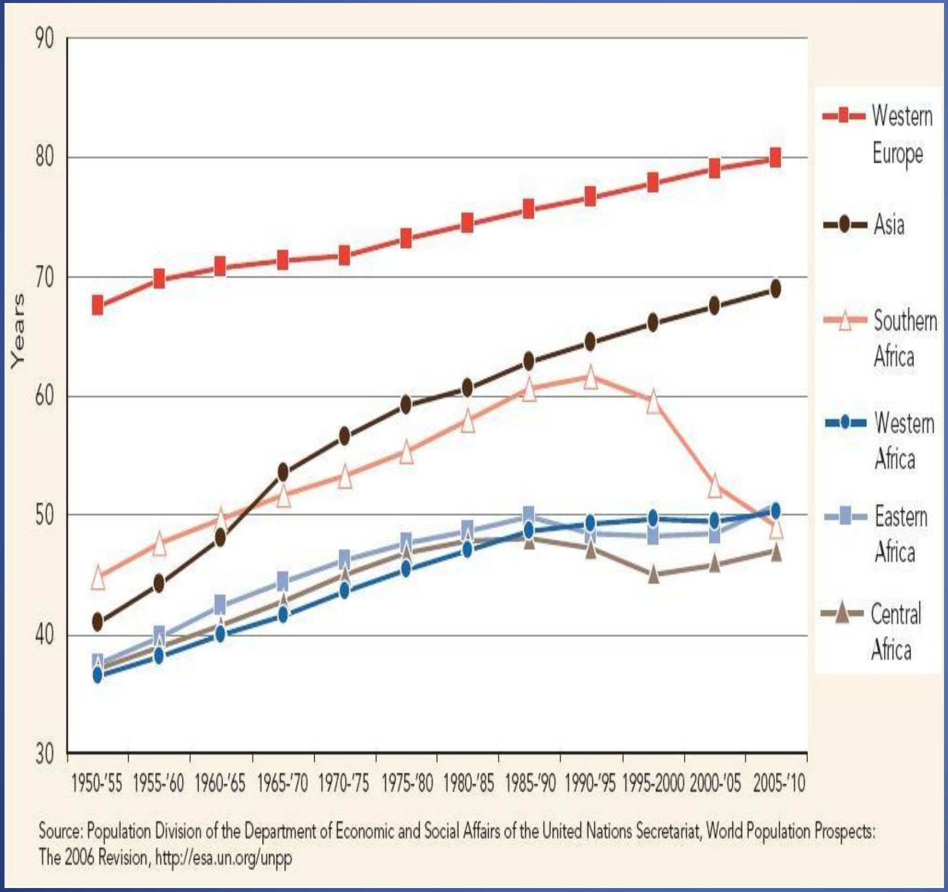
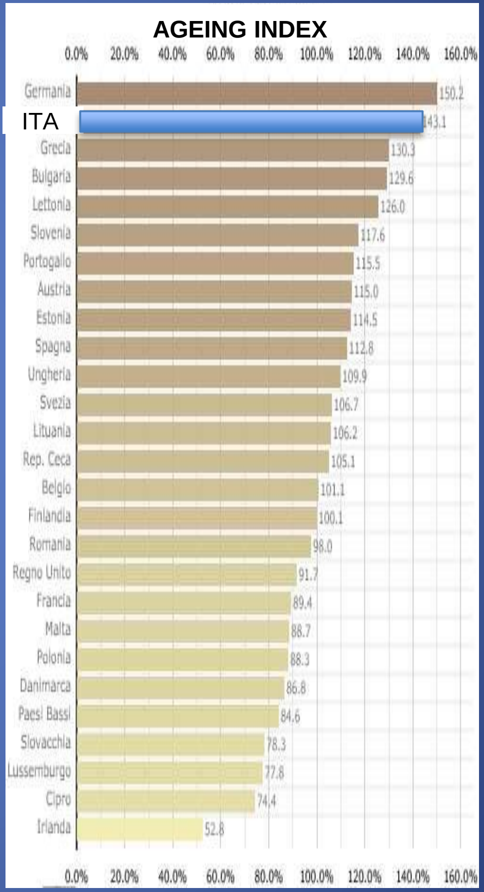
Società moderna



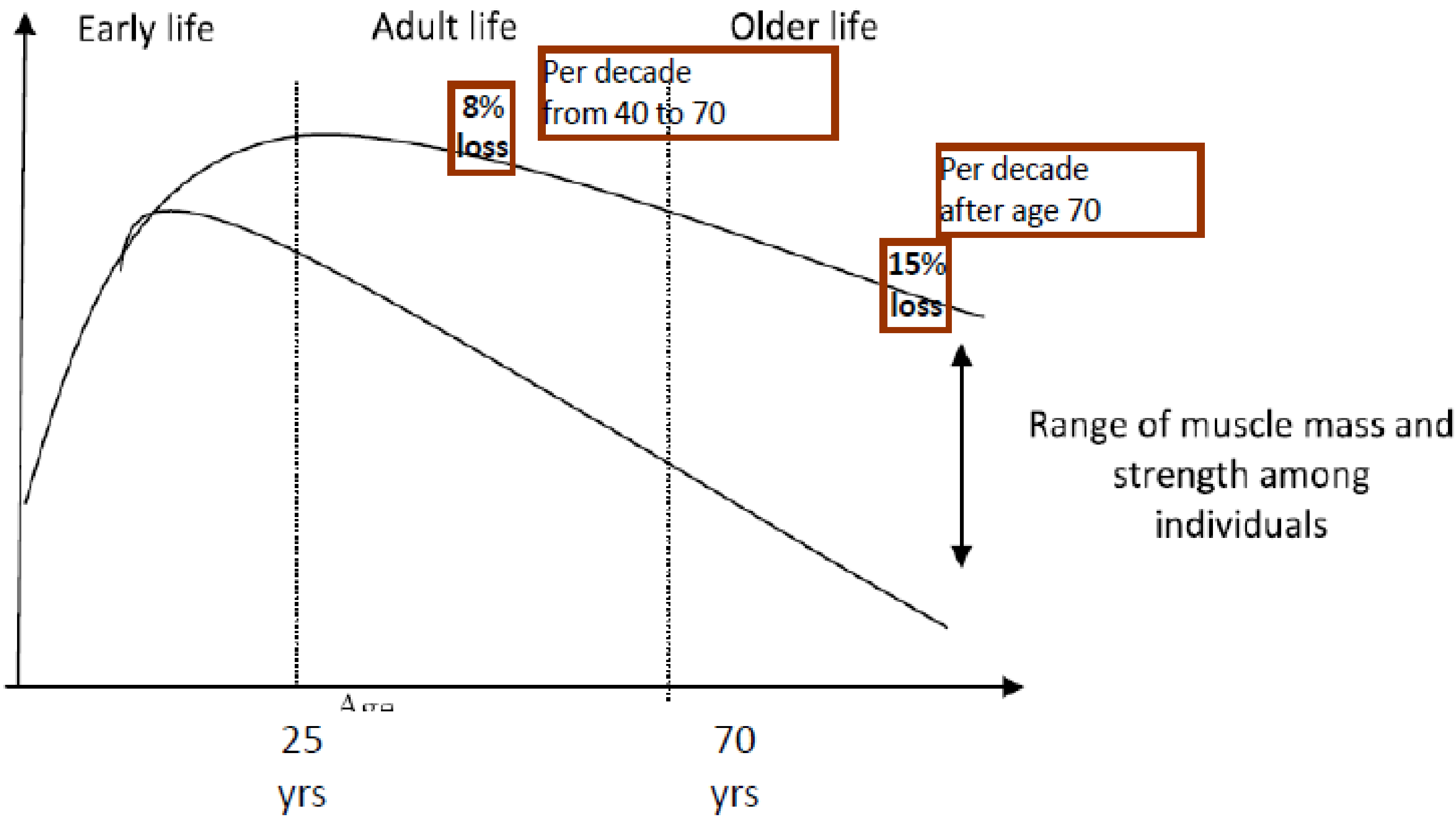


- % of people over 65y

Società moderna

Johanna Quaas, 86 years old

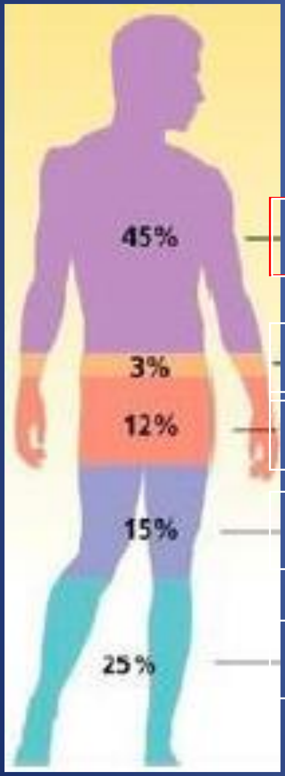
Lignano (ITA) Master Games 2011



Hairi N, www.intechopen.com 2008

INTRODUCTION

BODY COMPOSITION



Muscle

Essential Fat

Non essential Fat

Bone

Other

MUSCLE:

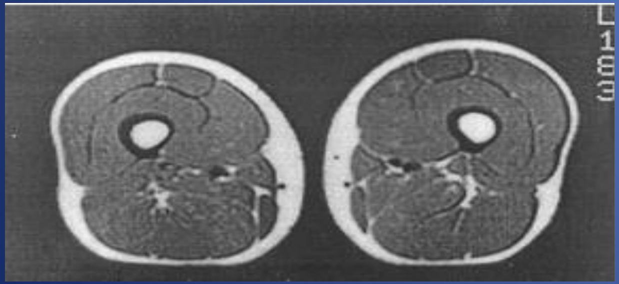
- the most represented tissue in the body
- 20% is proteins
- the tissue containing most of body proteins
- has multiple functions:
  - Movement-posture
  - Metabolism
  - Endocrine (myokines)

INTRODUCTION

<u>SARCOPENIA</u>

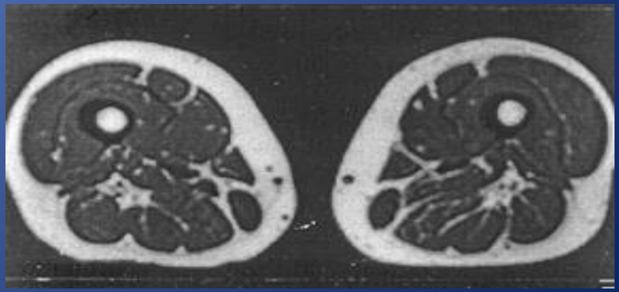
> "syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength, with a risk of adverse outcomes such as physical disability, poor quality of life and death"

European Working Group on Sarcopenia in Older People (EWGSOP)
2012



Young woman
(21y, BMI 24.3 kg/m^2)

Elderly woman
(73y, BMI 24.5 kg/m^2)



SARCOPENIA

ANABOLIC RESISTANCE TO AMINO ACID AND PROTEIN

MUSCLE ATROPHY

FAT MASS DEPOSITION

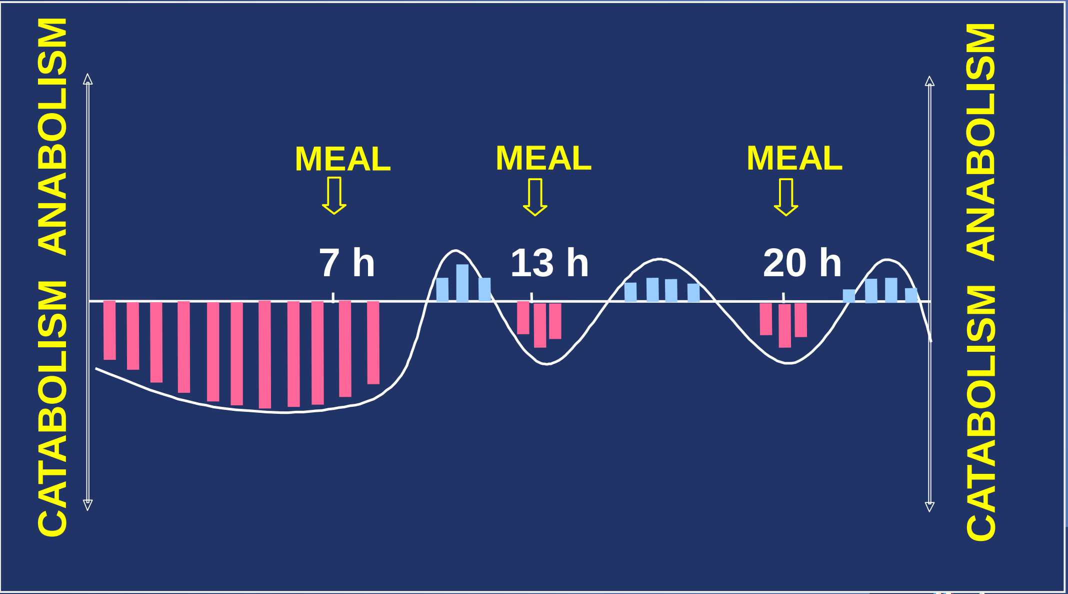
REDUCTION IN PHYSICAL ACTIVITY

OXIDATIVE STRESS

SYSTEMIC CHRONIC INFLAMMATION

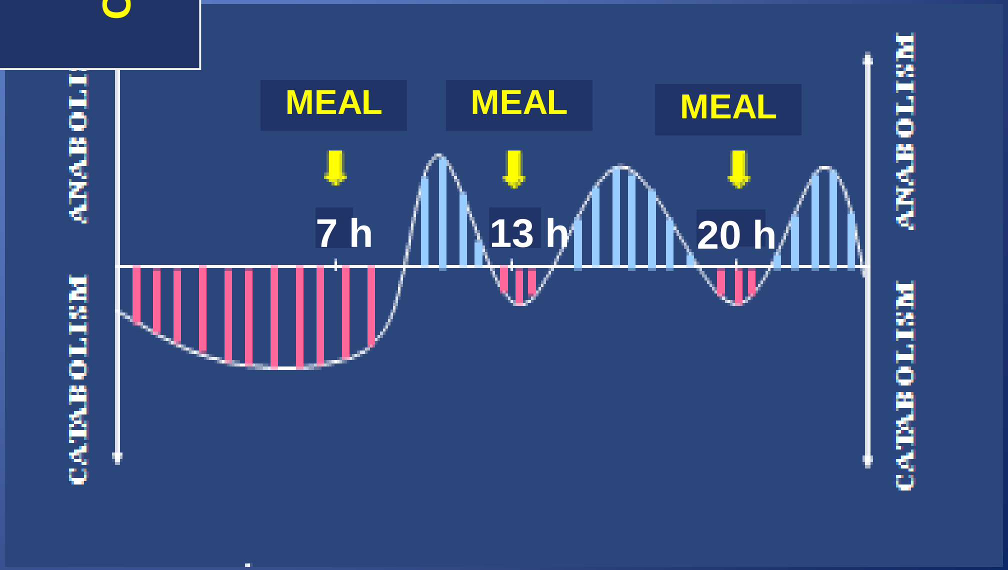
INSULIN-RESISTANCE

SARCOPENIA: Anabolic resistance



the inability to increase protein synthesis in response to a meal induced higher amino acid availability.

