

FRAGILITÀ MUSCOLO-SCHELETRICA STILI DI VITA E APPROPRIATEZZA TERAPEUTICA

LE SFIDE PER IL FUTURO



Baveno

7 - 8 ottobre 2022

GISMO

Gruppo Italiano Studio
Malattie Metabolismo Osseo

- Osteoporosi
- Malattie Muscolo-Scheletriche
- Malattie Metaboliche
- Dolore
- Nutrizione



Dott. Sergio Riso



*SC Scienza dell'Alimentazione e Dietetica
AOU «Maggiore della Carità» Novara*



Nutrizione e sarcopenia

Fragilità, sarcopenia e malnutrizione

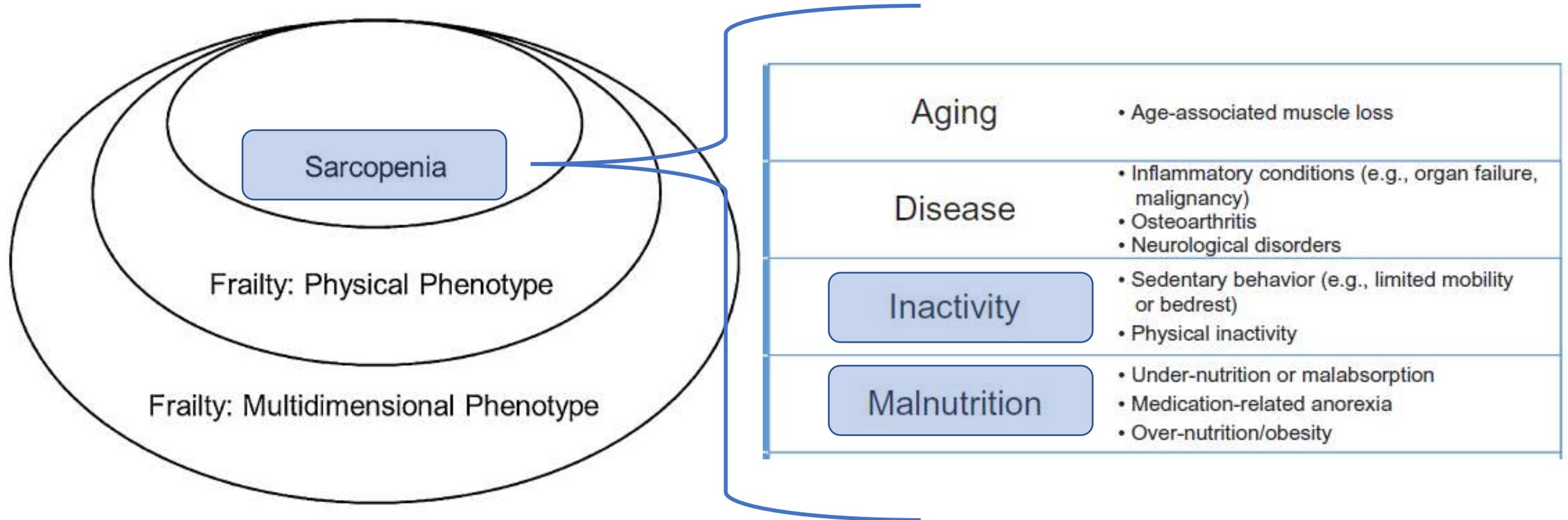
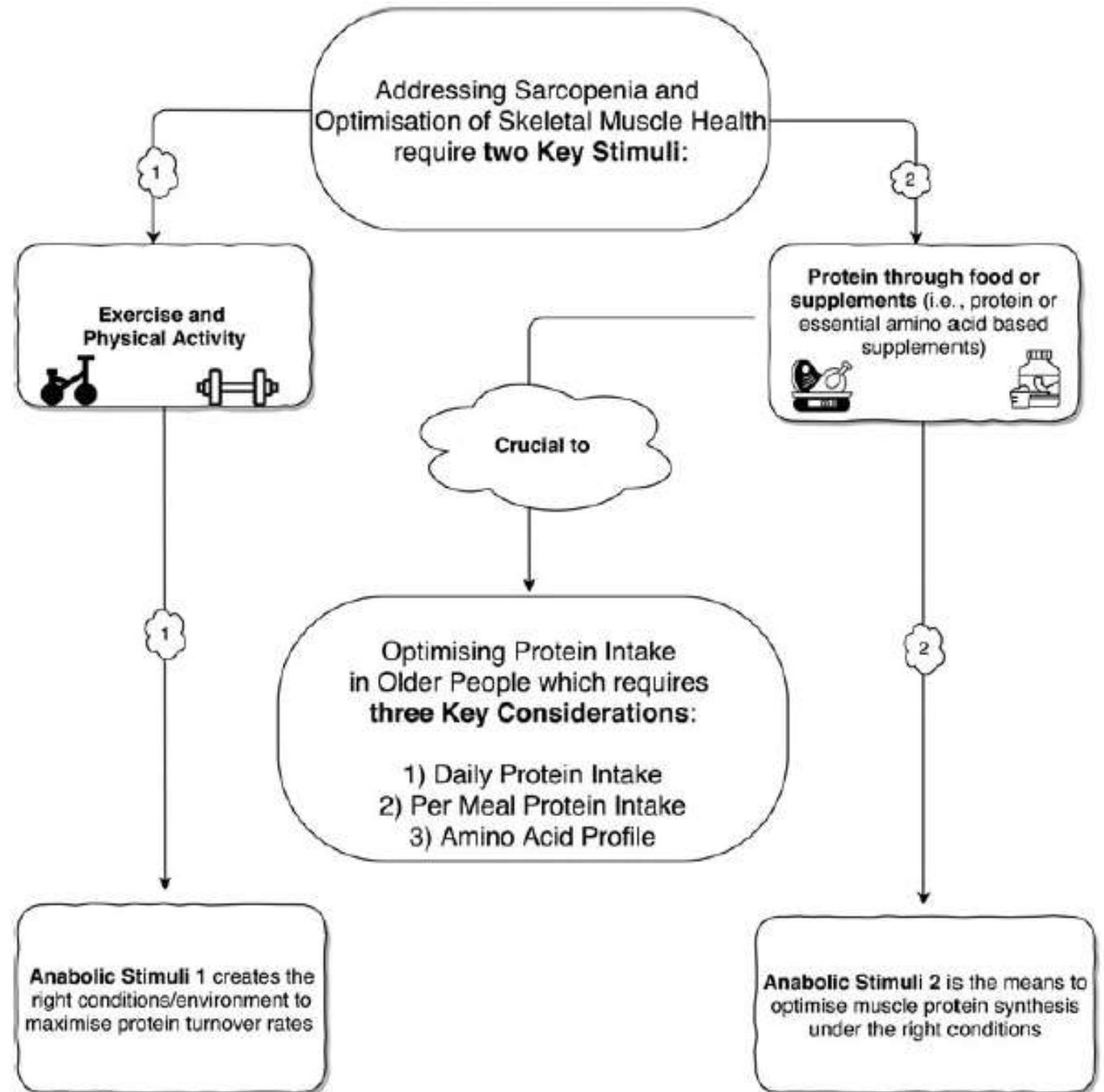


Fig. 2 Overlap between frailty and sarcopenia

A.J. Cruz-Jentoft Aging Clin Exp Res 2017
A.J. Cruz-Jentoft Aging Age and Ageing 2019

APPROCCIO OLISTICO DI CONTRASTO ALLA SARCOPENIA

Ispoglou T. Proc Nutr Soc 2021



Fabbisogno calorico

ESPEN Guideline

ESPEN guideline on clinical nutrition and hydration in geriatrics

Dorothee Volkert ^{a,*}, Anne Marie Beck ^b, Tommy Cederholm ^c, Alfonso Cruz-Jentoft ^d, Sabine Goisser ^e, Lee Hooper ^f, Eva Kiesswetter ^a, Marcello Maggio ^{g,h}, Agathe Raynaud-Simon ⁱ, Cornel C. Sieber ^{a,j}, Lubos Sobotka ^k, Dieneke van Asselt ^l, Rainer Wirth ^m, Stephan C. Bischoff ⁿ

Clin Nutr 2018

Recommendation 1

Guiding value for energy intake in older persons is 30 kcal per kg body weight and day; this value should be individually adjusted with regard to nutritional status, physical activity level, disease status and tolerance. (BM)

Grade of recommendation B – strong consensus (97% agreement)



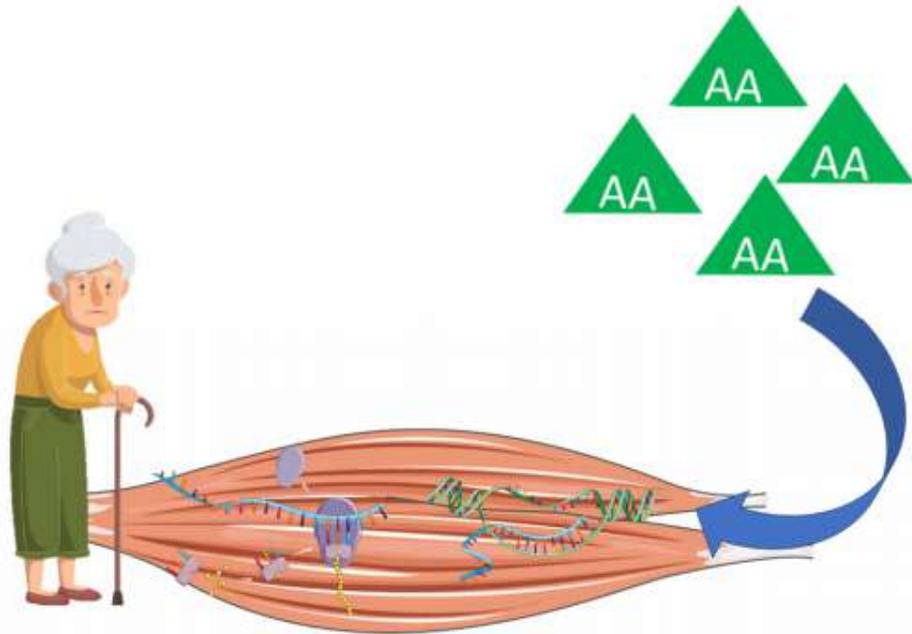
- *Based on usual physical activity levels (PAL) between 1.2 and 1.8, total energy expenditure (TEE) amounts to 24-36 kcal/kg*
- ***Minimal requirements of ill older persons are estimated to be between 27 and 30 kcal/kg***



