al.*, 2016; Isanejad *et al.*, 2016; F Landi *et al.*, 2017; Francesco Landi *et al.*, 2017; Bo *et al.*, 2018; Dulac *et al.*, 2018; Marzetti *et al.*, 2018)
Grip strength/body mass	(Isanejad *et al.*, 2016)
1-RM bicep curl	(Dillon *et al.*, 2009)
1-RM tricep extension	(Dillon *et al.*, 2009)
Knee extension	(Binder *et al.*, 2005; Kortebein *et al.*, 2007; Björkman, Finne-Soveri and Tilvis, 2012; Kim *et al.*, 2012; Deutz *et al.*, 2013; Kilgour *et al.*, 2013; Drummond *et al.*, 2014; Isanejad *et al.*, 2016; Mitchell *et al.*, 2017)
1-RM leg extension strength	(Dillon *et al.*, 2009; Verhoeven, 2009; Tieland *et al.*, 2012, 2017)
Isometric leg extension	(Kemmler *et al.*, 2010)
Isometric contraction of knee extensors and/or plantar flexors	(Deutz *et al.*, 2013; Daly *et al.*, 2017; Guizelini *et al.*, 2018)
Quadriceps strength	(Bunout *et al.*, 2001)
1-RM leg press strength (kg)	(Verhoeven, 2009; Cermak *et al.*, 2012; Tieland *et al.*, 2012, 2017; Deutz *et al.*, 2013; Daly *et al.*, 2014; Dulac *et al.*, 2018)
3-RM leg press strength	(Daly *et al.*, 2014, 2015)
Leg press (unspecified)	(Rydwik *et al.*, 2008)
1-RM leg curl	(Dillon *et al.*, 2009)
Isokinetic leg strength (unspecified)	(Stout *et al.*, 2013)
Rapid force capacity	(Guizelini *et al.*, 2018)

Abbreviations: RM: repetition maximum

3. Supplementary Table 3: Measures of Physical Function

Physical Function	
Measure	**Studies**
Timed up and go	(Rydwik *et al.*, 2008; Kemmler *et al.*, 2010; Del Favero *et al.*, 2012; Deutz *et al.*, 2013; Stout *et al.*, 2013; Daly *et al.*, 2014, 2015; Zhu *et al.*, 2015; Mitchell *et al.*, 2017; Bo *et al.*, 2018)
Chair stand test	(Daly *et al.*, 2014, 2015; F Landi *et al.*, 2017; Francesco Landi *et al.*, 2017; Bo *et al.*, 2018)
Chair risers	(Bonnefoy *et al.*, 2003; Del Favero *et al.*, 2012; Isanejad *et al.*, 2016)
Floor transfer test	(Ferrando *et al.*, 2010)
Squat	(Isanejad *et al.*, 2016)
Gait speed *(measured using: 6m gait speed test, 10m walking speed, maximum walking speed, 4m walk, 12 minute walk, self-selected gait speed, 6 minute walking distance)*	(Bunout *et al.*, 2001; Bonnefoy *et al.*, 2003; Scognamiglio *et al.*, 2005; Drummond *et al.*, 2014; Daly *et al.*, 2015; Isanejad *et al.*, 2016; Kim *et al.*, 2016; Bo *et al.*, 2018)
Tandem walk for six-metres	(Isanejad *et al.*, 2016)
Incremental walking test	(Del Favero *et al.*, 2012)
Stair ascent test	(Ferrando *et al.*, 2010; Drummond *et al.*, 2014)
Stair descent test	(Ferrando *et al.*, 2010)
Time to limit of tolerance	(Del Favero *et al.*, 2012)
Balance *(measured using four square step test, one leg stance)*	(Daly *et al.*, 2014; Isanejad *et al.*, 2016)
Short physical performance battery (*includes: chair risers, 4m walk [gait speed] and ability to stand for ten seconds with feet in 3 different positions [balance])*	(Tieland *et al.*, 2012; Deutz *et al.*, 2013; Gregorio *et al.*, 2014; Isanejad *et al.*, 2016; Mitchell *et al.*, 2017; Dulac *et al.*, 2018)
Senior Fitness Test *(includes: chair stand test, arm curl test, 2 minute step test, chair sit-and-reach test, back scratch test, eight-foot up-and-go test)*	(Szcześniak *et al.*, 2014)
Modified Physical Performance Test (*nine item test)*	(Drummond *et al.*, 2014; Gregorio *et al.*, 2014)
Physical activity scale for the elderly questionnaire	(Drummond *et al.*, 2014; Gregorio *et al.*, 2014)
Fatigue score [Chalder scale]	(Ferrie *et al.*, 2016)

Abbreviations: m: metres

4. Supplementary Table 4: Animal Models

Animal Model	References
Mice	(Faith *et al.*, 2011; Kar *et al.*, 2017; van Dijk *et al.*, 2017)
Rats	(Le Leu *et al.*, 2007; Marzani *et al.*, 2008; An *et al.*, 2014; Lee, Han and Yim, 2015)
Pigs	(Nunan, Sandercock and Brodie, 2010; Rist *et al.*, 2014; Zhou *et al.*, 2015, 2016; Lei *et al.*, 2018)
Golden Syrian hamsters	(Butteiger *et al.*, 2016)
Dogs	(Li *et al.*, 2017)
American pikas	(Kohl *et al.*, 2018)
Salmon	(Gajardo *et al.*, 2017)
Rainbow trout	(Rimoldi *et al.*, 2018)
Chicks	(Nakashima *et al.*, 2005)
Killifish	(Smith *et al.*, 2017)

5. Supplementary Table 5: Measures of Dietary Protein Used

Dietary Measure	References
Three-day food record	(Tieland *et al.*, 2012; Zhu *et al.*, 2015; Isanejad *et al.*, 2016; Beaumont *et al.*, 2017; Cardon-Thomas *et al.*, 2017; Mitchell *et al.*, 2017; Dulac *et al.*, 2018)
Food Frequency Questionnaire	(Ferrando *et al.*, 1996; Houston *et al.*, 2008; Wu *et al.*, 2011; Welch *et al.*, 2016)
The Healthy Food Diversity Index	(Claesson *et al.*, 2012; De Filippis *et al.*, 2016)
Four-day food record	(Gregorio *et al.*, 2014)
11-unit dietary score	(De Filippis *et al.*, 2016)
Seven-day weighed food diary	(De Filippis *et al.*, 2016)
'Recall' questionnaire	(Wu *et al.*, 2011)
Individual questionnaires, unique to that study	(F Landi *et al.*, 2017)
Telephone-facilitated 24-h dietary recalls	(Daly *et al.*, 2014; Farsijani *et al.*, 2016)
Diet History Questionnaire II[2]	(David *et al.*, 2014)

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