Biolo G et al. *Clin Nutr 2014*

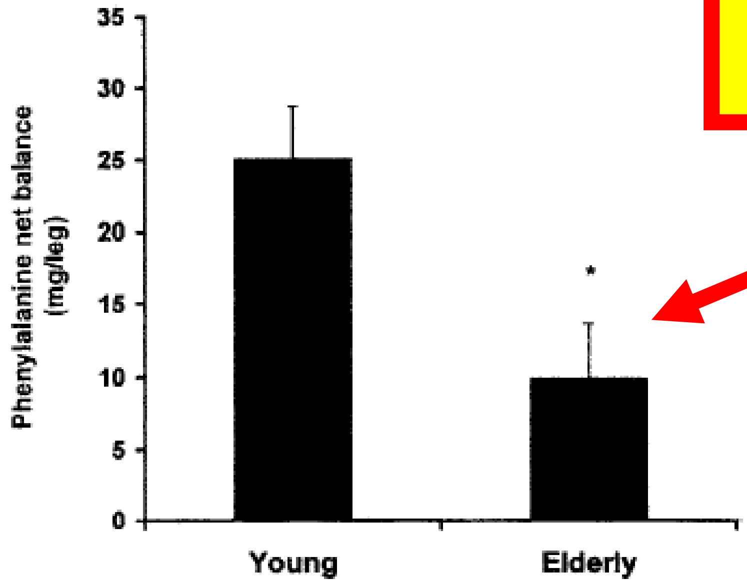


Aging is associated with diminished accretion of muscle proteins after the ingestion of a small bolus of essential amino acids[1–3]

Christos S Katsanos, Hisamine Kobayashi, Melinda Sheffield-Moore, Asle Aarsland, and Robert R Wolfe

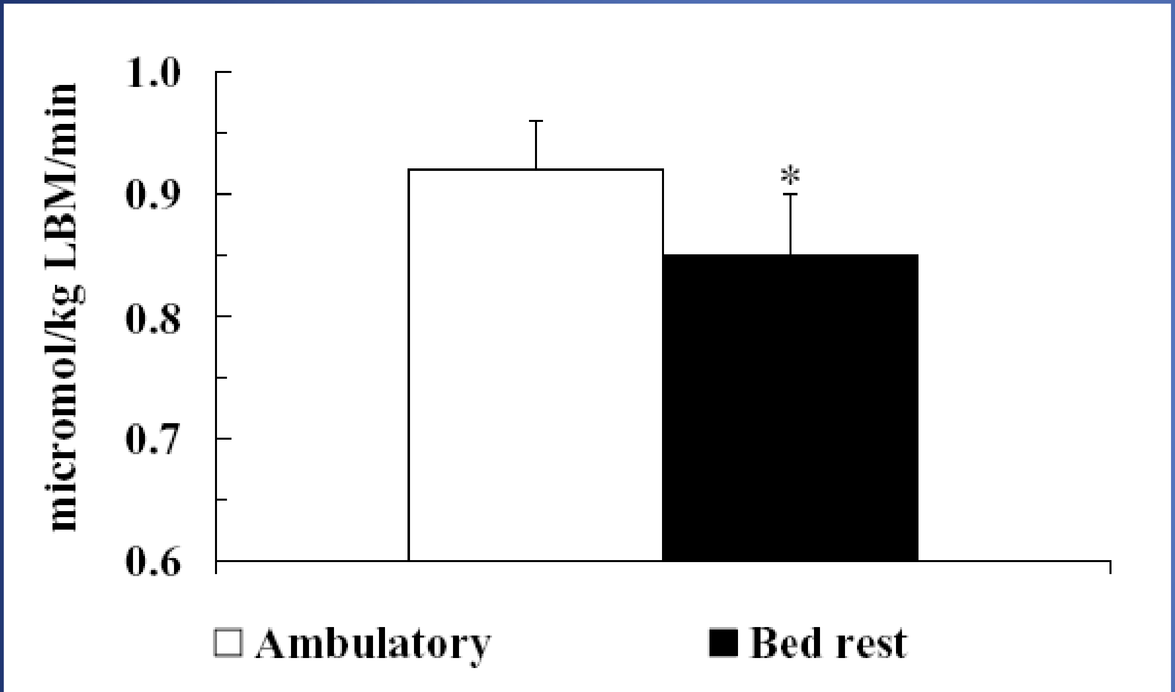
Am J Clin Nutr 2005;82:1065–73.

Anabolic resistance of aging



Mean (±SEM) leg phenylalanine net balance 3.5 h after the ingestion of essential amino acids calculated by measuring the area under the phenylalanine net balance response curve (in the calculations, basal net balance was taken as zero) in the elderly ($n = 11$) and the young ($n = 8$). Data were analyzed with a t test. *Significantly different from the young, $P = 0.010$.

SARCOPENIA: effects of immobilization

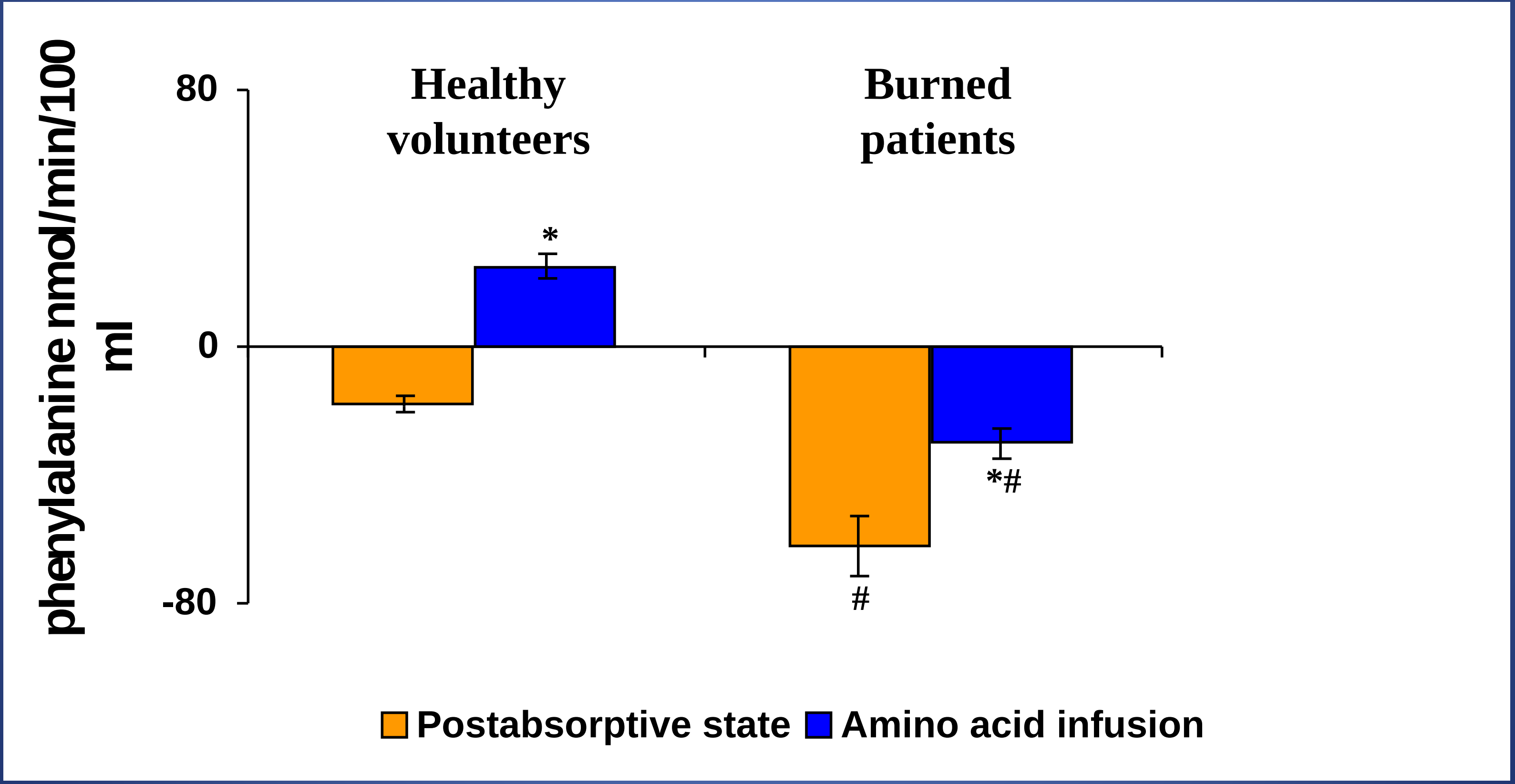


BED REST

Short-term bed rest impairs amino acid-induced protein anabolism in humans

Biolo et al., J Physiol 2004

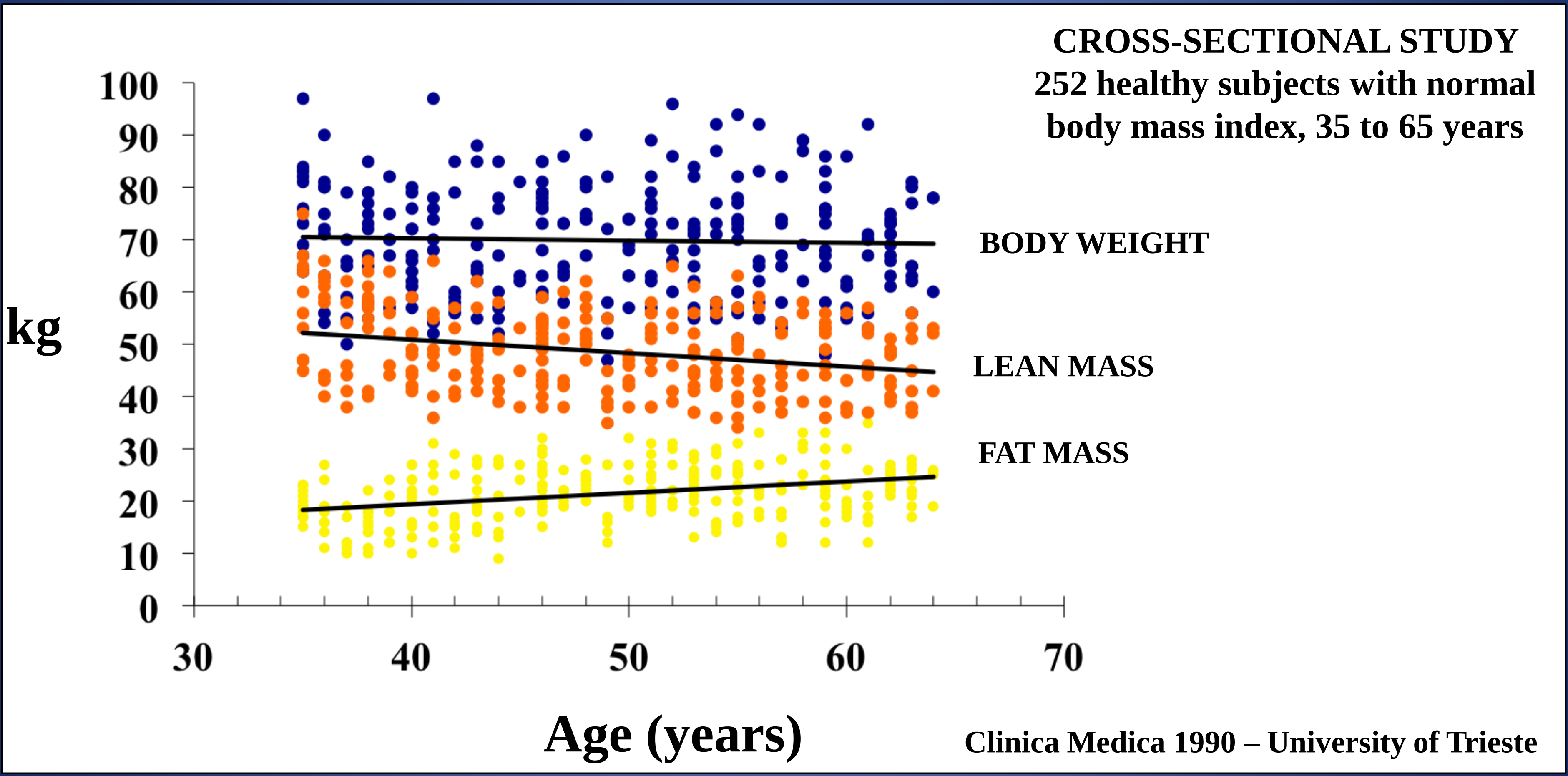
EFFECTS OF AMINO ACID INFUSION ON SKELETAL MUSCLE PROTEIN BALANCE IN SEVERELY BURNED PATIENTS



*, P<0.05 vs. postabsorptive state #, P<0.05 vs. healthy volunteers

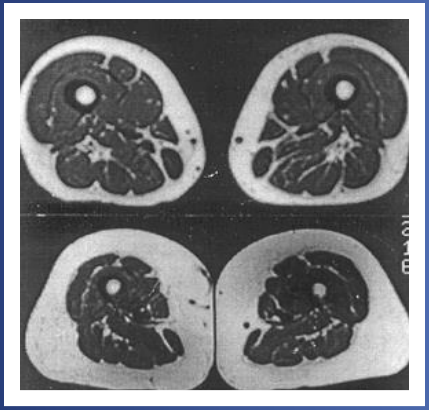
INTRODUCTION

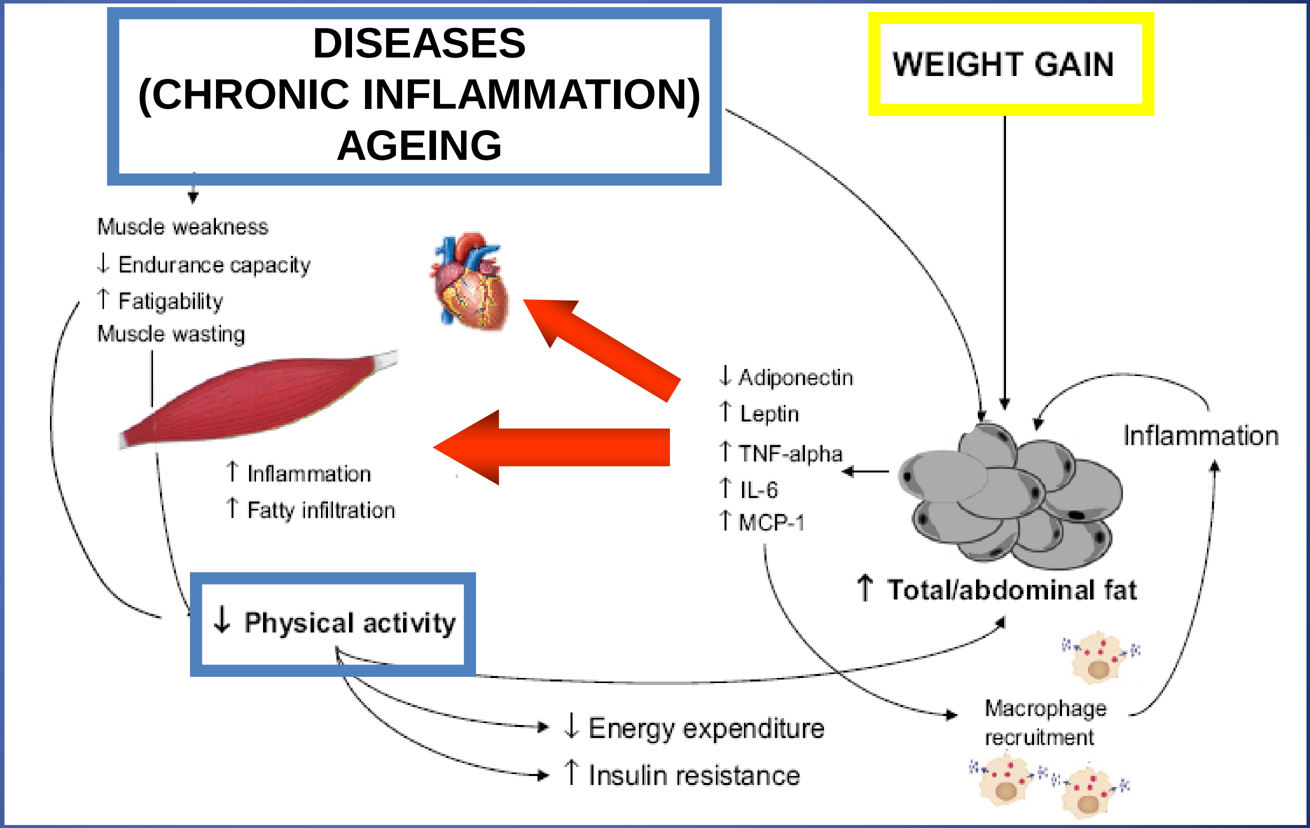
SARCOPENIA: Body weight and composition in aging