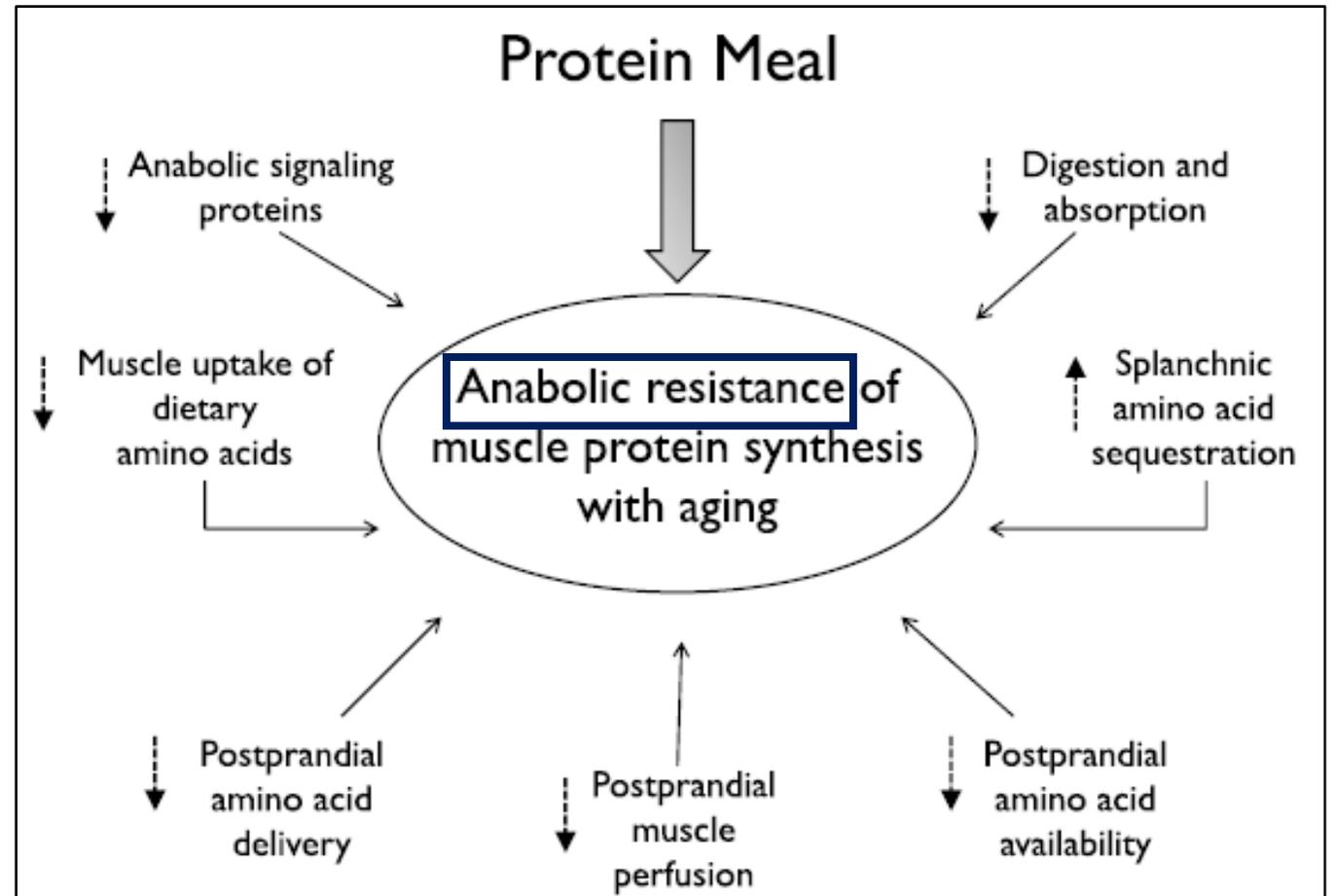
MONITORAGGIO!

- Peso
- Intake

Fabbisogno proteico



Coelho-Junior HJ. *Nutrients* 2020



Burd NA. *Exerc Sport Sci Rev* 2013

Nella definizione del fabbisogno proteico si deve tener conto del fenomeno, tipico nell'anziano, della **RESISTENZA ANABOLICA** della sintesi proteica muscolare

Fabbisogno proteico

ESPEN Guideline

ESPEN guideline on clinical nutrition and hydration in geriatrics

Dorothee Volkert ^{a,*}, Anne Marie Beck ^b, Tommy Cederholm ^c, Alfonso Cruz-Jentoft ^d, Sabine Goisser ^e, Lee Hooper ^f, Eva Kiesswetter ^a, Marcello Maggio ^{g,h}, Agathe Raynaud-Simon ⁱ, Cornel C. Sieber ^{a,j}, Lubos Sobotka ^k, Dienneke van Asselt ^l, Rainer Wirth ^m, Stephan C. Bischoff ⁿ

Clin Nutr 2018

Recommendation 2

Protein intake in older persons should be at least 1 g protein per kg body weight and day. The amount should be individually adjusted with regard to nutritional status, physical activity level, disease status and tolerance. (BM)

Grade of recommendation B – strong consensus (100% agreement)



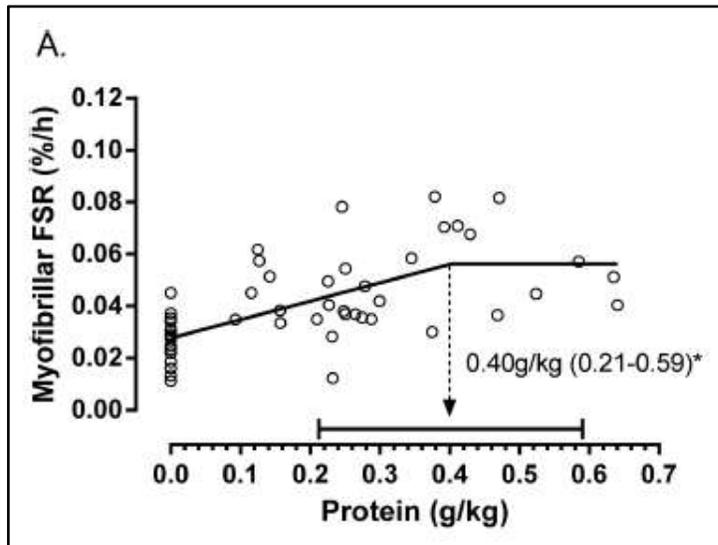
- Daily amounts of **1.0-1.2 g/kg** body weight have been suggested for **healthy older persons** by several expert groups
- Daily amounts of **1.2-1.5 g/kg** have been suggested for older persons with **acute or chronic illness** and up to 2.0 g/kg body weight and day in case of severe illness, injury or malnutrition.

Older people with severe **kidney disease** (ie, estimated glomerular filtration rate [GFR] < 30 mL/min/1.73m²) who are not on dialysis are an exception to the high-protein rule; these individuals need to **limit protein intake**.

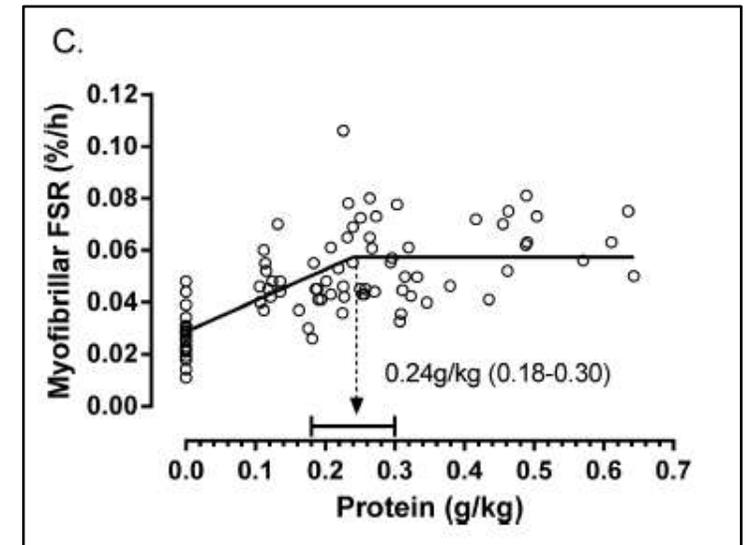
J. Bauer JAMDA 2013

Intake proteico per pasto

Protein Ingestion to Stimulate Myofibrillar Protein Synthesis Requires Greater Relative Protein Intakes in Healthy Older Versus Younger Men



Anziano sano (età media 71 aa)

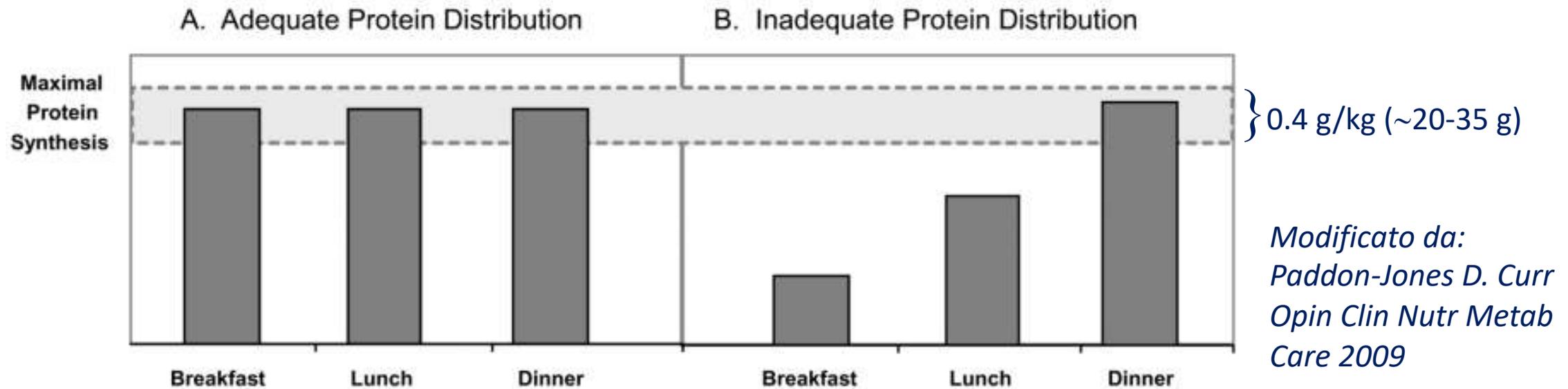


Giovane sano (età media 22 aa)

Nell'anziano sano, rispetto al giovane, è necessaria una **maggior quantità di proteine (0.4 g/kg vs 0.24 g/kg)** a pasto, per ottenere il massimo della sintesi protetica muscolare (miofibrillare).

Moore DR. *J Gerontol A Biol Sci Med Sci.* 2015

Distribuzione proteica

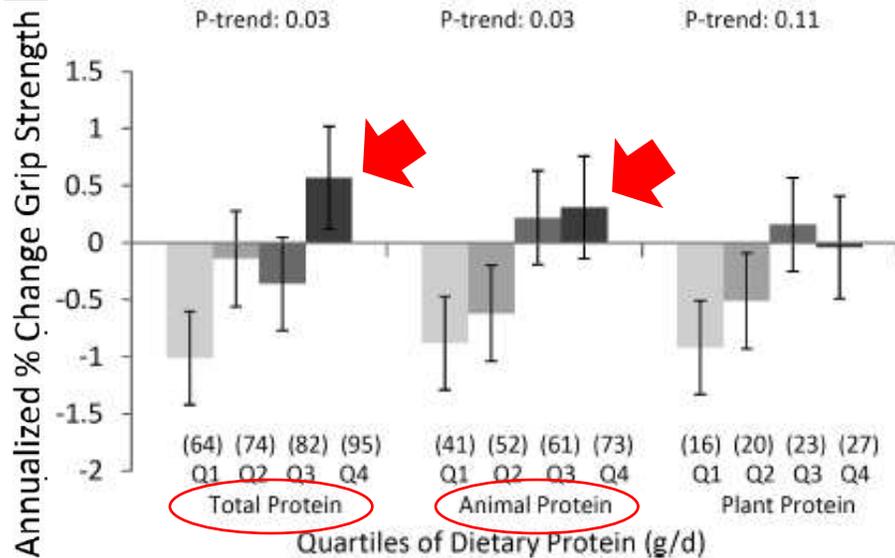


Una **adeguata distribuzione** della quota proteica ai pasti, con un apporto di proteine in **≥ 2 pasti principali** di circa **0.4 g/kg** di peso, costituisce una strategia potenzialmente efficace nel contrastare la sarcopenia, attraverso l'ottimizzazione dello stimolo sulla sintesi proteica muscolare.