INTRODUCTION

SARCOPENIA: Role of fat mass and inflammation



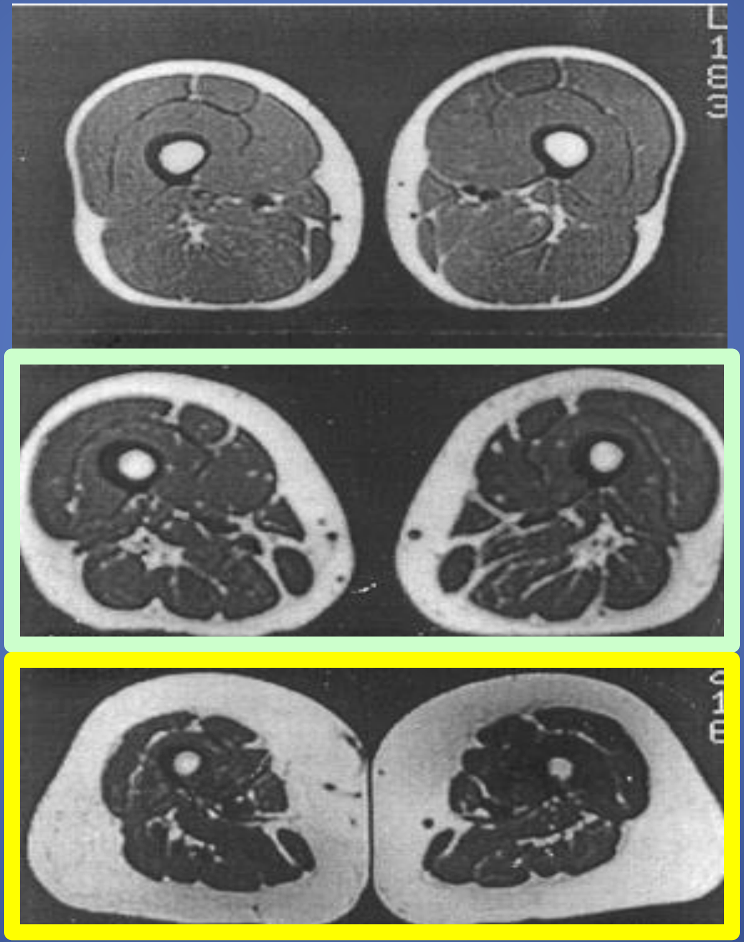


Zamboni et al., Nutrition, Metabolism & Cardiovascular Diseases 2008

Inter-relationships between adipose tissue and muscle. A mechanism leading to sarcopenic obesity.

INTRODUCTION

SARCOPENIA



SARCOPENIC OBESITY

COMPOSIZIONE CORPOREA

OBESITÀ SARCOPENICA

Sindrome caratterizzata da progressiva e generalizzata alterazione della composizione corporea, con:

- **eccesso di tessuto adiposo (obesità)**
- **ridotti massa e funzionalità muscolari (sarcopenia)**

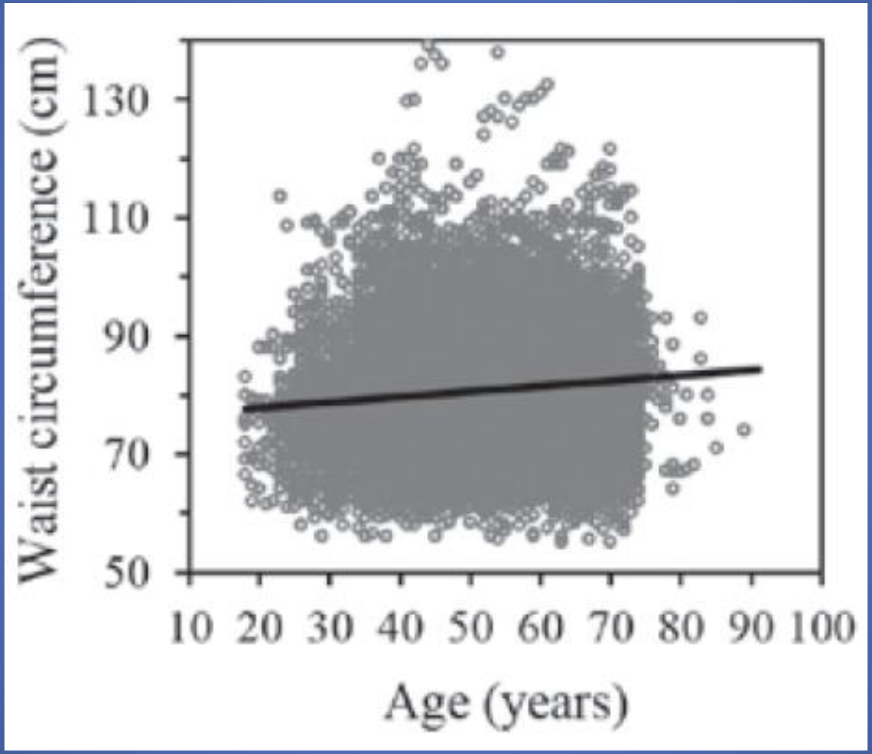
Prevalenza maggiore in anziani e persone affette da malattie croniche

Interferisce negativamente con

- **capacità fisica**
- **metabolismo**
- **funzione cardiovascolare**

con conseguente peggioramento della qualità della vita, aumento della morbidità e della mortalità.

Correlation between waist circumference and age



Correlations were examined in longitudinal data for waist circumference in all subjects (21,358). The line represents a least-squares plot of the data. P=4.34x10-60, R2=0.0124, waist circumference (cm)=76.0696+0.0893x;

BIOMEDICAL REPORTS 3: 767-777, 2015

Società moderna

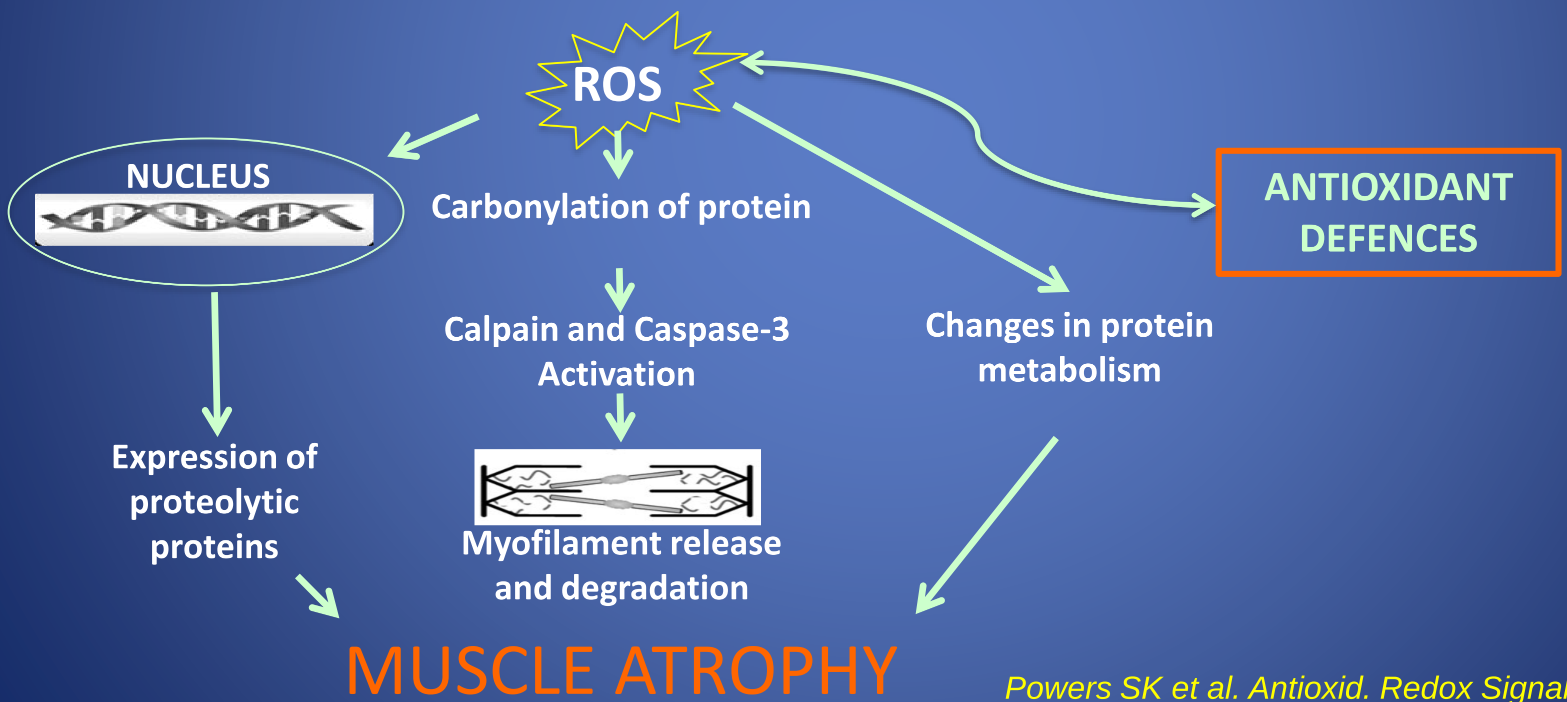
Johanna Quaas, 86 years old

Pengzue Su ,87-year old

SARCOPENIA: Oxidative stress

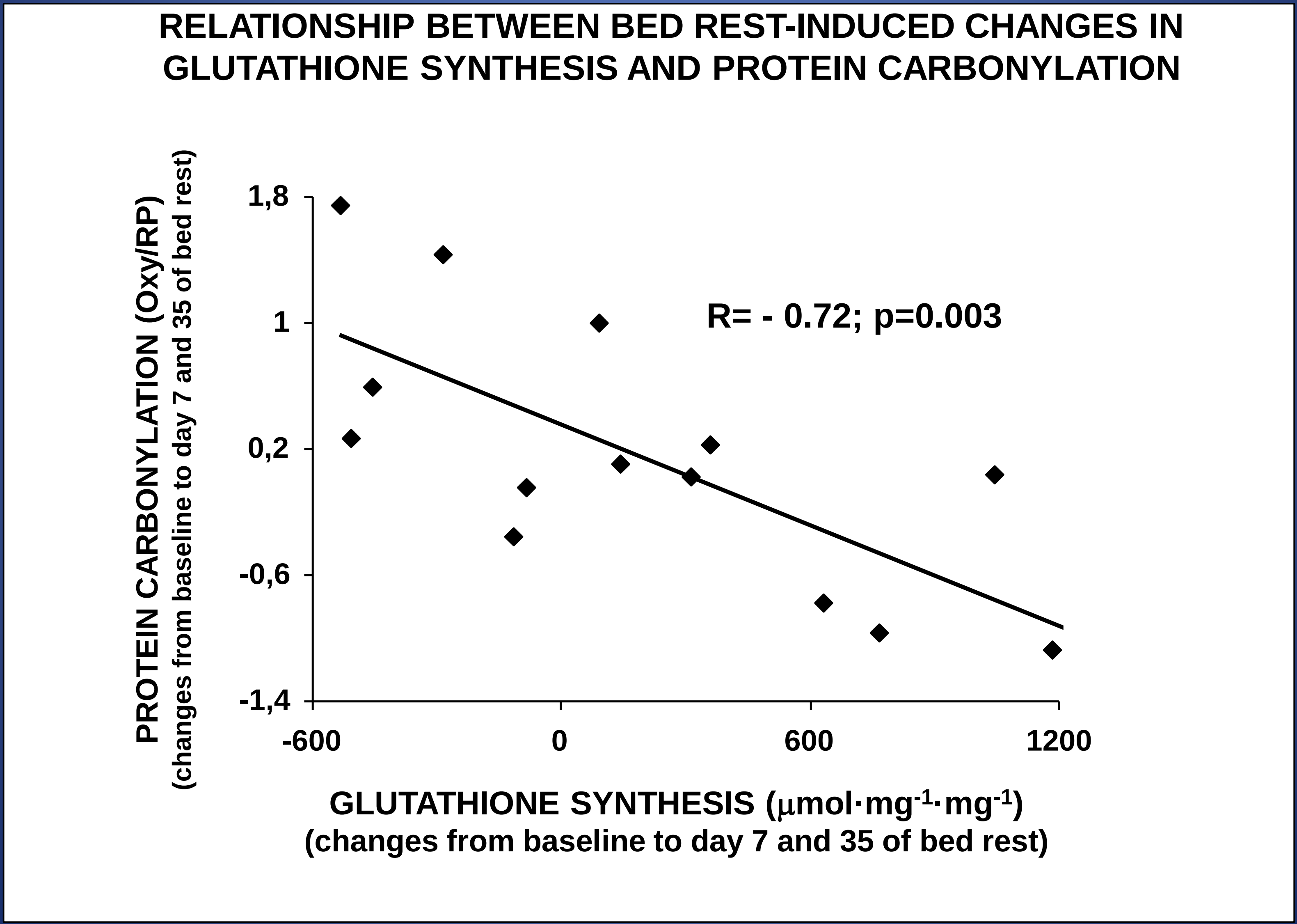
"An imbalance between oxidants and antioxidants in favor of the oxidants, potentially leading to damage, is termed *oxidative stress*".

Sies H. Exp Physiol. 1997



Powers SK et al. Antioxid. Redox Signal. 2011 - modified

Glutathione synthetic capacity directly modulates oxidative stress



CHRONIC DISEASES AND MUSCLE WAISTING

COPD

CHRONIC INACTIVITY

Exacerbations

Systemic inflammation
Oxidative stress

Anabolic/Catabolic disequilibrium

HYPOXIA

COPD Skeletal Muscle Disease

Man WDC et al. Clinical Science (2009) – Adapted

Recommended Dietary Allowance (RDA) for protein

~0.83 g/kg/d

European Food Safety Agency, 2012
Food and Nutrition Board, 2002

Net balance of body proteins

Difference between *nitrogen intake* and *total nitrogen loss*

Nitrogen Balance technique has limitations →

- Systematic errors:
  overestimated intake
  underestimated losses
  (Millward DJ. J Nutr. 1998)
- Conceptual limitation:
  metabolic adaptation to nitrogen intakes
  (Young VR. J Nutr. 1986)

RDA → No differences between gender and age
(Conley TB et al. J Nutr Biochem. 2013)

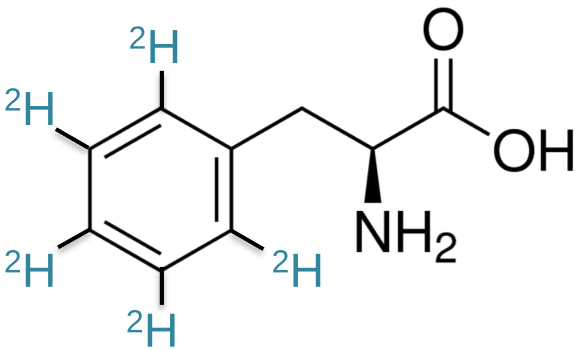
METODOLOGIA

Gold-standard technique to determining protein needs

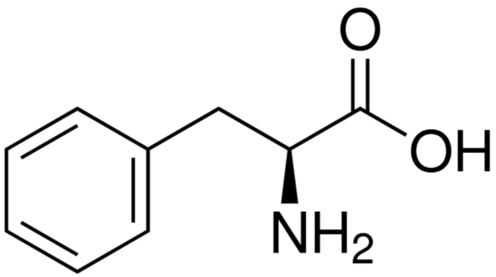
Measurement of whole-body protein metabolism using stable isotope-labeled amino acids

Antonione et al., 2008

[ring-$^{2}H_{5}$] – Phenylalanine



Phenylalanine



- Chemically identical
- Follow the same metabolic fate
- Non radioactive
- Evaluable through GCMS

- Long-lasting
- Complex
- Decreased compliance
- Expansive

PlanHab

PLANETARY HABITAT SIMULATION

STUDY DESIGN

- 10 healthy men. Each subject participated in a randomized crossing-over design study.
- 3 campaigns, 2 months washout.