Qualità proteica

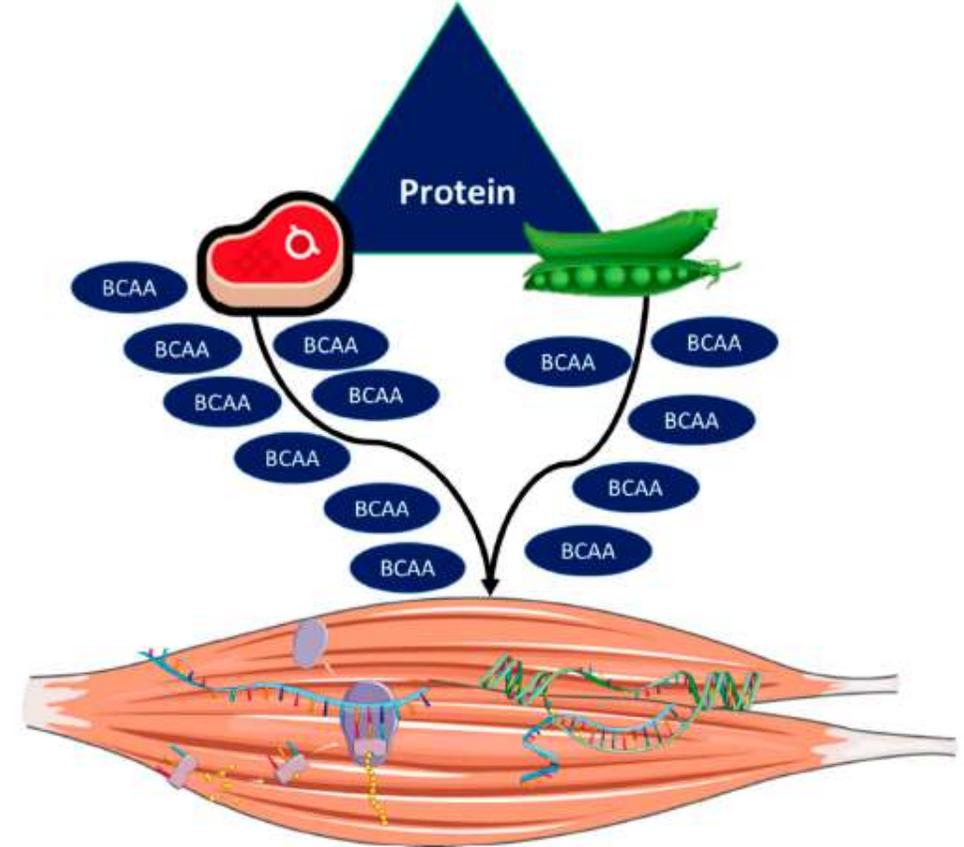
Dietary Protein Intake Is Protective Against Loss of Grip Strength Among Older Adults in the Framingham Offspring Cohort

Robert R. McLean,^{1,2} Kelsey M. Mangano,^{1,2} Marian T. Hannan,^{1,2} Douglas P. Kiel,^{1,2} and Shivani Sahni^{1,2}



Un più alto intake (quarto quartile) di **proteine totali** ed **animali** ha un'azione protettiva sulla perdita della forza muscolare (hand-grip) nei soggetti di età > 60 aa.

J Gerontol A Biol Sci Med 2016



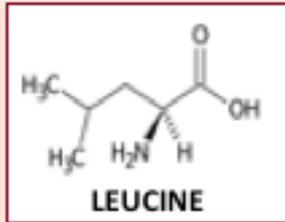
HJ Coelho-Junior Nutrients 2020

La **maggior azione anabolica** delle proteine animali è attribuibile almeno in parte alla **maggior digeribilità** (90% vs 50%) ed al maggior contenuto in **AA essenziali**, in particolare **ramificati** (soprattutto **leucina**)

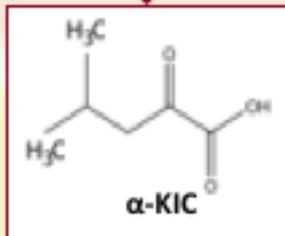
Gorissen SHM. Proc Nutr Soc 2017

Supplementazione proteica: leucina

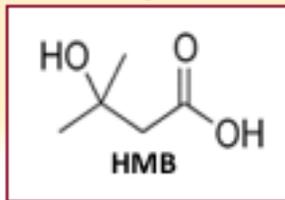
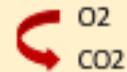
MUSCLE



Branched chain aminoacid transferase

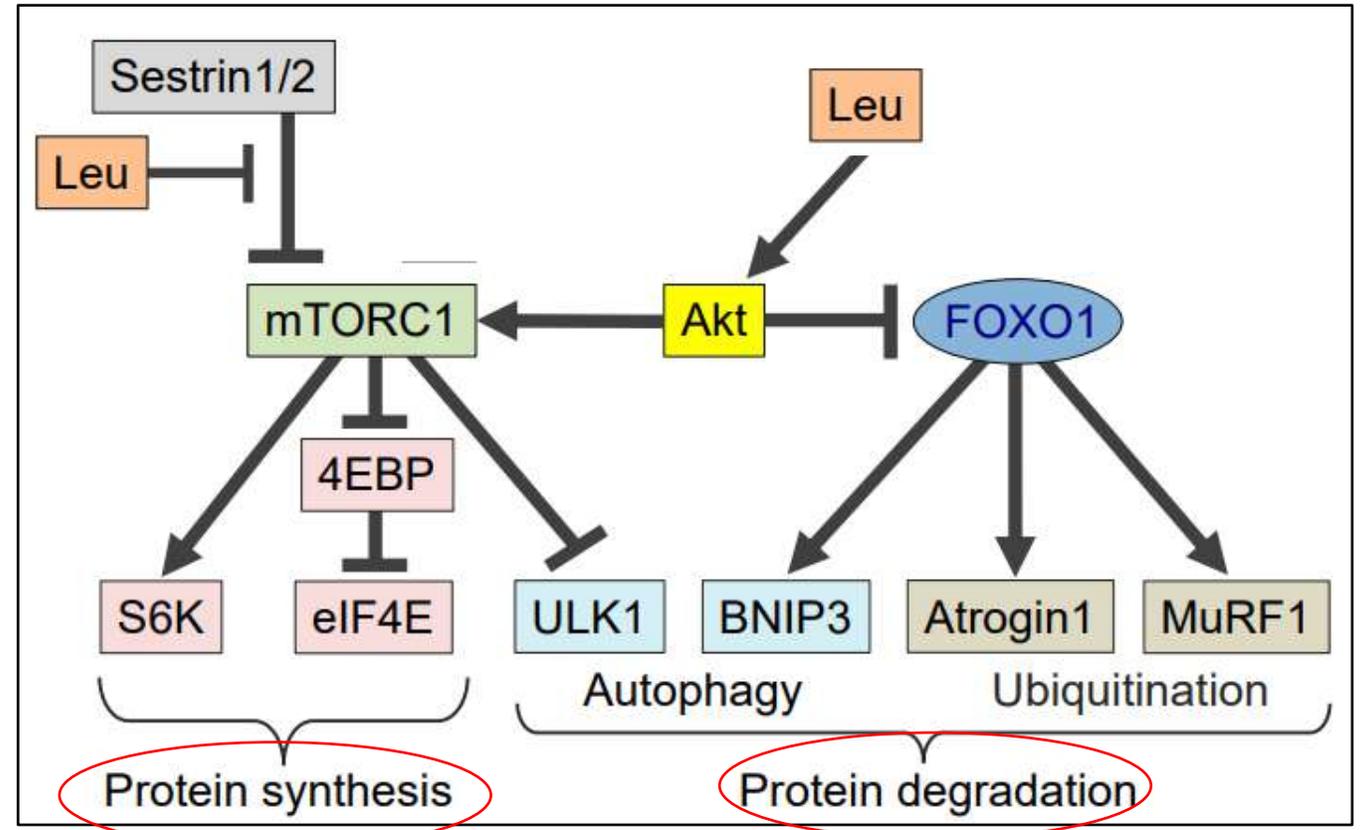


Kic dioxygenase (citosol)



LIVER

5-10%



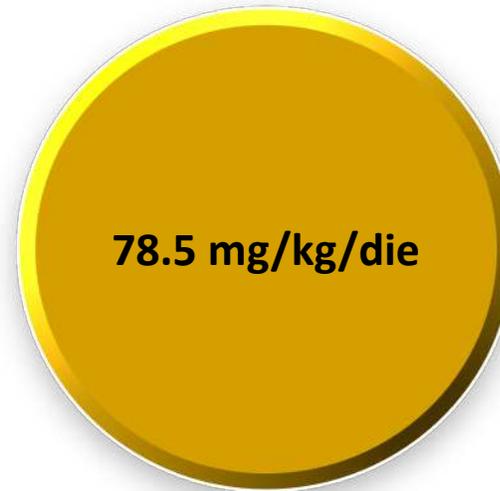
Modificato da: Kamei Y. Nutrients 2020

Intake di leucina

Dietary leucine requirement of older men and women is higher than current recommendations

Sylwia Szwiega,¹ Paul B Pencharz,^{1,2,3} Mahroukh Rafii,¹ Mackenzie Lebaron,¹ Jessica Chang,¹ Ronald O Ball,⁴ Dehan Kong,⁵ Libai Xu,⁵ Rajavel Elango,^{6,7} and Glenda Courtney-Martin^{1,2,8}

Am J Clin Nutr 2021



Raggiungibile con intake proteico di alta qualità compreso tra 1 e 1.2 g/kg/die

Intake attualmente raccomandato sulla base di studi su giovani adulti

Intake suggerito

Intake di leucina



Whey Protein Isolate
23 g Protein
2.5 g Leucine
92 Calories



Soy Protein Isolate
31 g Protein
2.5 g Leucine
125 Calories



Skim Milk
3.7 Servings (874 mL)
2.5 g Leucine
333 Calories



Top Round Beef
1.3 Servings (142 g)
2.5 g Leucine
391 Calories



Whole Wheat Bread
12.8 Servings (641 g)
2.5 g Leucine
3462 Calories



Raw Chicken Breast
1.3 Servings (142 g)
2.5 g Leucine
147 Calories



Raw Peanuts
5 Servings (149 g)
2.5 g Leucine
876 Calories



Greek Yogurt
1.1 Servings (250 g)
2.5 g Leucine
143 Calories



Raw Eggs
4.6 eggs
2.5 g Leucine
321 Calories

- 2.5–2.8 g of leucine per meal is sufficient to reach anabolic threshold and optimise MPS

J. Bauer. JAMDA 2013

In almeno 2 pasti principali!