3 different experimental protocols were performed:

10-d BED REST IN NORMOXIC CONDITION

10-d BED REST IN HYPOXIC CONDITION

10-d NORMAL PHYSICAL ACTIVITY IN HYPOXIC CONDITION

- Participants were kept in isocaloric condition.
- Hypoxia levels: 12.5 kPa = 4000 mt. above the sea.

STUDY DESIGN

10-d BED REST IN NORMOXIC CONDITION

10-d BED REST IN HYPOXIC CONDITION

10-d NORMAL PHYSICAL ACTIVITY IN HYPOXIC CONDITION

BDC-1 | **10th-d**

- **7:00 AM**
- **Fasting state**
- **Body composition: DXA**
- **Baseline blood collection (t_0)**
- **Polyethylene catheter inserted into the antecubital veins of both arms**

[ring-$^2H_5$] – Phenylalanine INFUSION

$^2H_2$ – Tyrosine INFUSION

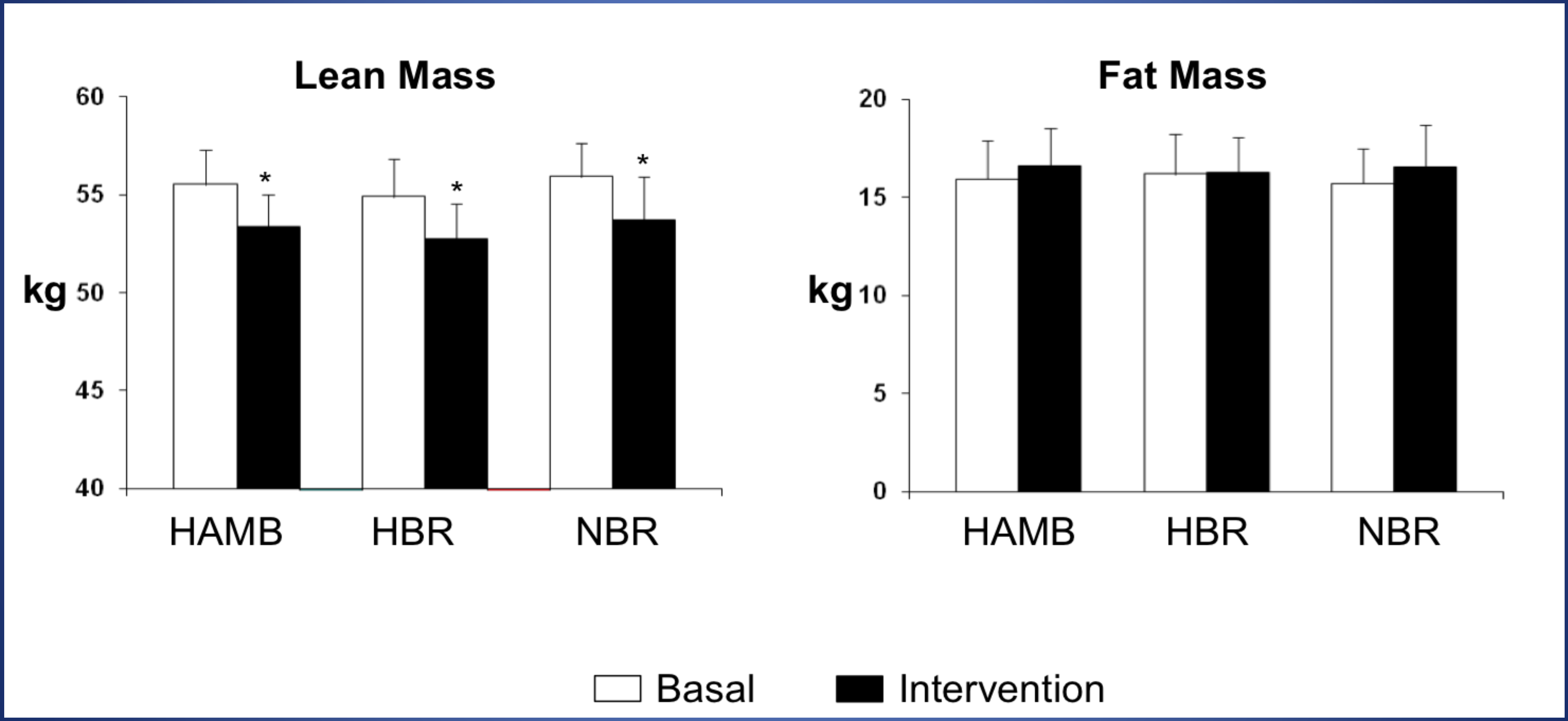
} Whole body protein metabolism

0 1 2 3 4 5 6 7 hrs

Blood draw (0) **Blood draw** (3) **Blood draw** (5) **Blood draw** (7)

BODY COMPOSITION

Assessed by DEXA
(Discovery W—QDr series, Hologic, Bedford USA)



HAMB = Hypoxia in ambulatory condition
HBR = Hypoxic bed rest
NBR = Normoxic bed rest

Debevec T. et al. 2014

Our preliminary data from bed rest studies

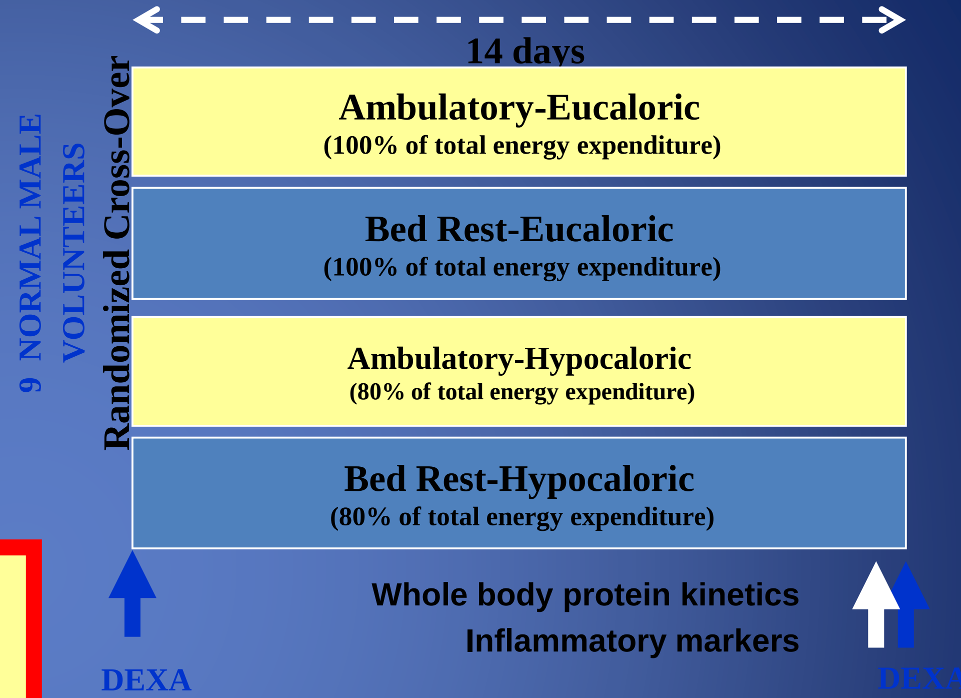
Calorie restriction accelerates the catabolism of lean body mass during 2 wk of bed rest[1–3]

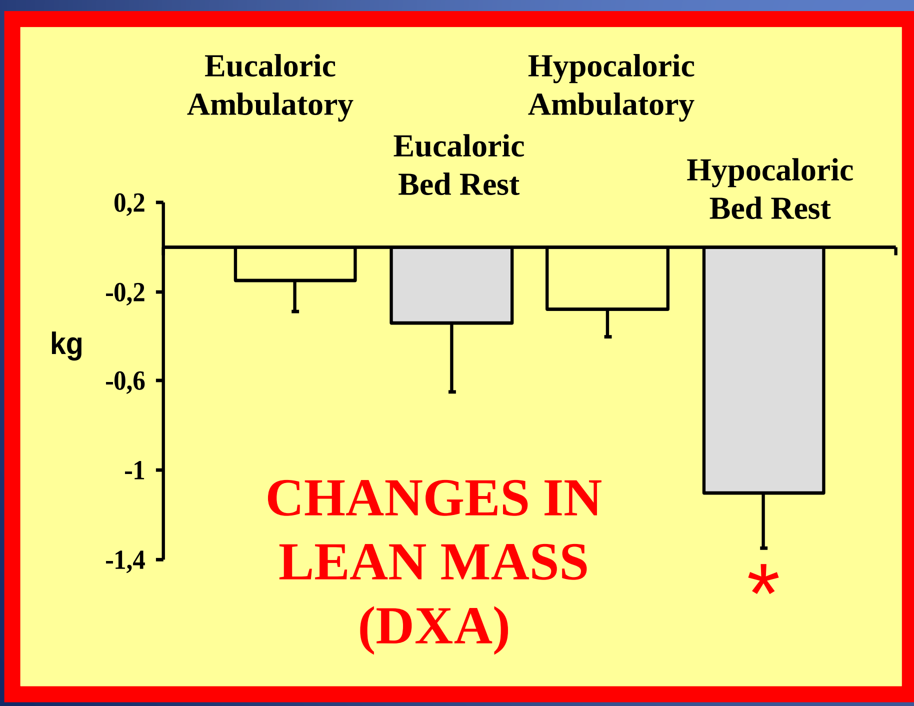
Gianni Biolo, Beniamino Ciocchi, Manuela Stulle, Alessandra Bosutti, Rocco Barazzoni, Michela Zanetti, Raffaella Antonione, Marion Lebenstedt, Petra Platen, Martina Heer, and Gianfranco Guarnieri

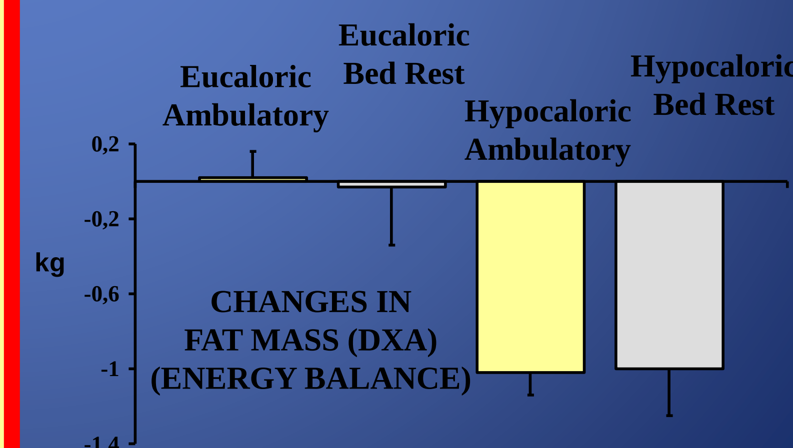
Am J Clin Nutr 2007;86:366–72.

EXPERIMENTAL PROTOCOL

STBR study DLR – Cologne – Germany







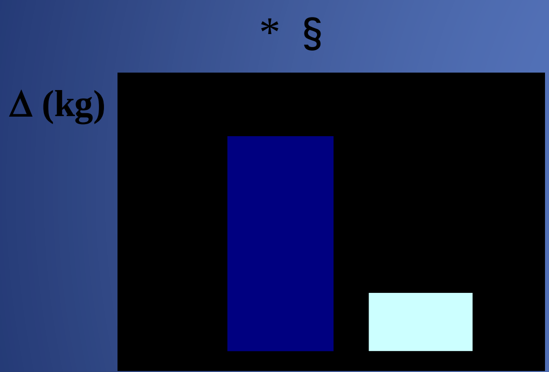
Our preliminary data from bed rest studies

Positive energy balance is associated with accelerated muscle atrophy and increased erythrocyte glutathione turnover during 5 wk of bed rest[1–3]

Gianni Biolo, Francesco Agostini, Bostjan Simunic, Mariella Sturma, Lucio Torelli, Jean Charles Preiser, Ginette Deby-Dupont, Paolo Magni, Felice Strollo, Pietro di Prampero, Gianfranco Guarnieri, Igor
Rado Pišot, and Marco V Narici

Am J Clin Nutr 2008;88:950–8.

Changes in fat mass (bioimpedence)



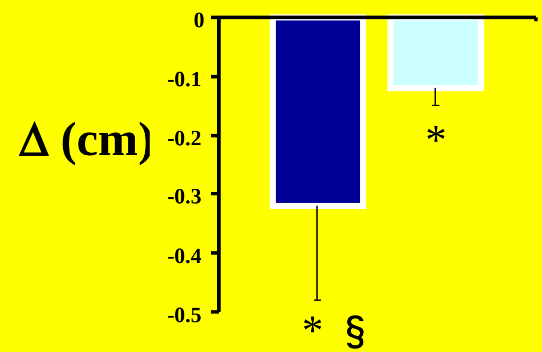
Positive Energy Balance

Near-neutral Energy Balance

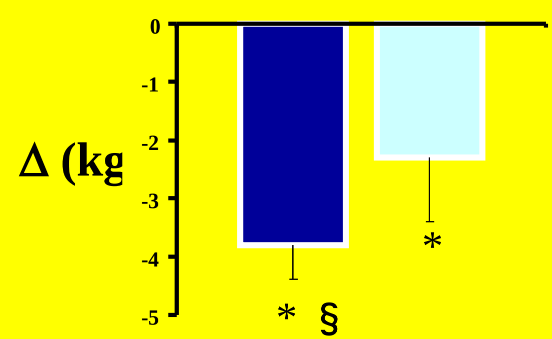
*, p<0.05 significant different from zero;
§, p<0.05 versus near-neutral energy balance

EFFECTS OF POSITIVE ENERGY BALANCE ON BED REST-MEDIATED MUSCLE ATROPHY

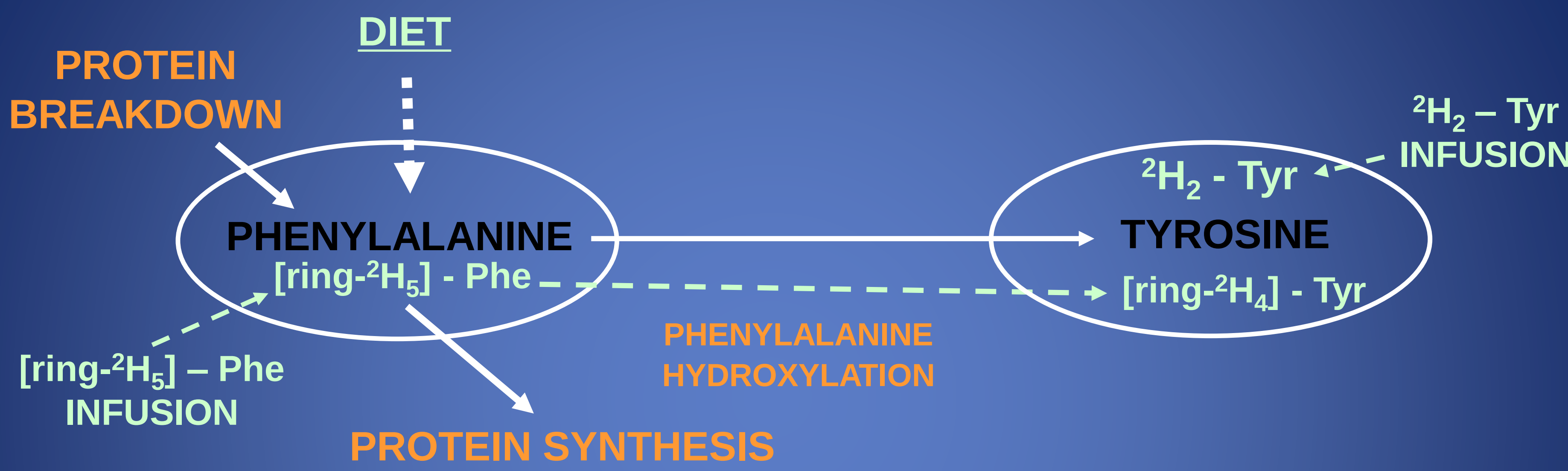
Changes in vastus lateralis thickness (ultrasounds)



Changes in fat-free mass (bioimpedence)



MEASUREMENT OF WHOLE-BODY PROTEIN METABOLISM IN VIVO



Phenylalanine and Tyrosine metabolic measurements

PROTEIN KINETICS

$$Phe_B = \frac{IR\ [ring\text{-}^2H_5]\text{-}Phe}{E\ [ring\text{-}^2H_5]\text{-}Phe}$$

$$Phe_{hydrox} = \frac{IR\ ^2H_2\text{-}Tyr \times E\ [ring\text{-}^2H_4]\text{-}Tyr}{E\ ^2H_2\text{-}Tyr \times E\ [ring\text{-}^2H_5]\text{-}Phe}$$

$$Phe_S = Phe_B - Phe_{hydrox}$$

IR = Infusion rate

E = Enrichment

Phe_S = Protein Synthesis

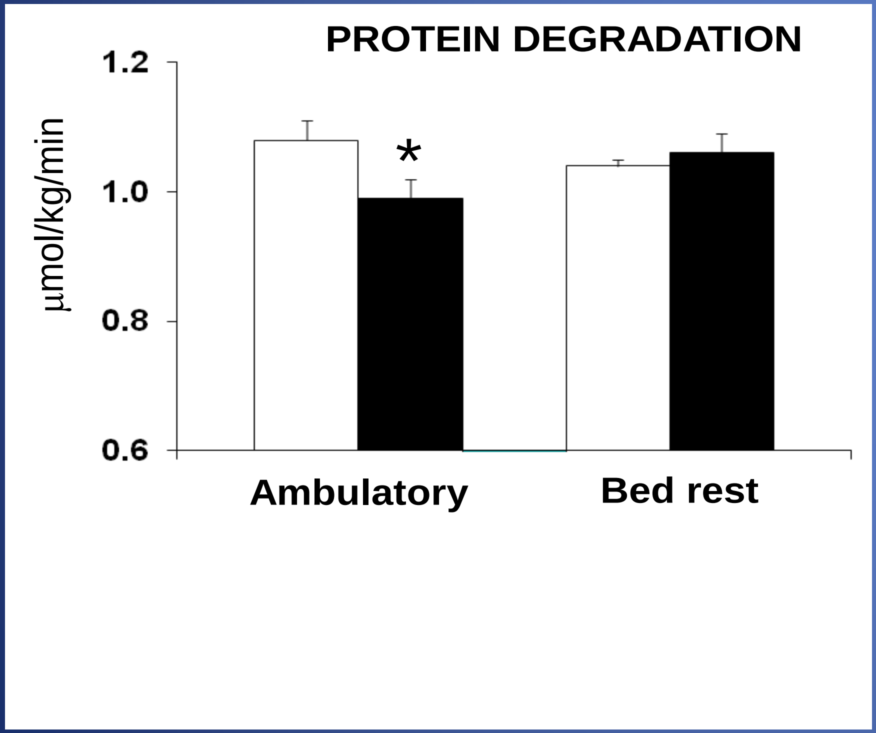
Phe_B = Protein Breakdown

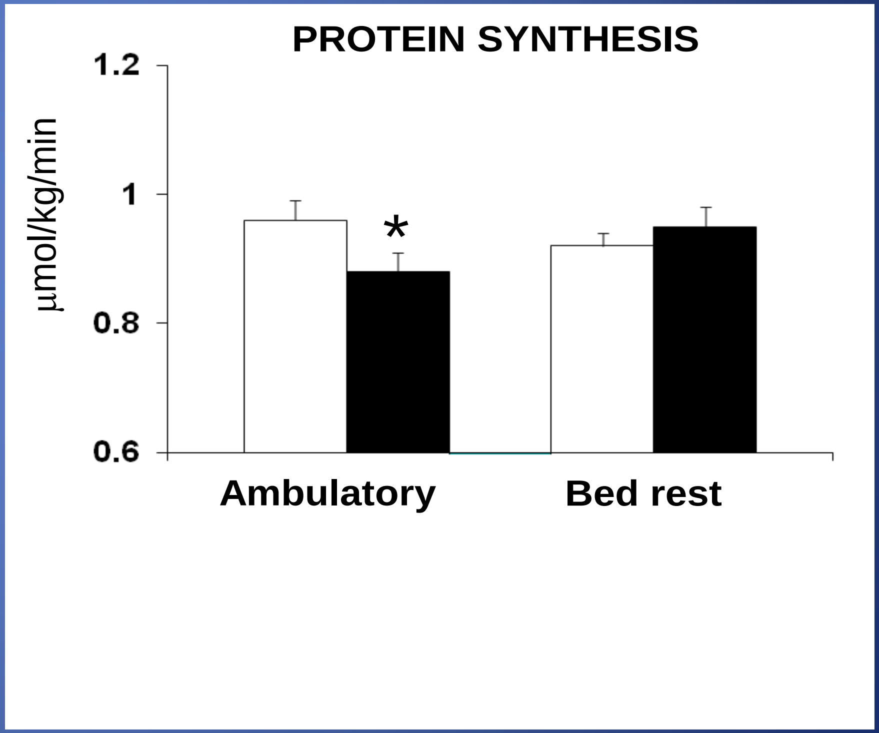
Phe_{hydrox} = Phenylalanin to Tyrosin hydroxylation

RESULTS

EFFECTS OF 10-d BED REST AND/OR 10-d EXPOSURE TO HYPOXIA ON PROTEIN KINETICS

*p<005

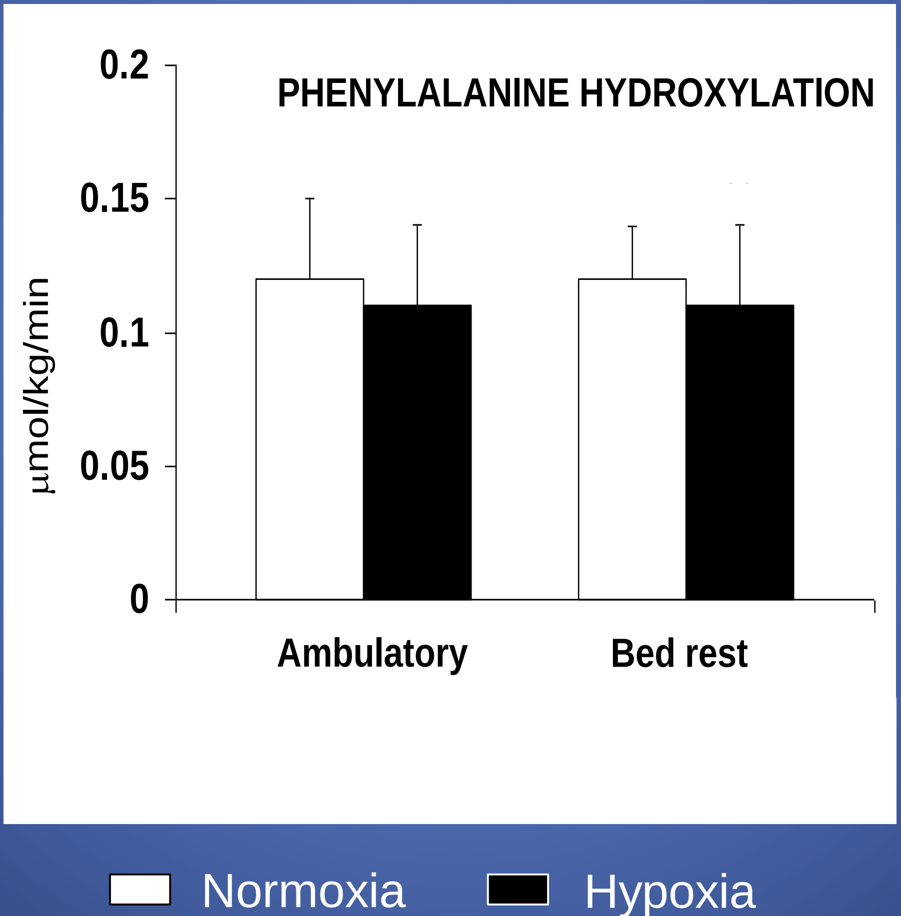




Normoxia Hypoxia

RESULTS

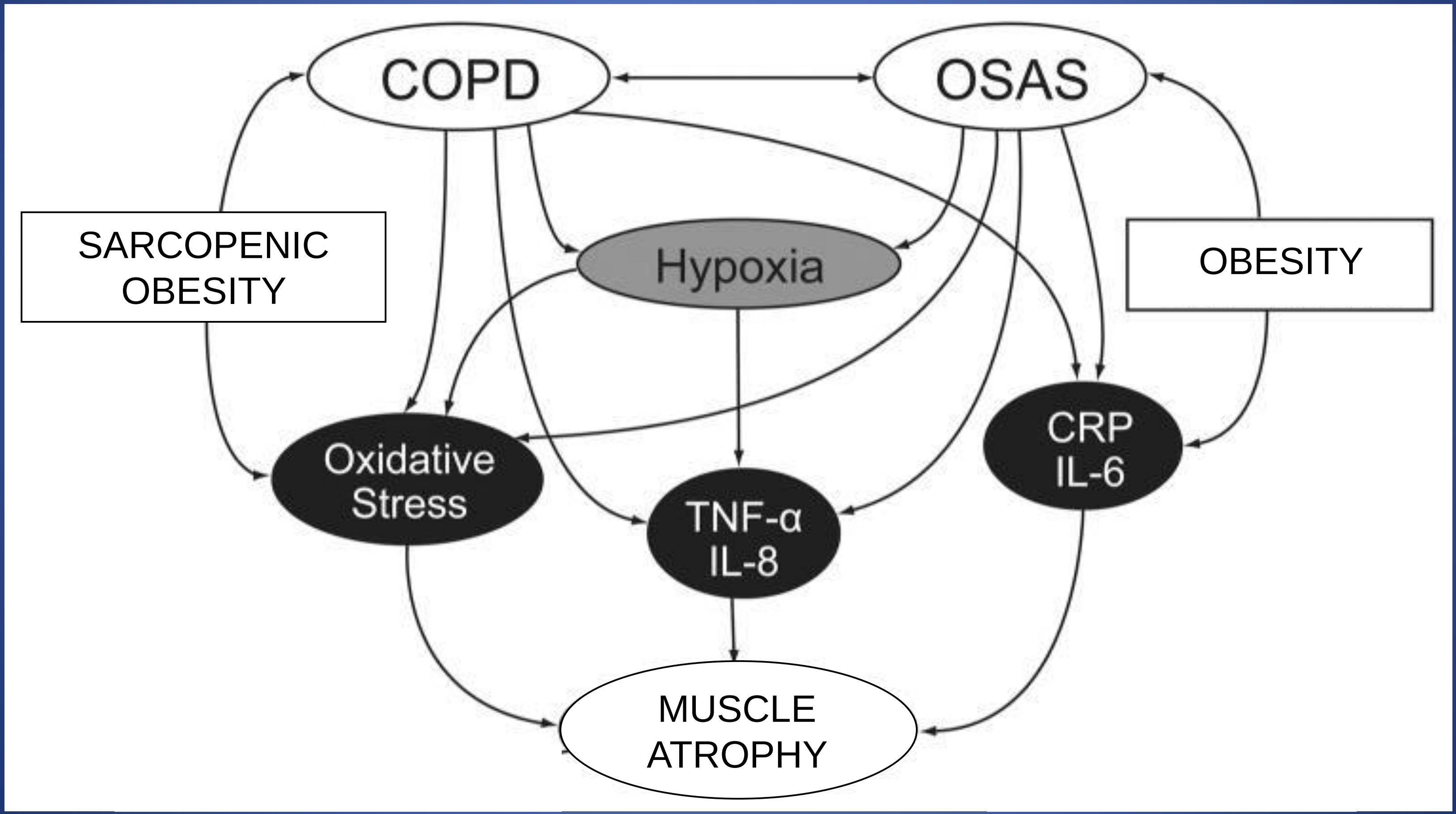
EFFECTS OF 10-d BED REST AND/OR 10-d EXPOSURE TO HYPOXIA ON PROTEIN KINETICS



CONCLUSIONI

- Chronic exposure to experimental hypoxia decreases whole body protein synthesis in the post-absorptive state, suggesting an increased protein requirement.