«Real life»: intake proteico

Prevalence of protein intake below recommended in community-dwelling older adults: a meta-analysis across cohorts from the PROMISS consortium

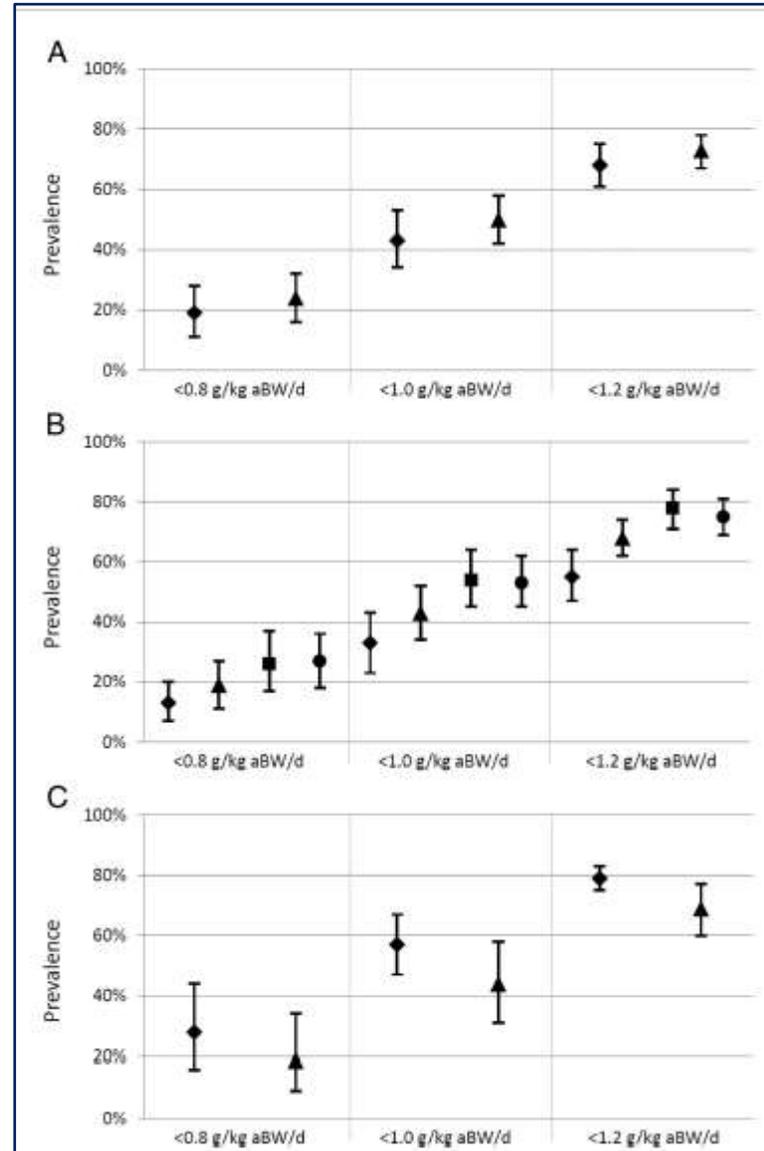
Hengeveld LM. *J Cachexia Sarcopenia Muscle* 2020

- Metanalisi di dati relativi a 8107 anziani **in comunità**: 4 studi di coorte e 4 survey nazionali

PREVALENZA:

- *Intake proteico < 1 g/kg/die*: **46.7%**
- *Intake proteico < 1.2 g/kg/die*: **70.8%**

Maggior prevalenza nelle donne, nei soggetti con BMI più elevato e con appetito scarso



sexo

BMI

appetito

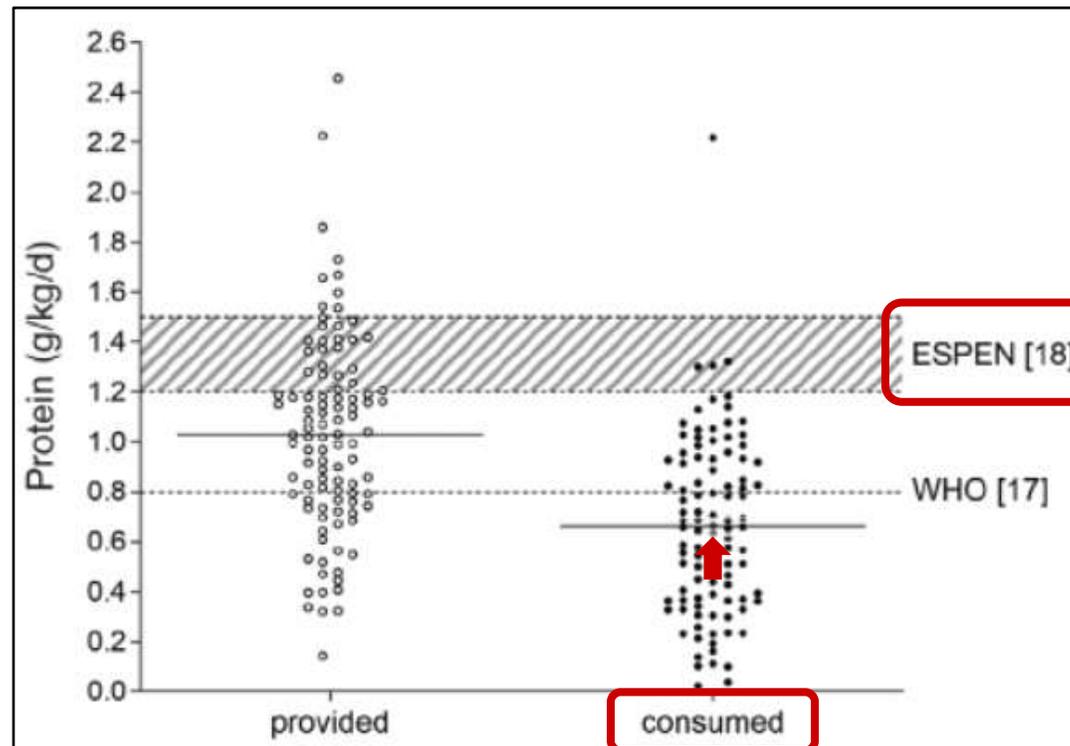


«Real life»: intake proteico

During Hospitalization, Older Patients at Risk for Malnutrition Consume <0.65 Grams of Protein per Kilogram Body Weight per Day

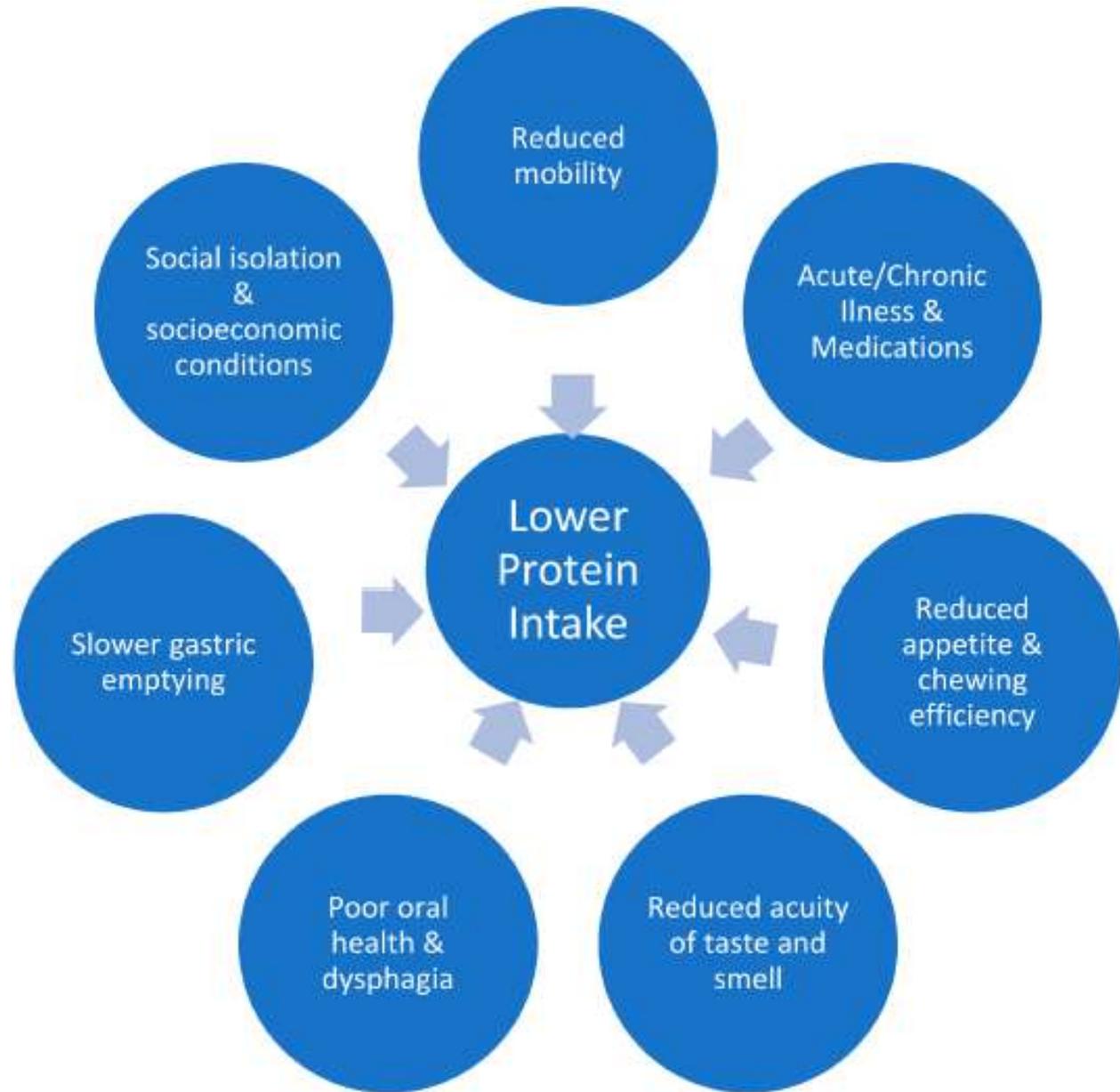
Michelle E. G. Weijzen, MSc¹ ; Imre W. K. Kouw, PhD¹ ; Phil Geerlings, RD²;
Lex B. Verdijk, PhD¹ ; and Luc J. C. van Loon, PhD¹ 

Nutr Clin Pract 2020



Factors leading to lower protein intake in older adults.

MN Lochlainn. Nutrients 2018



Strategie nutrizionali

Nutritional counselling

- for older persons/care givers—individualised (B)
- by a qualified person in several sessions (GPP)

Food modification

- food fortification (B)
- additional snacks/meals*, finger food (GPP)
- texture-modified, enriched foods (GPP)
- organoleptic enhancement (flavor/taste/visual appearance) *
- increasing variety of diet *
- considering individual preferences *

Oral nutritional supplements (ONS) (3 A, 3 GPP)

Enteral/parenteral nutrition (12 GPP)

Grades of recommendation: A = based on strong evidence (at least one high-quality RCT), B = based on medium evidence (high quality case-control or cohort studies); GPP = good practice point/expert consensus: Recommended best practice based on the clinical experience of the guideline development group.* topic not addressed in the ESPEN Guideline 2019 [21].



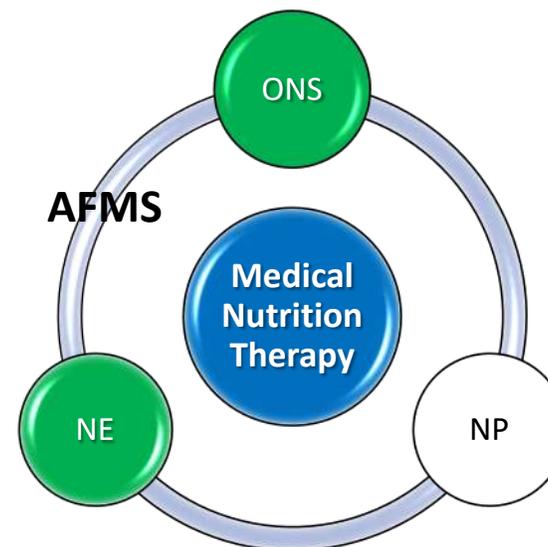
**INTESITÀ
d'intervento**

Supplementi Nutrizionali Orali (ONS)

ESPEN Guideline

ESPEN guidelines on definitions and terminology of clinical nutrition

T. Cederholm ^{a,*}, R. Barazzoni ^b, P. Austin ^{c,y}, P. Ballmer ^d, G. Biolo ^e, S.C. Bischoff ^f,
C. Compher ^{g,1}, I. Correia ^{h,1}, T. Higashiguchi ^{i,1}, M. Holst ^j, G.L. Jensen ^{k,1}, A. Malone ^{l,1},
M. Muscaritoli ^m, I. Nyulasi ^{n,1}, M. Pirlich ^o, E. Rothenberg ^p, K. Schindler ^q,
S.M. Schneider ^r, M.A.E. de van der Schueren ^{s,z}, C. Sieber ^t, L. Valentini ^u, J.C. Yu ^{v,1},
A. Van Gossum ^w, P. Singer ^x



Ministero della Salute

DIREZIONE GENERALE IGIENE, SICUREZZA ALIMENTI E NUTRIZIONE

UFFICIO 4

LINEE GUIDA SUGLI ALIMENTI A FINI MEDICI SPECIALI (AFMS)