SARCOPENIA: Effect of hypoxia



McNicholas WT et al. AM J Respir Crit Care Med (2009) – Adapted

SARCOPENIA

ANABOLIC RESISTANCE TO AMINO ACID AND PROTEIN

MUSCLE ATROPHY

FAT MASS DEPOSITION

REDUCTION IN PHYSICAL ACTIVITY

OXIDATIVE STRESS

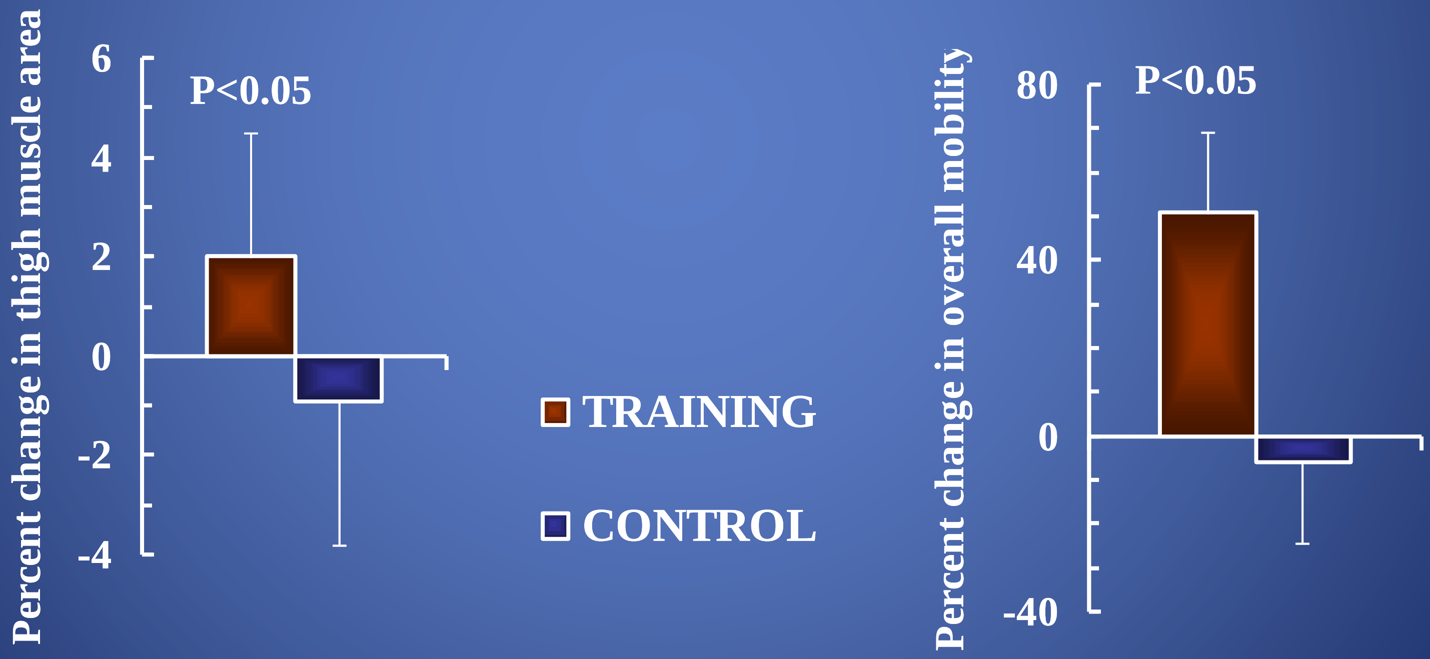
SYSTEMIC CHRONIC INFLAMMATION

INSULIN-RESISTANCE

Exercise Training for Physical Frailty in Very Elderly People

Fiatarone et al., New Engl J Med 1994

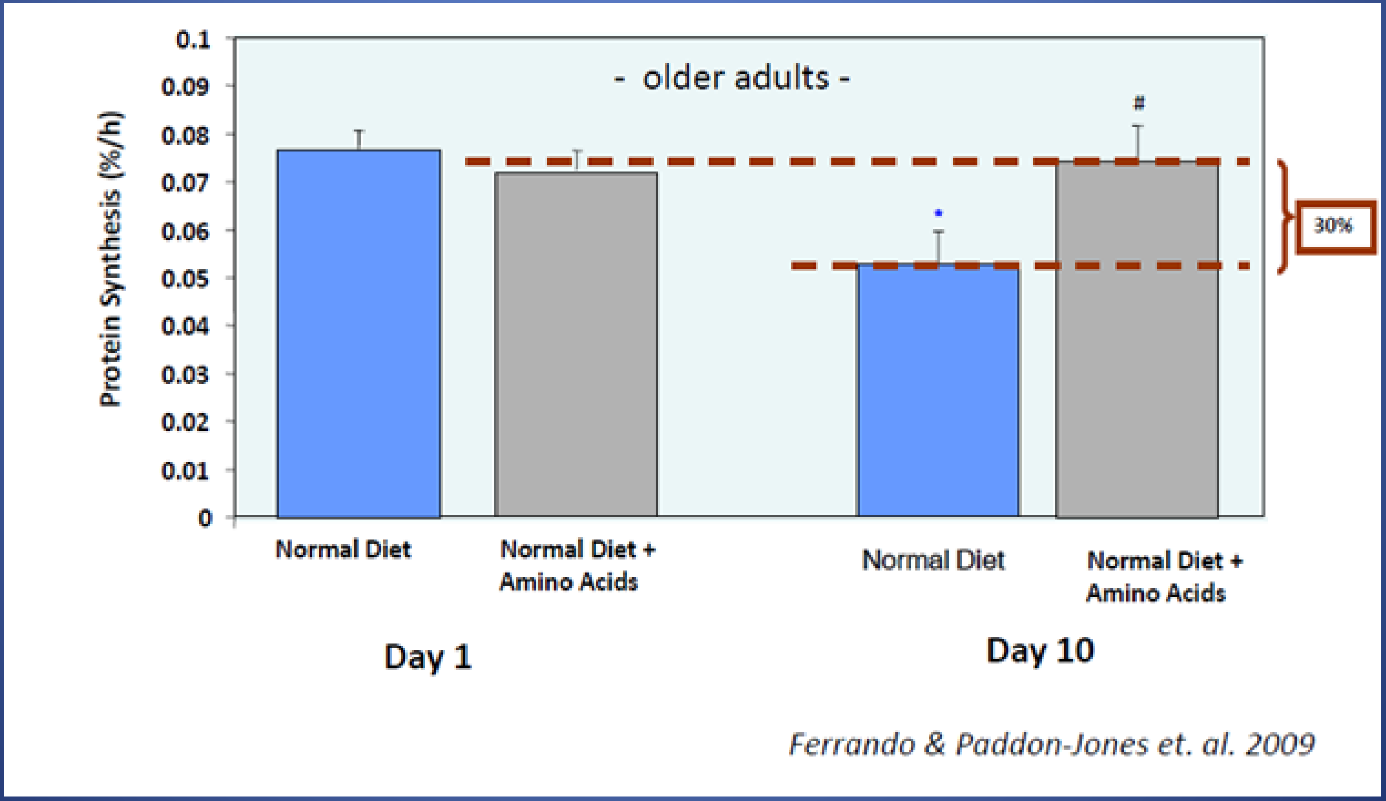
Randomized, placebo-controlled trial. 100 frail nursing home residents. Progressive resistance exercise training over a 10-week period.



Aging, immobilization and anabolic resistance

EAA supplementation to increase nitrogen intake improves muscle function during bed rest in the elderly☆

Clinical nutrition



PANGEA

TELESNA AKTIVNOST IN PREHRANA ZA KAKOVOSTNO STARANJE

ATTIVITÀ FISICA E NUTRIZIONE PER UN INVECCHIAMENTO DI QUALITÀ

2007-2013

cooperazione territoriale europea
programma per la cooperazione transfrontaliera
Italia-Slovenia

evropsko teritorialno sodelovanje
program čezmejnega sodelovanja
Slovenija-Italija

PANGeA

Attività fisica e nutrizione per un invecchiamento di qualità

Javni razpis 02/2009 / PANGeA / 01.10.2011- 30.09.2014

Banco pubblico 02/2009 / PANGeA / 01.10.2011- 30.09.2014

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Progetto cofinanziato dal Fondo europeo di sviluppo regionale

Projekt sofinancira Evropski sklad za regionalni razvoj

UNIVERSITÀ DEGLI STUDI DI TRIESTE

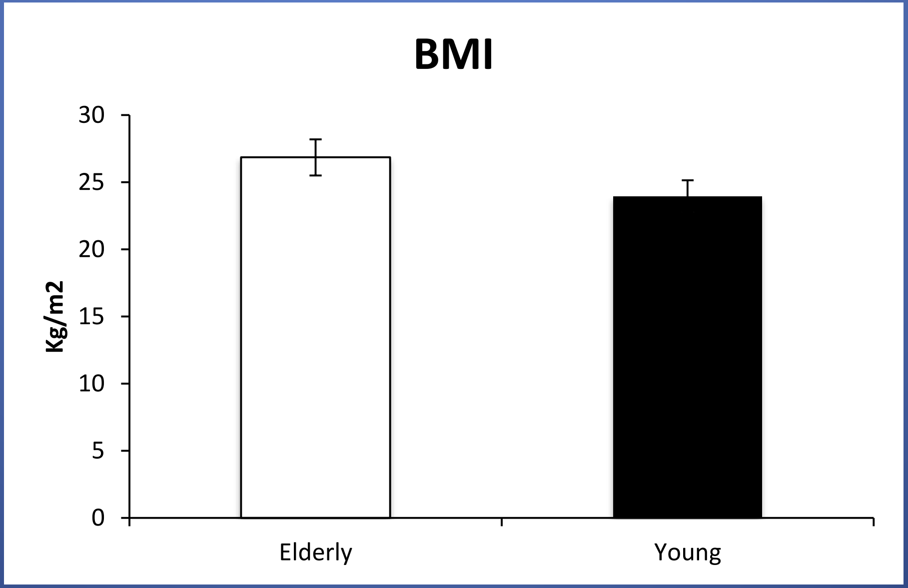
VOLONTARI

8 Elderly volunteers

Age (y): 59 ± 1
Height (m): 1.73 ± 0.04
Weight (kg): 79.6 ± 10.5

7 Young volunteers

Age (y): 23 ± 1
Height (m): 1.77 ± 0.07
Weight (kg): 74.8 ± 8.8



DISEGNO SPERIMENTALE

7 healthy young (23±1y) subjects

8 healthy old (59±1y) subjects

Ambulatory | **Bed rest**

-7 — **BR 0** — **BR 7** — **BR 14**

- **Body composition: bioimpedance**
- **Metabolic test: Oral Meal Test + D5-Phe load**

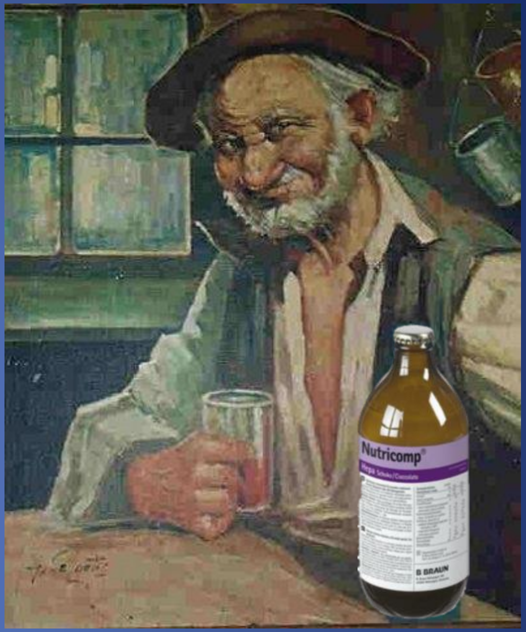
- **Participants were kept in isocaloric condition.**

PANGEA
TELESNA AKTIVNOST IN PREHRANA ZA KAKOVOSTNO STARANJE
ATTIVITÀ FISICA E NUTRIZIONE PER UN INVECCHIAMENTO DI QUALITÀ

PROCEDURA SPERIMENTALE

ORAL MEAL TEST and D5-Phe BOLUS

- 7:00 AM
- Fasting state (12h)
- Baseline blood collection (t_0)
- Drink in 5 min
- Duration: 6h (1 blood sample per hour)

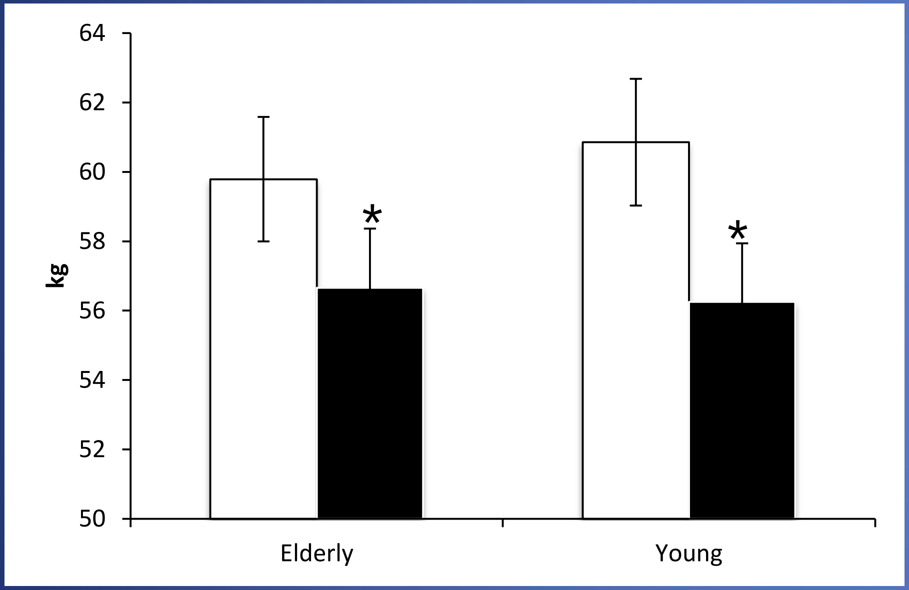


☆ *Meal test* administration (55% carbohydrate, 15% proteins, 30% lipids)
☆ Oral administration of a single bolus of 0.3g of D5-Phe
↑ Blood draw for baseline data collection
↑ Blood draw

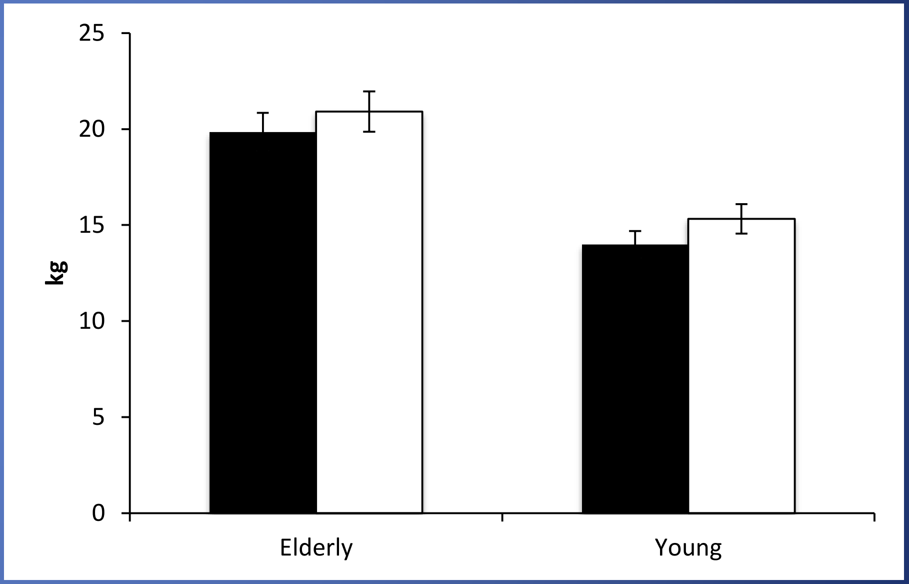
COMPOSIZIONE CORPOREA

Assessed by BIOIMPEDANCE

MASSA MAGRA



MASSA GRASSA

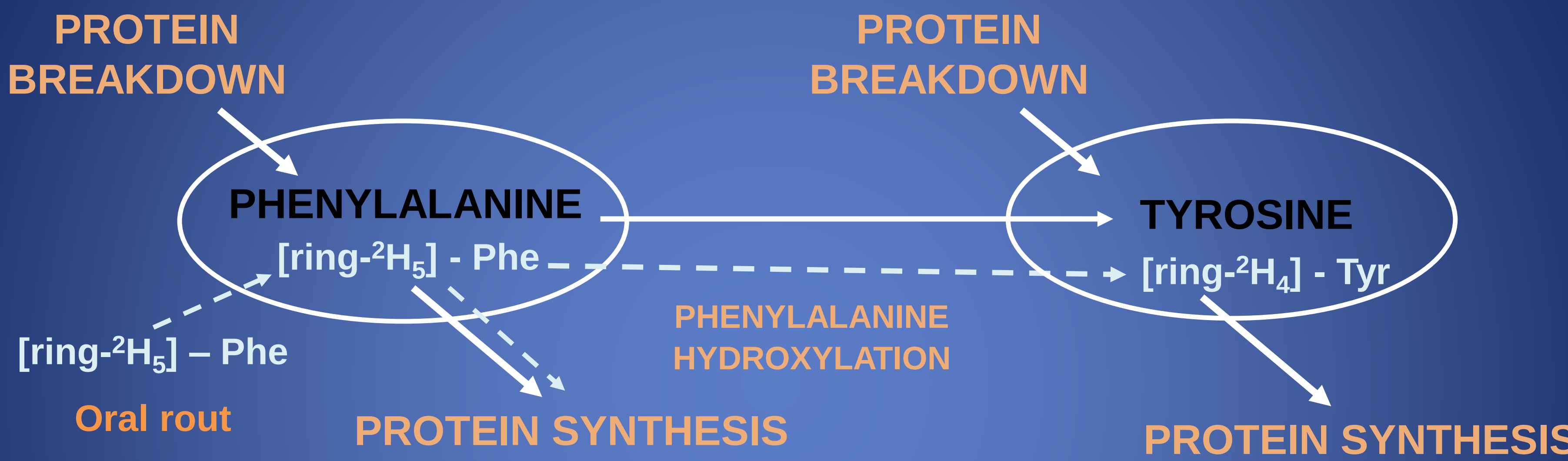


□ BDC-1 ■ BR 14

* = $p < 0.05$

PANGEA
TELESNA AKTIVNOST IN PREHRANA ZA KAKOVOSTNO STARANJE
ATTIVITÀ FISICA E NUTRIZIONE PER UN INVECCHIAMENTO DI QUALITÀ