Revisione del 11 luglio 2022

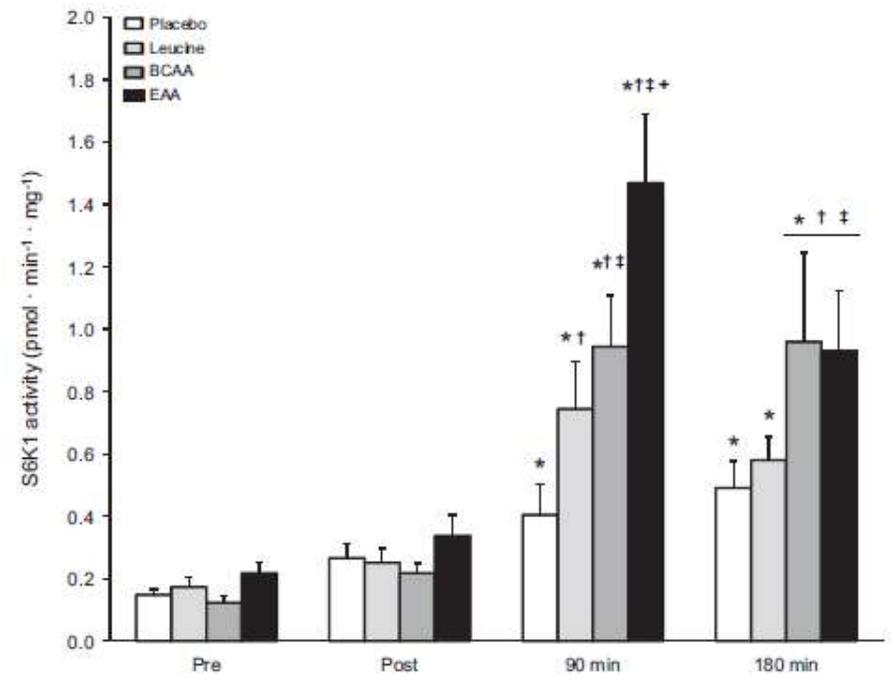
Supplementi Nutrizionali Orali (ONS)

- I prodotti denominati supplementi nutrizionali orali (ONS) sono AFMS destinati alla prevenzione o alla gestione della malnutrizione calorico-proteica, presentati in forma liquida, cremosa o in polvere per soggetti ancora in grado di alimentarsi per la via naturale.
- Da utilizzare «sotto controllo medico»

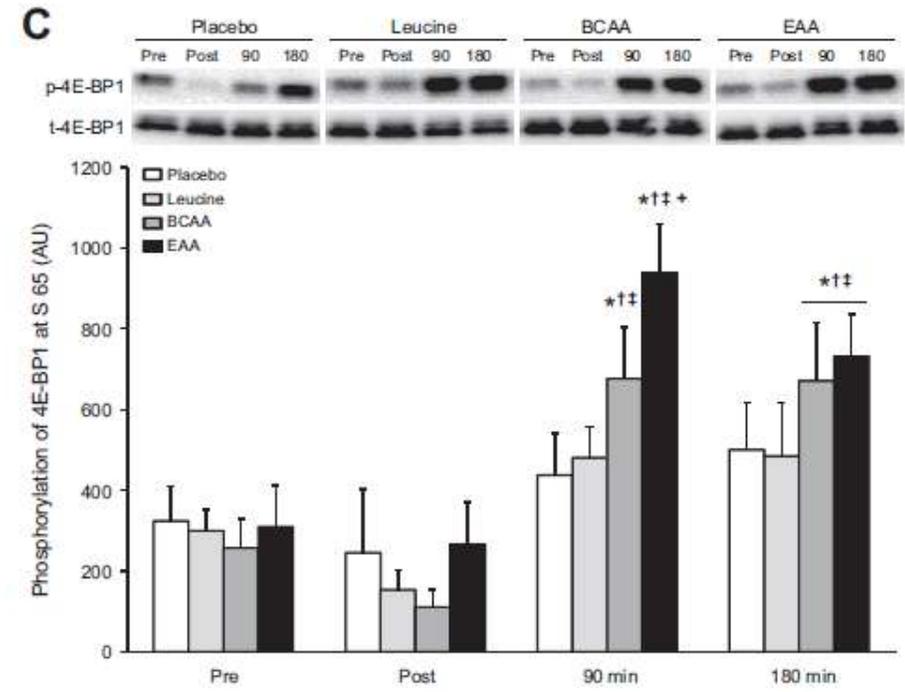
Leucina: azione sinergica di EAA

Activation of mTORC1 by leucine is potentiated by branched-chain amino acids and even more so by essential amino acids following resistance exercise

Moberg M. Am J Physiol Cell Physiol 2016



↑ Fosforilazione proteina chinasi S6K:
EAA > BCAA > Leucina > placebo



↑ Fosforilazione proteina chinasi 4E-BP:
EAA > BCAA > Leucina > placebo

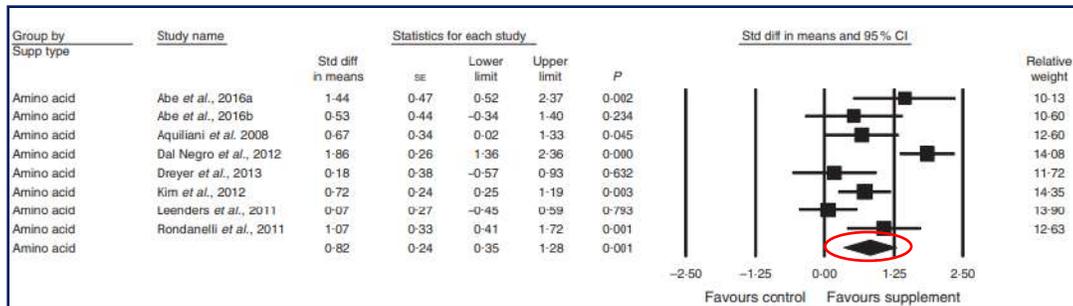
Leucina: azione sinergica di EAA

Systematic review and meta-analysis of the effect of protein and amino acid supplements in older adults with acute or chronic conditions

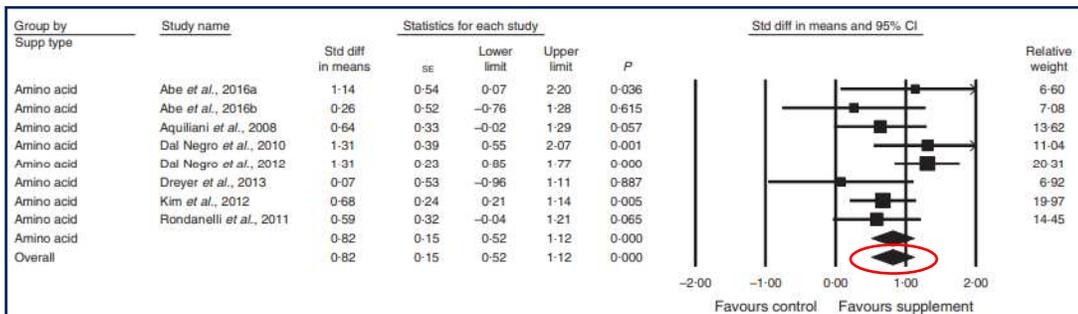
Heilok Cheng¹, Jielan Kong¹, Catherine Underwood¹, Peter Petocz², Vasant Hirani¹, Beryl Dawson³ and Fiona O'Leary^{1*}

Br J Nutr 2018

- Pazienti anziani malnutriti, sarcopenici con patologia acuta e cronica, in ospedale, RSA, comunità.
- **Analisi del sottogruppo EAA:** supplementazione con **EAA (3-20 g/die; prevalentemente 8 g/die)** arricchita in **leucina (1.2-7.2 g/die; prevalentemente 2.5 g/die)**
- Durata supplementazione: 3-12 settimane



- ↑ **Forza muscolare** (hand grip, muscolo quadricipite)



- ↑ **Performance fisica** (Walking test, Timed Up and Go, Activity Daily Life, SF-36 Quality of life)

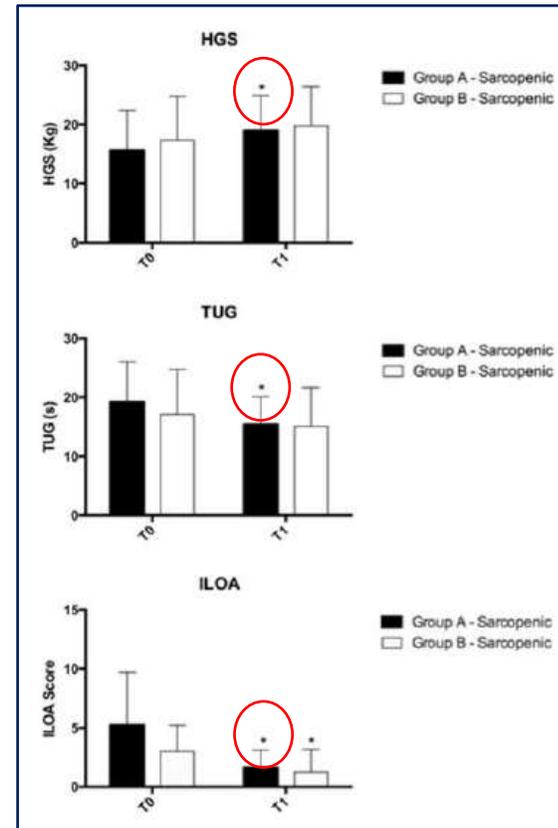
Leucina: azione sinergica di EAA

Effects of essential amino acid supplementation and rehabilitation on functioning in hip fracture patients: a pilot randomized controlled trial

Marco Invernizzi¹ · Alessandro de Sire^{1,2} · Federico D'Andrea³ · Deborah Carrera³ · Filippo Renò⁴ · Silvia Migliaccio⁵ · Giovanni Iolascon² · Carlo Cisarì^{1,6}

Invernizzi M. *Aging Clin Exp Res.* 2018

- 32 pazienti a 3 mesi da intervento per **frattura femore**
- **Counseling dietistico + programma riabilitativo** (5 sessioni di 40 min/sett. per 2 settimane, a seguire protocollo di esercizi al domicilio)
- Nel gruppo di studio (16 pazienti) supplementazione con **8 g/die di EAA (2.5 g/die di leucina)**
- Valutazione sarcopenia: Hand Grip (HGS) + BIA (SMI)
- Follow-up: 2 mesi
- Outcome primario: Hand Grip (HGS), Timed Up and Go (TUG), Iowa Level of Assistance scale (ILOA)



Miglioramento di tutti i parametri nei pazienti sarcopenici supplementati con EAA

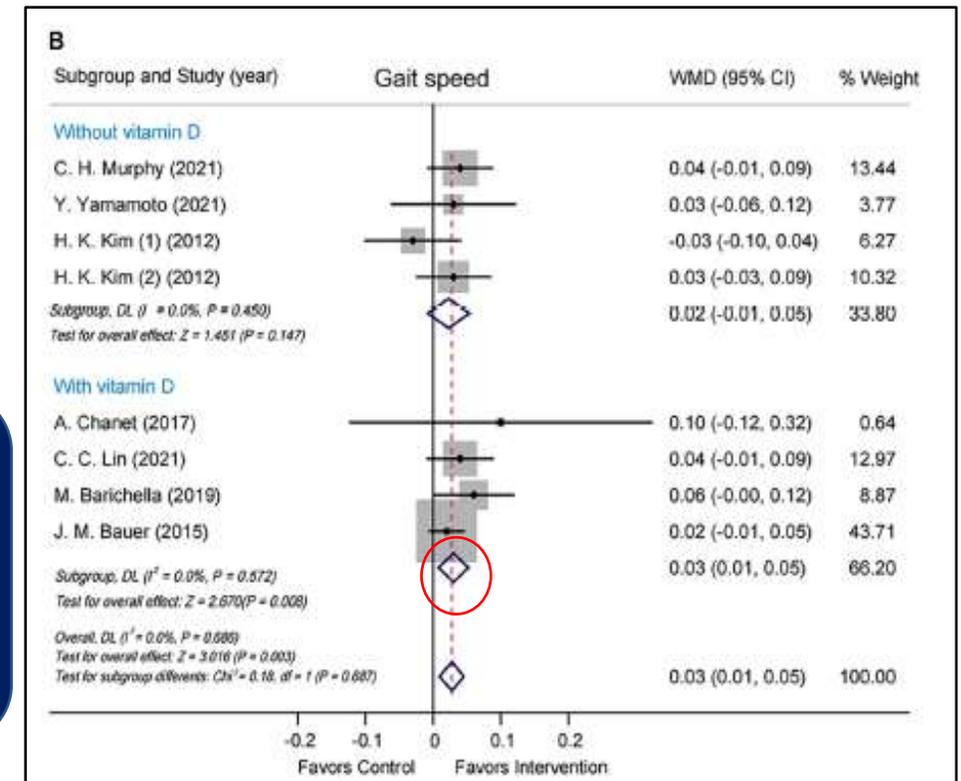
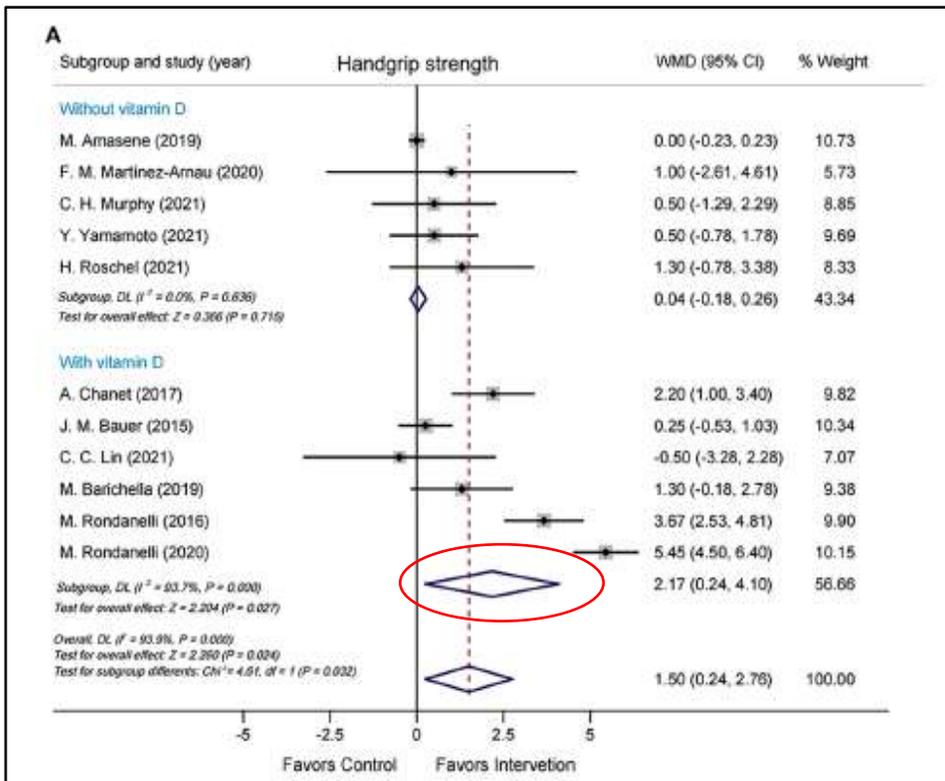
Leucina: azione sinergica di Vit. D

The Effect of Leucine Supplementation on Sarcopenia-Related Measures in Older Adults: A Systematic Review and Meta-Analysis of 17 Randomized Controlled Trials

Yufei Guo^{1†}, Xiaoya Fu^{1†}, Qingjing Hu^{1†}, Lihua Chen² and Hui Zuo^{1,3*}

Front Nutr. 2022

- Maggior efficacia della supplementazione **leucina + Vit. D** vs sola leucina
- Durata supplementazione: 4-13 settimane



- **Leucina: 3-6 g (5/6 studi)**
- **Vit D: 800 UI/die (4/6 studi)**

↑ Handgrip nel sottogruppo leucina + Vit. D

↑ Velocità del cammino nel sottogruppo leucina + Vit. D

Supplementazione: leucina + Vit D

Effects of a Vitamin D and Leucine-Enriched Whey Protein Nutritional Supplement on Measures of Sarcopenia in Older Adults, the PROVIDE Study: A Randomized, Double-Blind, Placebo-Controlled Trial

Bauer JM. JAMDA 2015

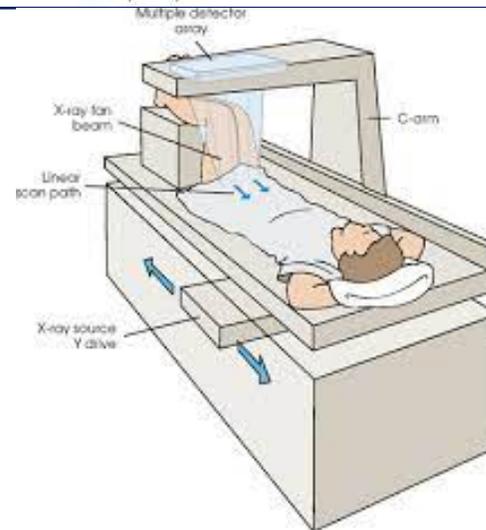
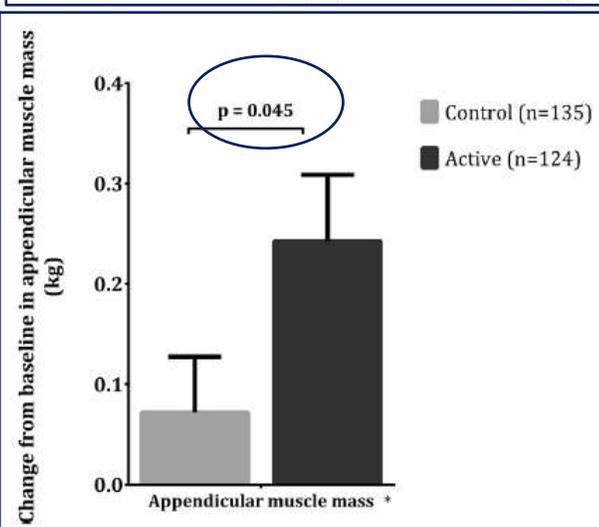
- 380 **anziani sarcopenici**, con limitazioni funzionali di grado lieve-moderato (Short Physical Performance Battery score 4-9) e ridotto Indice di Massa Muscolare Scheletrica ($\leq 37\%$ uomo, $\leq 28\%$ donna) alla BIA
- Supplementazione per 13 settimane con **ONS con sieroproteine arricchite in leucina + Vit D** vs ONS isocalorico (senza proteine)
- Descrizione ONS: 40 g di prodotto (gruppo di studio: 20 g di sieroproteine, 3 g di Leucina e 800 UI di Vit D; gruppo di controllo: maltodetrine e grassi) da ricostituire con 100-150 ml di acqua 2 volte/die prima di colazione e cena.
- **Outcome primario:** Handgrip e SPPB a 7 e 13 settimane
- **Outcome secondari:** Chair-stand test, velocità del cammino, test dell'equilibrio, massa muscolare appendicolare (DEXA) a 7 e 13 settimane

Supplementazione: leucina + Vit D



Table 2
Muscle Strength and Function Outcomes

	Mean (SD)	Change From Baseline, Mean (SD)		Estimated Between-Group Difference Mean (95% CI) Active – Control	P*
	Baseline	Week 7	Week 13		
Handgrip strength, kg					
Active ⁱ	20.9 (7.9)	0.20 (3.2)	0.79 (3.6) [†]	0.30 [§] (–0.46–1.05)	.44
Control ⁱⁱ	20.6 (7.5)	0.34 (2.8)	0.54 (3.2)		
SPPB					
Active [§]	7.5 (1.9)	0.50 (1.26)	0.86 (1.38)**	0.11 [§] (–0.21–0.42)	.51
Control ^{††}	7.5 (2.0)	0.51 (1.21)	0.77 (1.45)**		
Chair-stand time, s ^{††}					
Active ⁱⁱⁱ	17.1 (15.2, 21.2)	–1.4 (–3.3–0.4)	–2.5 (–4.2 to –0.6)**	–1.01 [§] (–1.77 to –0.19)	.018
Control ⁱⁱ	17.6 (14.6, 20.6)	–1.0 (–3.0–1.1)	–1.2 (–3.3–0.8)**		
Balance test ^{§§}					
Active [§]	3.0 (2.0, 4.0)	0.0 (0.0–0.0)	0.0 (0.0–1.0)	N.A.	.89
Control ^{††}	3.0 (2.0, 4.0)	0.0 (0.0–1.0)	0.0 (0.0–1.0)		
Gait speed, m/s					
Active [§]	0.8 (0.2)	0.03 (0.11)	0.07 (0.12)**	0.01 [§] (–0.02–0.04)	.46
Control ^{***}	0.8 (0.2)	0.03 (0.10)	0.05 (0.12)**		



RISULTATI

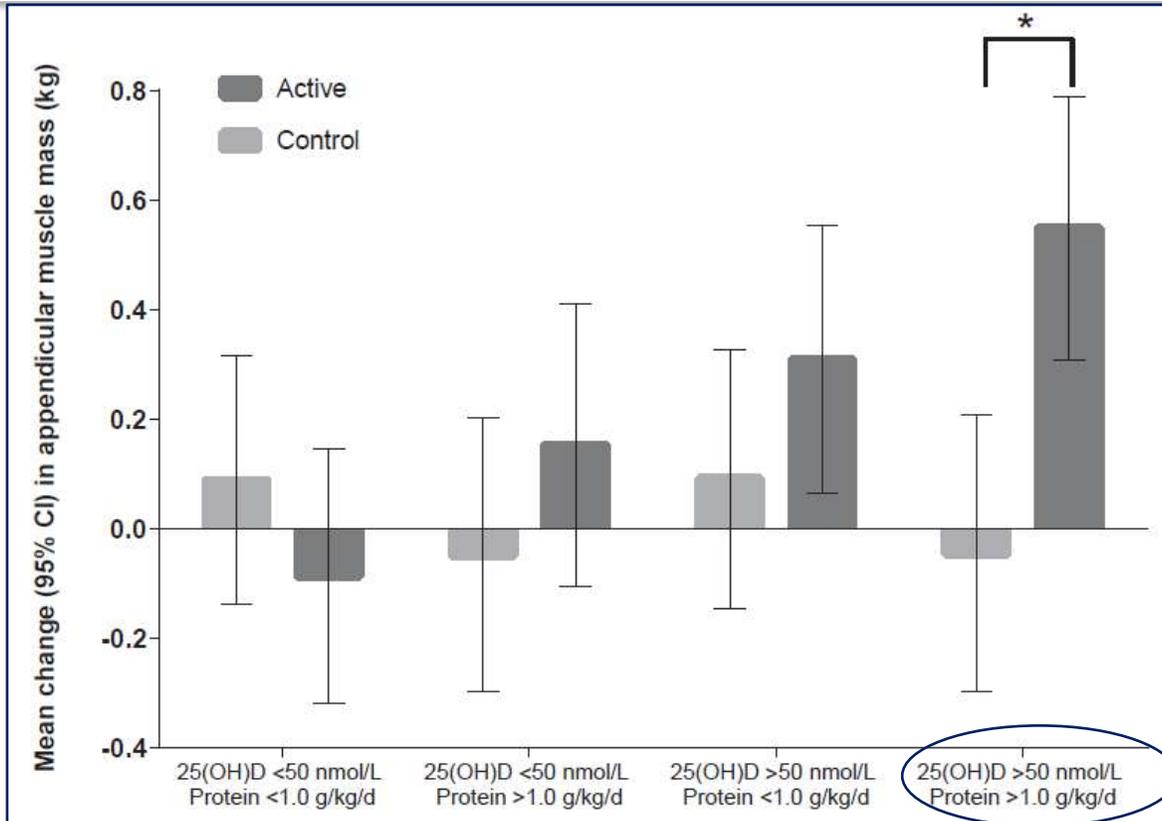
Dopo 13 settimane, nel gruppo di studio, si osserva un **miglioramento della performance fisica e della massa muscolare**