MISURAZIONE DELLA RISPOSTA ANABOLICA IN VIVO



Unlabelled amino acids concentrations

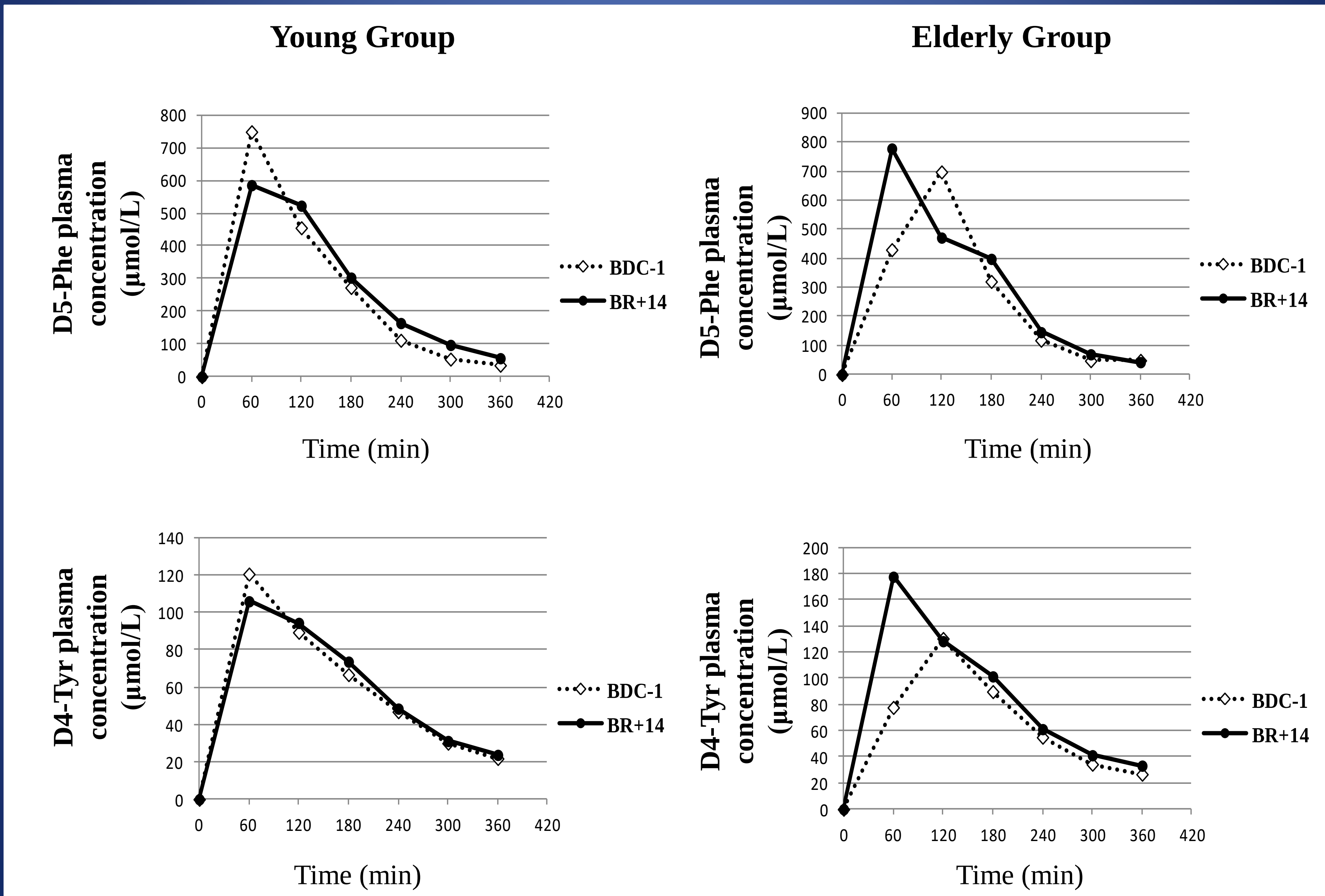
$$[aa] = \frac{a \times (E - E_{t0})}{100}$$

D5-Phe and D4-Tyr concentrations

$$[aa^*] = \frac{[aa] \times TTR}{100}$$

$[aa^*]$ concentration of the labelled amino acids
$[aa]$ concentration of the unlabelled amino acids
a = concentration of the internal standard
$E - E_{t0}$ = difference between the isotopic enrichment of the internal standard and the natural enrichment
TTR = difference between the enrichment of the labelled amino acids and the unlabelled amino acids

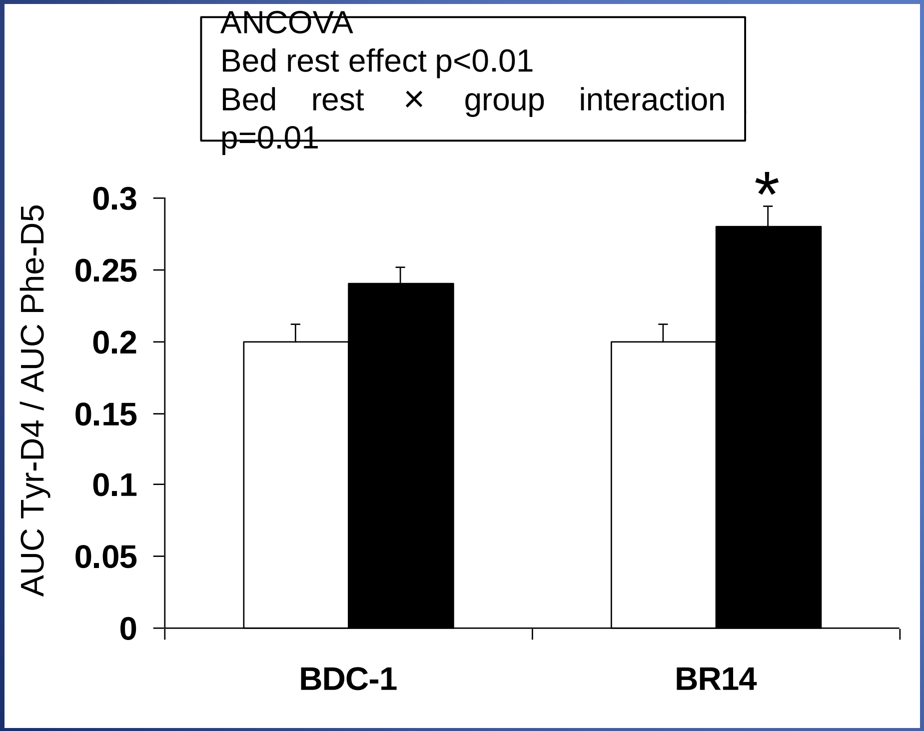
RISULTATI


Young Group
Elderly Group
D5-Phe plasma concentration (µmol/L)
D4-Tyr plasma concentration (µmol/L)
Time (min)
BDC-1
BR+14
0
60
120
180
240
300
360
420

RISULTATI

ANABOLIC RESISTANCE: A NEW METHOD

AUC D4-Tyr / AUC D5-Phe (T_0-T_{360})

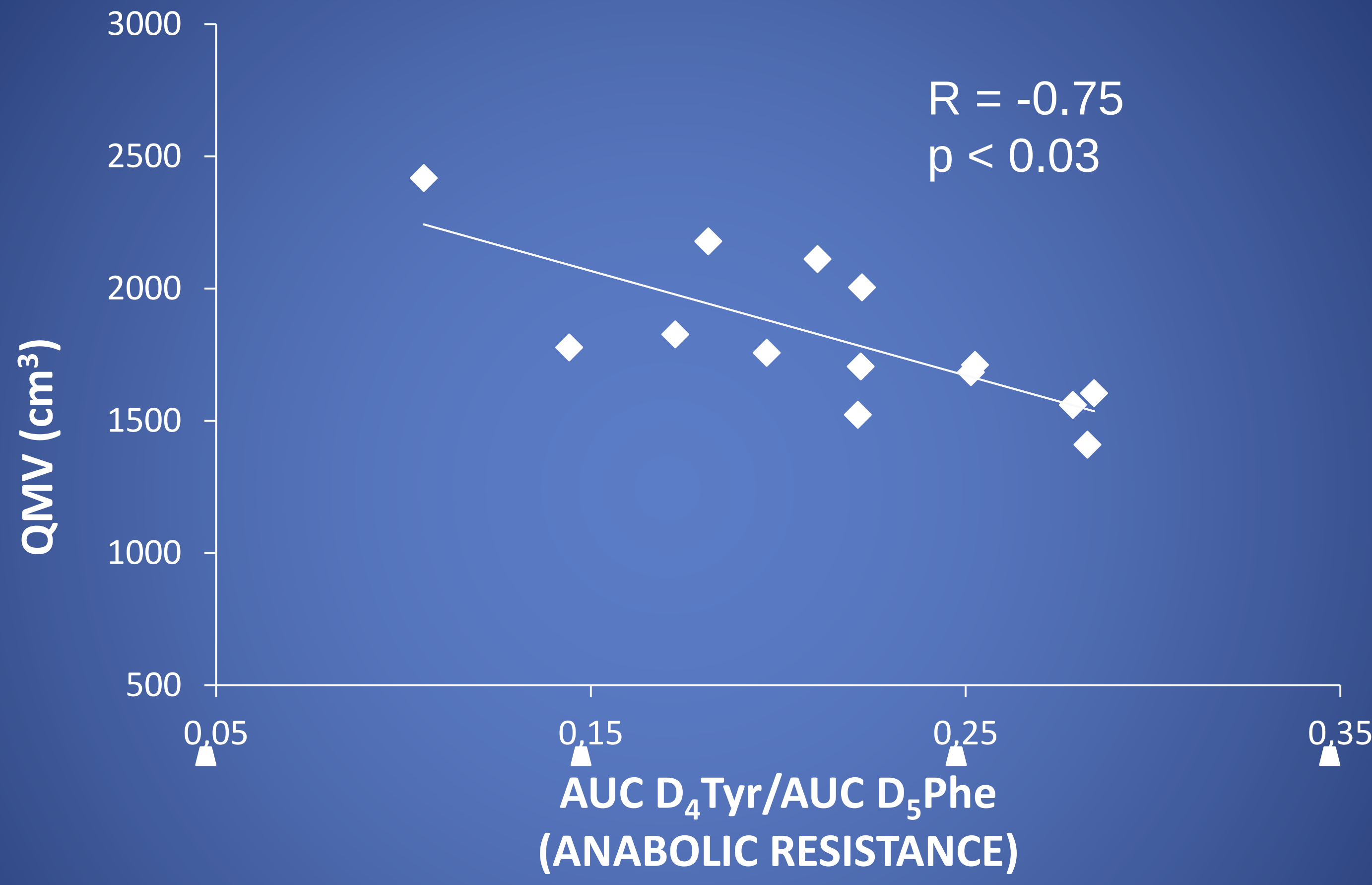


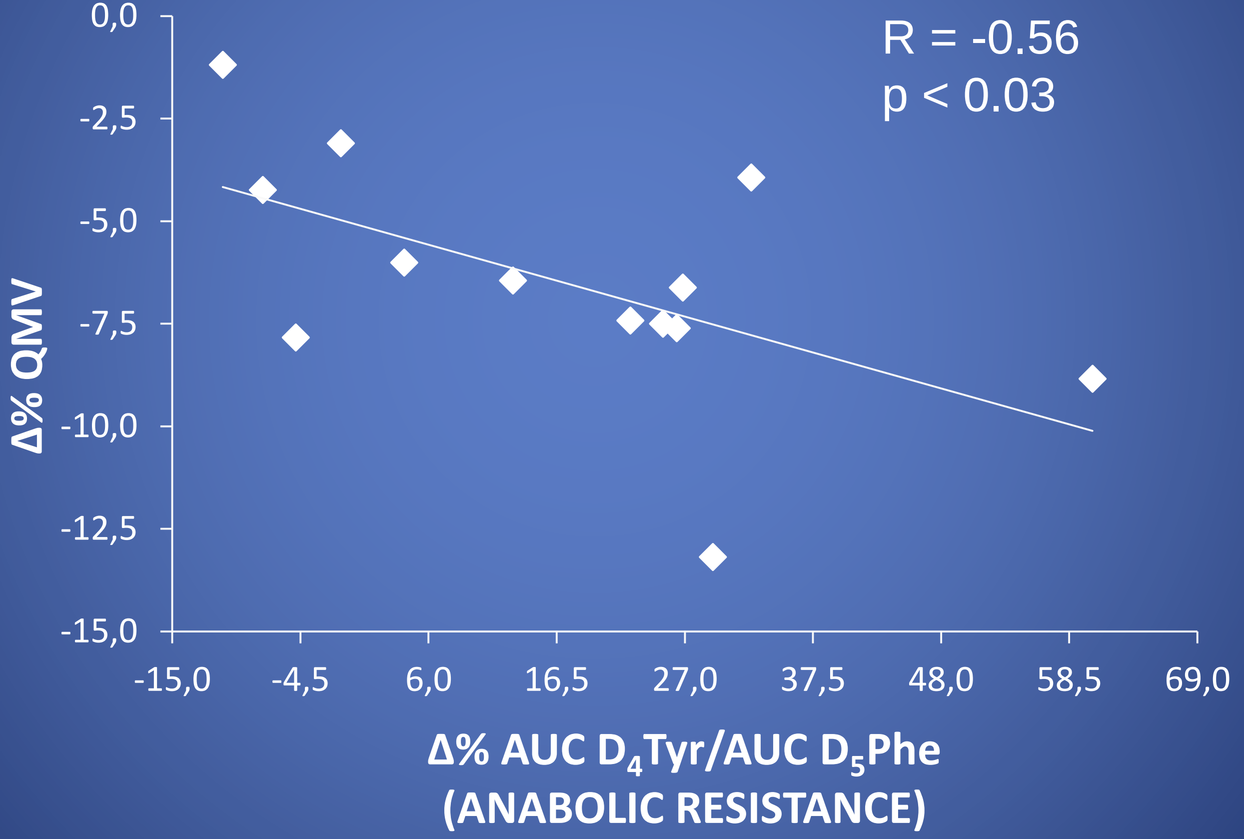
VARIATION (%)

+5±9% YOUNG

+19±7% ELDERLY

■ Elderly □ Young

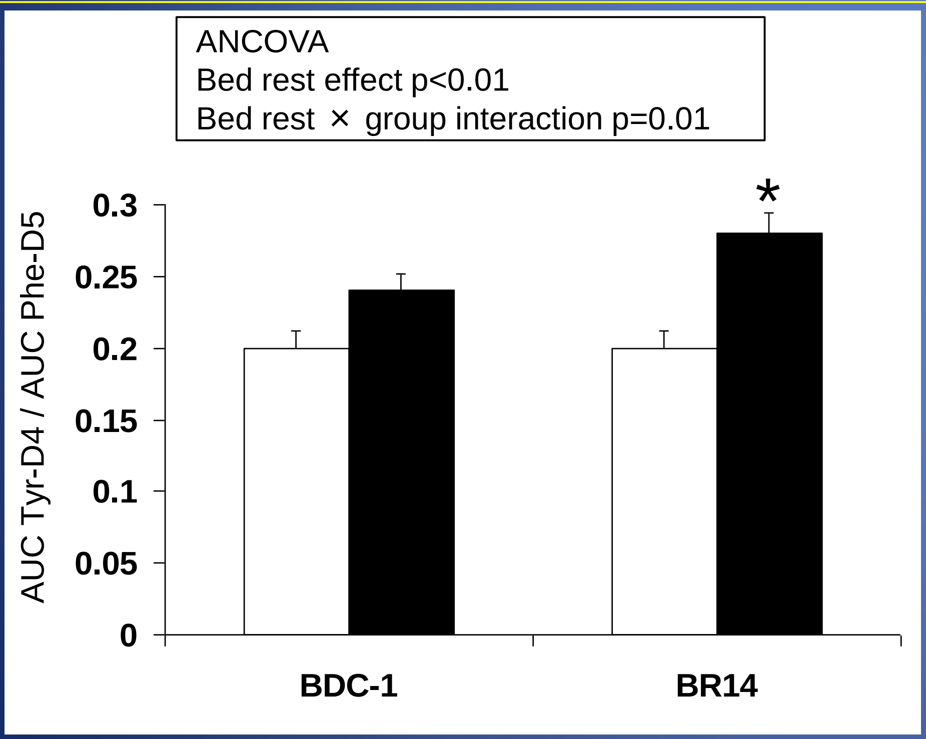

R = -0.75
p < 0.03
QMV (cm3)
3000
2500
2000
1500
1000
500
0.05
0.15
0.25
0.35
AUC D4Tyr/AUC D5Phe
(ANABOLIC RESISTANCE)


R = -0.56
p < 0.03
0,0
-2,5
-5,0
-7,5
-10,0
-12,5
-15,0
Δ% QMV
-15,0
-4,5
6,0
16,5
27,0
37,5
48,0
58,5
69,0
Δ% AUC D4Tyr/AUC D5Phe
(ANABOLIC RESISTANCE)