Supplementazione: leucina + Vit D

Original article

Sufficient levels of 25-hydroxyvitamin D and protein intake required to increase muscle mass in sarcopenic older adults – The PROVIDE study

Verlaan S. Clin Nutr 2018



RISULTATI

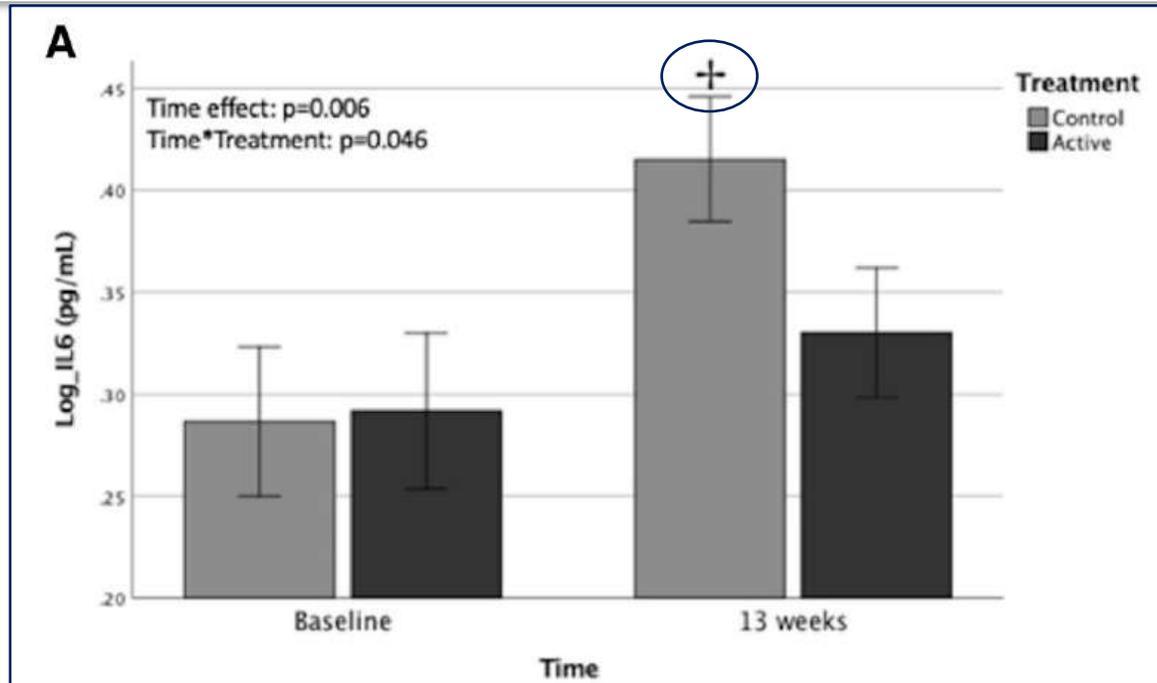
In soggetti anziani sarcopenici, dopo 13 settimane di supplementazione con Leucina + Vit D, si riscontra un aumento significativo della massa muscolare in presenza di livelli sierici di Vit D > 50 nmol/L (20 ng/ml) e con apporti di proteine > 1 g/Kg/die

«Soggetti con valori più bassi potrebbero richiedere una supplementazione più prolungata»

Supplementazione: leucina + Vit D

Thirteen weeks of supplementation of vitamin D and leucine-enriched whey protein nutritional supplement attenuates chronic low-grade inflammation in sarcopenic older adults: the PROVIDE study

Liberman K. Aging Clin Exp Res 2019



RISULTATI

Dopo 13 settimane di supplementazione con Leucina + Vit D in soggetti anziani sarcopenici si riscontra una riduzione della progressione dell'infiammazione cronica di basso grado (IL-6)

Azione sinergica anti-infiammatoria e immunomodulante di Leucina e Vit D ?

Supplementazione: leucina + Vit D

Improving rehabilitation in sarcopenia: a randomized-controlled trial utilizing a muscle-targeted food for special medical purposes

Rondanelli M. J Cachexia Sarcopenia Muscle 2020

- 140 pazienti anziani (≥ 65 anni) candidati a ricovero riabilitativo, senza grave compromissione cognitiva (MMSE ≥ 18) e affetti da sarcopenia in base ai criteri EWGSOP 2010.
- I pazienti sono stati randomizzati in due gruppi per ricevere un supplemento nutrizionale orale (**ONS**), per **almeno 4 settimane** (durata minima della riabilitazione) **fino a 8 settimane** (durata massima della riabilitazione).
- **Descrizione ONS:** 40 g di prodotto (150 kcal, 20 g di sieroproteine, 2,8 g di leucina, 0,5 g di Calcio, 800 UI di Vitamina D)/ 2 volte al giorno vs 40 g di prodotto (isocalorico, maltodestrine)/ 2 volte al giorno
- **Endpoint primario:** variazione media della velocità del cammino al mese
- **Endpoint secondari:** Variazione media (al mese) di misure di performance fisica: Chair-stand test, Timed up and go test (TUG), Short Physical Performance Battery (SPPB)
- **Altri principali endpoint secondari:** Handgrip, Massa muscolare appendicolare e indice di massa muscolare (DEXA)

Supplementazione: leucina + Vit D

Improving rehabilitation in sarcopenia: a randomized-controlled trial utilizing a muscle-targeted food for special medical purposes

Rondanelli M. *J Cachexia Sarcopenia Muscle* 2020

Analyses	Control formula Within-group change (N = 63)	Experimental formula Within-group change (N = 64)	Treatment effect Between-group difference	P value
Primary analysis	-0.001 (-0.008 to 0.006)	0.061 (0.043 to 0.080) ^a	0.062 (0.043 to 0.082)	<0.001
Sensitivity analyses	—	—	—	
Multivariable analysis ^b	—	—	0.042 (0.026 to 0.058)	<0.001
Worst case scenario analysis	-0.006 (-0.138 to 0.001)	0.052 (0.033 to 0.070) ^a	0.058 (0.038 to 0.078)	<0.001

Data are provided as mean and 95%CI.

^aWithin-group change significant at the 5% level.

^bModel adjusted for sex, age, monthly change in energy intake, monthly change in creatinine, and monthly change in total cholesterol.

Aumento significativo della velocità del cammino

Supplementazione: leucina + Vit D

Endpoint	Control formula Within-group change (N = 63)	Experimental formula Within-group change (N = 64)	Treatment effect Between-group difference ^a	P-value
Secondary outcome variables				
MMSE (score)	-0.11 (-0.16 to -0.05) ^a	0.46 (0.25 to 0.66) ^a	0.57 (0.352 to 0.773)	<0.001
Trail making test (s)	-0.12 (-0.48 to 0.23)	-3.32 (-4.01 to -2.63) ^a	-3.20 (-3.97 to -2.43)	<0.001
Barthel index (score)	0.92 (-0.15 to 1.99)	5.02 (3.77 to 6.27) ^a	4.10 (2.47 to 5.73)	<0.001
Activities of daily living (score)	0.01 (-0.10 to 0.12)	0.67 (0.51 to 0.83) ^a	0.66 (0.46 to 0.85)	<0.001
Tinetti scale (score)	0.27 (-0.57 to 0.03)	2.09 (1.67 to 2.52) ^a	2.26 (1.85 to 2.88)	<0.001
Body weight (kg)				<0.001
Handgrip strength (kg)				<0.001
SF-12 PCS (score)				0.08
SF-12 MCS (score)				0.82
Appendicular skeletal muscle mass (kg)				0.011
Skeletal muscle mass index (kg/m ²)				0.023
SPPB (score)				<0.001
Chair stand test (s)				<0.001
Timed up and go test (s)				<0.001
Exploratory SPPB (score)				<0.001
Protein intake (g/day)				<0.001
Energy intake (kcal/day)				<0.001
Mini Nutritional Assessment (score)	0.36 (0.04 to 0.68) ^a	1.88 (1.48 to 2.27) ^a	1.52 (1.02 to 2.02)	<0.001
C-reactive protein (mg/dL)	0.05 (-0.11 to 0.21)	-0.38 (-0.58 to -0.19) ^a	0.43 (0.18 to 0.68)	<0.001
25-hydroxyvitamin D (ng/mL)	0.09 (-0.64 to 0.83)	6.70 (5.26 to 8.14) ^a	6.61 (5.00 to 8.21)	<0.001
Total cholesterol (mg/dL)	-2.87 (-6.82 to 1.07)	1.87 (-2.70 to 6.43)	4.74 (-1.24 to 10.71)	0.12
Albumin (g/dL)	-0.14 (-0.21 to -0.07) ^a	0.20 (0.15 to 0.25) ^a	0.34 (0.25 to 0.43)	<0.001
Creatinine (mg/dL)	-0.01 (-0.03 to 0.01)	0.02 (0.00 to 0.05) ^a	0.03 (0.00 to 0.06)	0.031

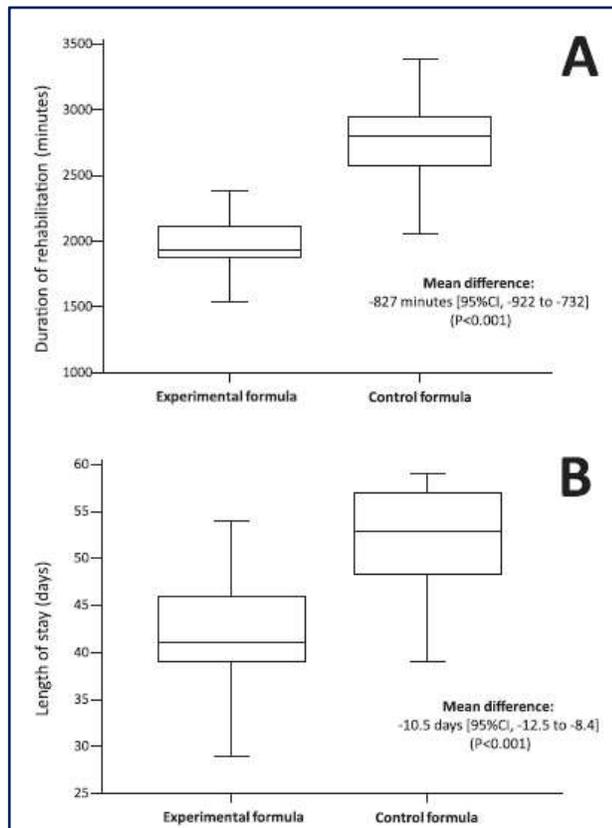
MIGLIORAMENTO significativo di :

- *Stato funzionale: handgrip*
- *Composizione corporea: massa muscolare appendicolare e indice di massa muscolare scheletrica*
- *Performance fisica: Chair stand test, TUG (Timed up and go test) e punteggio SPPB*

Supplementazione: leucina + Vit D

Improving rehabilitation in sarcopenia: a randomized-controlled trial utilizing a muscle-targeted food for special medical purposes

Rondanelli M. J Cachexia Sarcopenia Muscle 2020



Minor durata della riabilitazione : 33.1 vs 46 h

Minor durata della degenza: 41.8 vs 52.2 gg

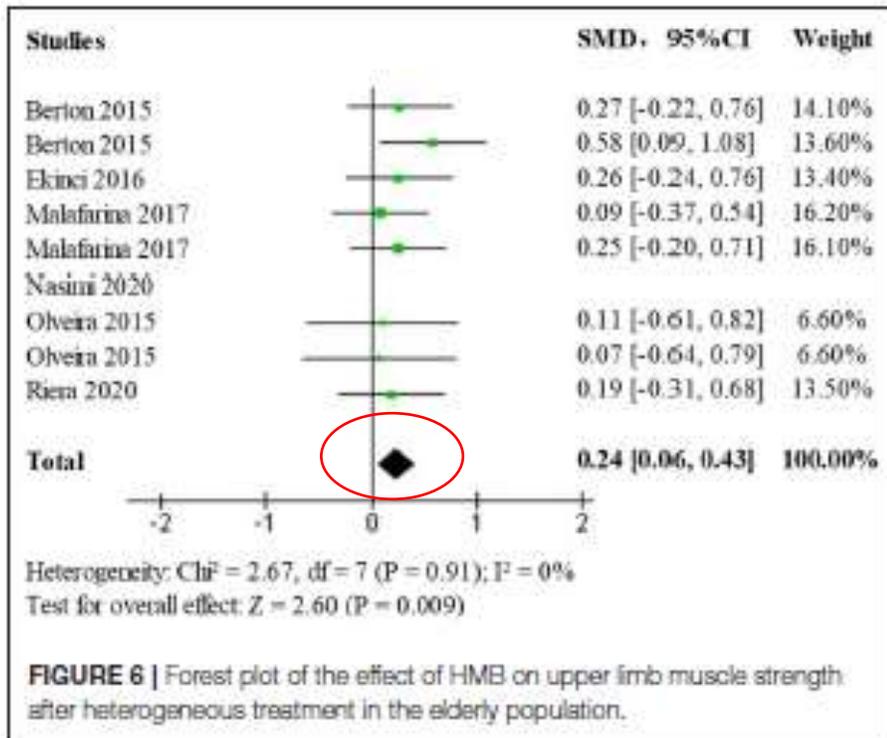
HMB

Effect of β -hydroxy- β -methylbutyrate (HMB) on the Muscle Strength in the Elderly Population: A Meta-Analysis

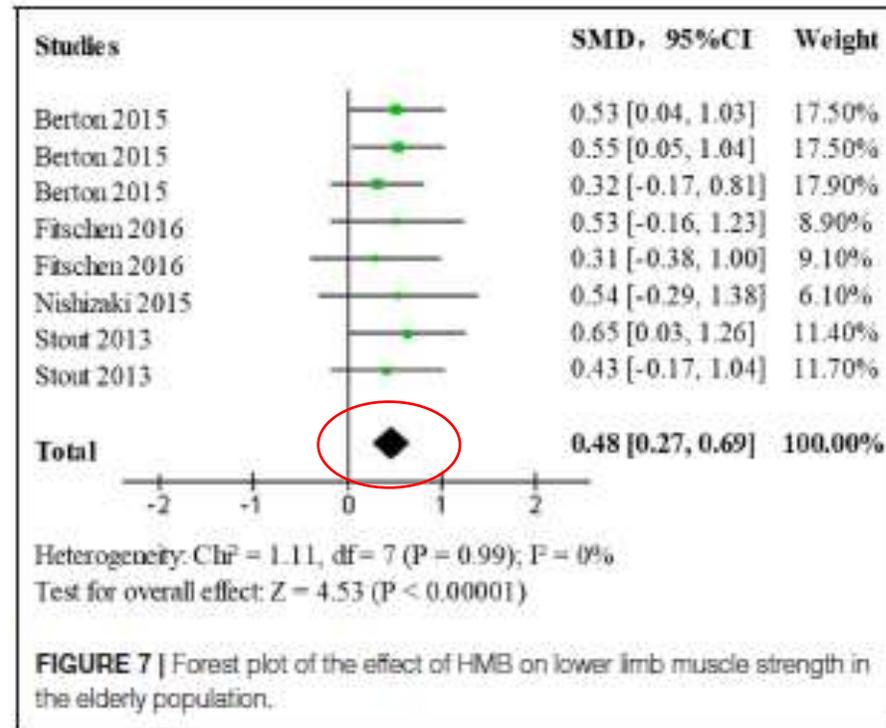
Ziru Lin, Anqi Zhao and Jiguo He*

Front Nutr. 2022

- 9 studi (896 pazienti anziani, con patologie acute e croniche, sarcopenici, sani)
- HMB associato a proteine, aminoacidi
- Dose HMB: 3 g/die (7 studi), 1.5 g/die (2 studi)
- Durata supplementazione: 2-24 settimane



↑ Forza muscolare arti superiori



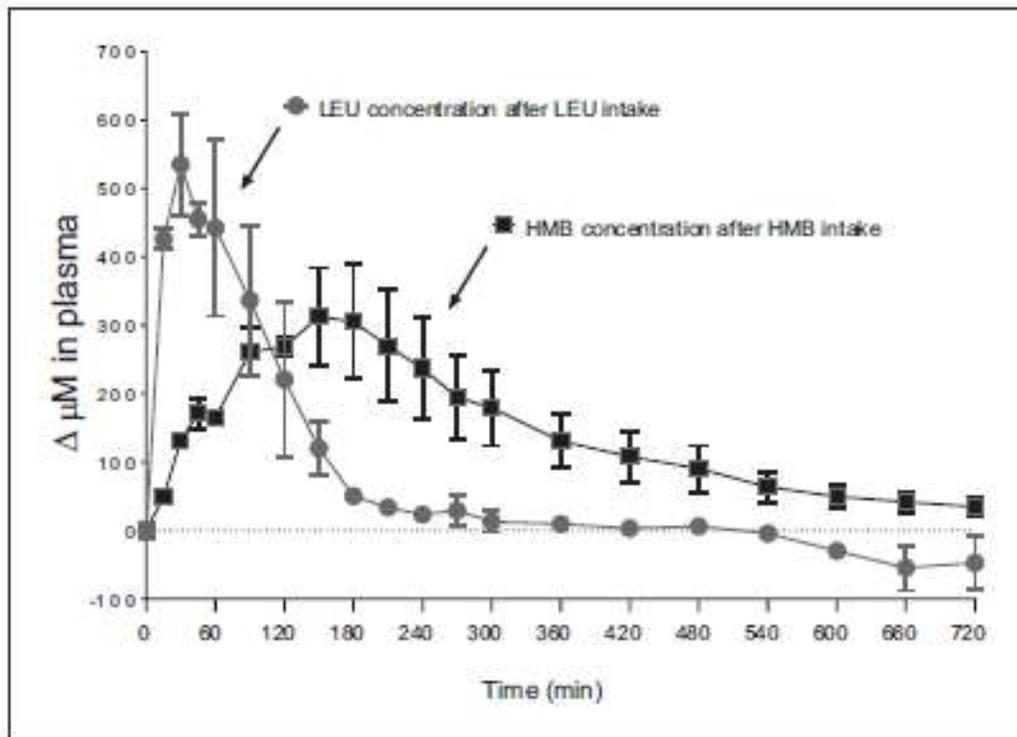
↑ Forza muscolare arti inferiori

HMB

Is β -hydroxy β -methylbutyrate an effective anabolic agent to improve outcome in older diseased populations?

Mariëlle P.K.J. Engelen and Nicolaas E.P. Deutz

Curr Opin Clin Nutr Metab Care 2018



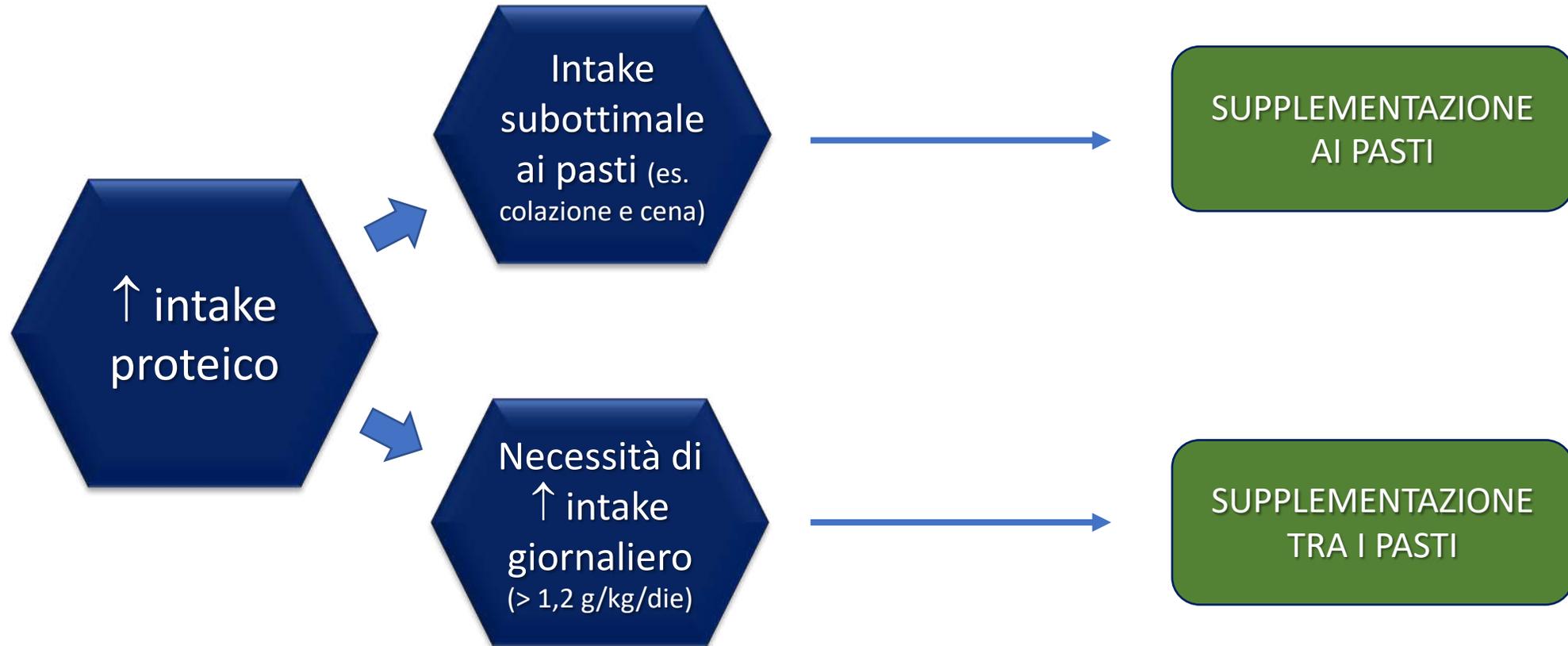
- Maggior emivita dell' HMB (1.5 g) vs Leucina (3 g)

Possibile effetto anticatabolico «retard»



Razionale per una supplementazione ad effetto sinergico con leucina e Vit. D

Strategie nutrizionali di supplementazione



Conclusioni

- Un apporto proteico di **almeno 1-1.2 g/kg/die** e una **adeguata distribuzione**, con una quantità di proteine in **≥ 2 pasti principali** di circa **0.4 g/kg** di peso, costituisce una strategia potenzialmente efficace nel contrastare la sarcopenia, attraverso l'ottimizzazione dello stimolo sulla sintesi proteica muscolare.
- Il frequente riscontro di apporti subottimali suggerisce il ricorso a supplementazioni proteiche: l'impiego di formulazioni di **Aminoacidi Essenziali**, arricchite in **Leucina, HMB, Vit D rappresenta una strategia efficace per il mantenimento dello stato di salute muscolare**.
- Sono necessari studi d'intervento per ottimizzare gli effetti in specifiche popolazioni di pazienti e sviluppare strategie personalizzate attraverso una miglior definizione di dosi, durata, timing di trattamento (approccio proattivo) e combinazione con esercizio fisico.