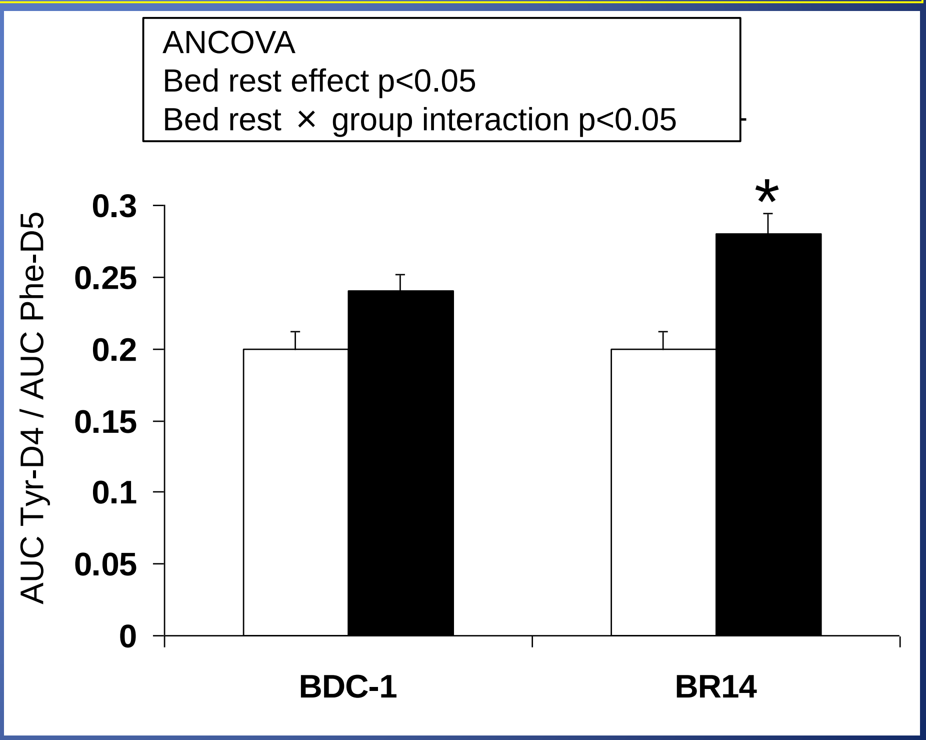
RISULTATI

ANABOLIC RESISTANCE: A NEW METHOD

AUC D4-Tyr / AUC D5-Phe (T_0-T_{360})



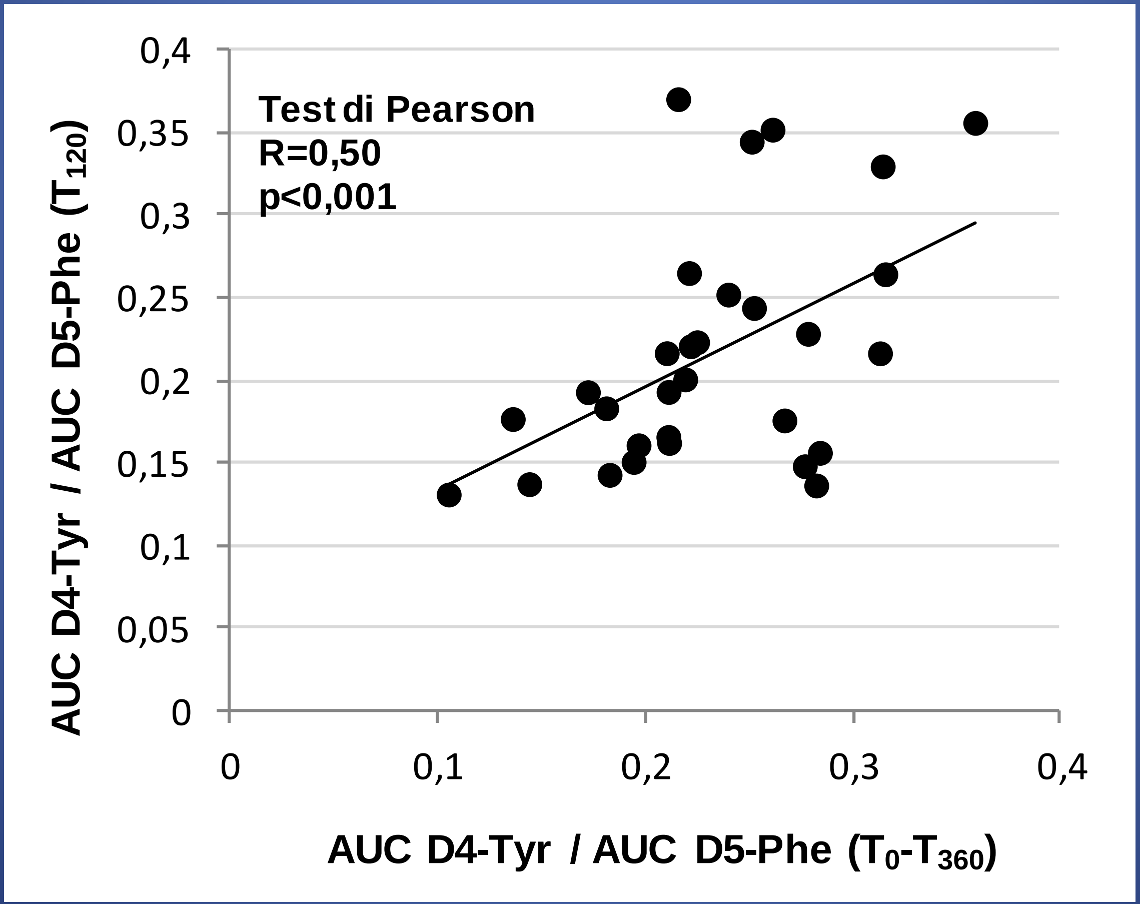
AUC D4-Tyr / AUC D5-Phe (T_0-T_{120})



□ BDC-1 ■ BR 14

RISULTATI

ANABOLIC RESISTANCE: A NEW METHOD



- Ageing and immobilization determine the development of anabolic resistance.

- We proposed a new easier method to assess anabolic resistance.

This new, simple, method:

- Is safe (no need of aseptic tracer solution).
- reduces time and costs.
- improves compliance of evaluated individuals.

PROTEIN INTAKE

quantity

&

quality

protein quantity

Recommended Dietary Allowance (RDA) for protein

~0.83 g/kg/d

European Food Safety Agency, 2012
Food and Nutrition Board, 2002

RDA → No differences between gender and age
(Conley TB et al. J Nutr Biochem. 2013)

Optimal protein intake in the elderly

Robert R. Wolfe [a,*], Sharon L. Miller [b], Kevin B. Miller [c]

"The RDA was based on the results of the available studies that estimated the *minimum protein intake* necessary to avoid a progressive loss of lean body mass as determined by nitrogen balance and may, therefore, not be adequate in many conditions"

Clinical Nutrition (2008) **27**, 675–684

Optimal protein intake in the elderly

Robert R. Wolfe [a,*], Sharon L. Miller [b], Kevin B. Miller [c]

There is an evidence that **the RDA for elderly** may be **greater than 0.8 g/kg/day** to **improve muscle mass, strength and function** as well as to improve immune status, wound healing, blood pressure and bone health

Clinical Nutrition (2008) **27**, 675–684

"Protein intakes above the RDA value have *no benefit* and may pose *long-term health risks*."

Conley TB et al. J Nutr Biochem.

Higher protein intake has been shown to be useful in subjects with:

- *Ageing* *(accepted)*
- *COPD* *(controversial)*
- *Obesity* *(controversial)*
- *Type 2 diabetes* *(controversial)*
- *Heart disease* *(controversial)*

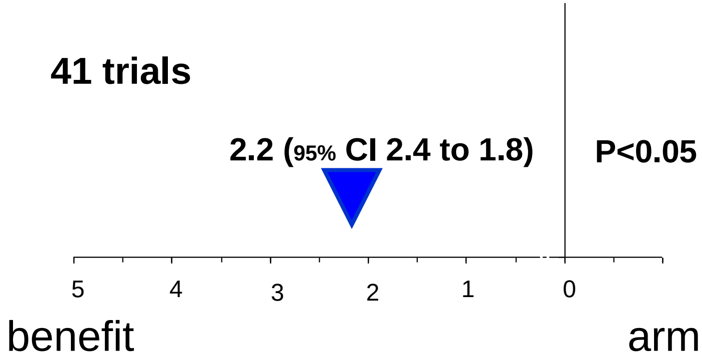
→ ***SARCOPENIA***

Layman DK *Nutrition & Metabolism*, 2009

Protein and energy supplementation in elderly people at risk from malnutrition

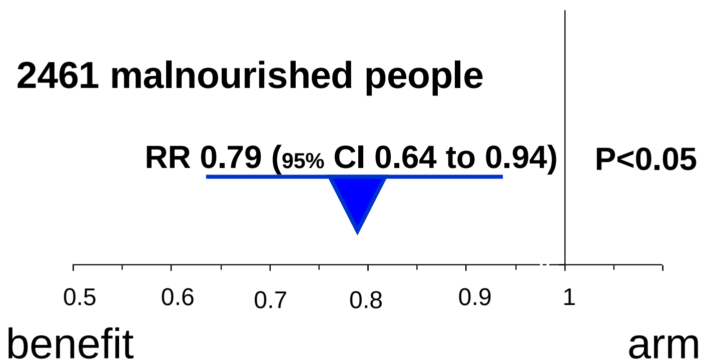
Cochrane Database Syst Rev 2009

% WEIGHT CHANGE

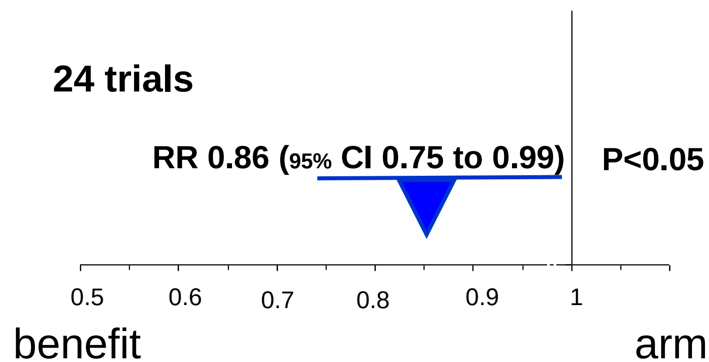


62 trials
10,187 participants
commercial “sip-feeds”
intervention < 18 months

MORTALITY



COMPLICATIONS



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], Yves Boirie MD, PhD [m]

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[g] *McMaster University, Hamilton, Ontario, Canada*
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[j] *Centre Hospitalier Universitaire Vaudois, Service de Néphrologie, Lausanne, Switzerland*
[k] *University of Adelaide, Adelaide, Australia*
[l] *University of Texas Medical Branch, Galveston, TX*
[m] *Université d' Auvergne, INRA, CRNH, Centre Hospitalier Universitaire, Clermont-Ferrand, France*

CHRONIC DISEASES

PROT-AGE recommendations for protein levels in geriatric patients with specific acute or chronic diseases

- The amount of additional dietary protein or supplemental protein needed depends on the disease, its severity, the patient's nutritional status prior to disease, as well as the disease impact on the patient's nutritional status.
- Most older adults who have an acute or chronic disease need more dietary protein (ie, 1.2–1.5 g/kg BW/d); people with severe illness or injury or with marked malnutrition may need as much as 2.0 g/kg BW/d.
- Older people with severe kidney disease (ie, estimated glomerular filtration rate [GFR] < 30 mL/min/1.73m^2) who are not on dialysis are an exception to the high-protein rule; these individuals need to limit protein intake.

JAMDA 14 (2013) 542–559

424 subjects with Cardiovascular Disease were enrolled at the "Cardiovascular Centre" of the Ospedale Maggiore (Trieste, Italy).

	Male (n=237)	Female (n=187)	Total (n=424)
AGE	68±12	69±14	68±13
BMI	26 [24-30]	25 [22-28]	26 [23-29]
Abdominal circumerence	98 [92-108]	90 [80-97]	95 [88-103]
CVD	73%	61%	68%
CV Events	30%	18%	25%

Protein intake according to level of physical activity

	METS = 0 **(n=238 - 61,6%)**	METS > 0 (n=148 – 38,4%)	p-value
GFR	64±24	71±21	0,665
Proteine g/kg/die	**0,52 [0,42-0,63]**	**0,55 [0,43-0,67]**	**0,035**
Eventi CV	25,6%	24,3%	0,774
Patologie CV	71,8%	62,2%	0,047
Rischio CV molto alto	54,6%	56,1%	0,779

- Only the 8% of the population reach the recommended protein intake (1 - 1,2 g/kg/die)
- Higher percentage of inactive subjects (61,6%)
- Lower protein intake in the inactive subjects
- High risk of SARCOPENIA

Tence M., Di Girolamo F.G., Biolo G. 2015

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HEALTHY AGEING

PROT-AGE recommendations for dietary protein intake in *healthy* older adults

- To maintain and regain muscle, older people need more dietary protein than do younger people; older people should consume an average daily intake in the range of 1.0 to 1.2 g/kg BW/d.
- The per-meal anabolic threshold of dietary protein/amino acid intake is higher in older individuals (ie, 25 to 30 g protein per meal, containing about 2.5 to 2.8 g leucine) in comparison with young adults.
- Protein source, timing of intake, and amino acid supplementation may be considered when making recommendations for dietary protein intake by older adults.
- More research studies with better methodologies are desired to fine tune protein needs in older adults.

JAMDA 14 (2013) 542–559

PROT-AGE recommendations for older people with kidney disease

Nondialysis CKD

- **Severe CKD, GFR <30***: Limit protein intake to 0.8 g/kg BW†/d
- **Moderate CKD, 30 <GFR <60:** Protein >0.8 g/kg BW†/d is safe, but GFR should be monitored 2x/year
- **Mild CKD, GFR >60:** Increase protein intake per patient needs

Hemodialysis

>1.2 g/kg BW†/d or, if achievable, 1.5 g/kg BW†/d‡

Peritoneal Dialysis

>1.2 g/kg BW†/d or, if achievable, 1.5 g/kg BW†/d‡

JAMDA 14 (2013) 542–559

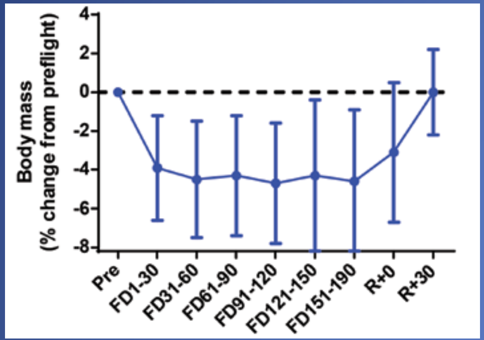
BW, body weight; CKD, chronic kidney disease; GFR, glomerular filtration rate.

*GFR is measured in mL/min/1.73 m^2.

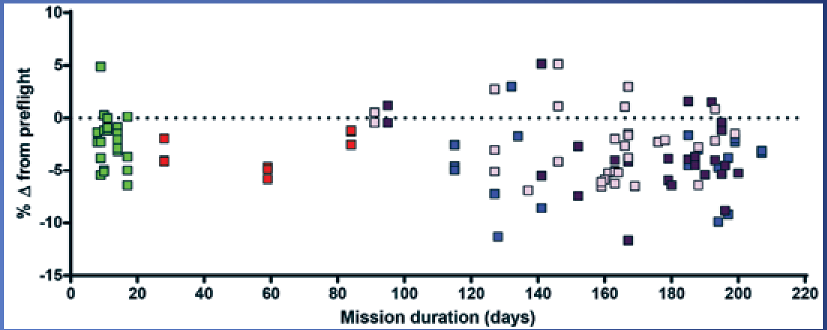
†Recommendations are based on ideal body weight. Regular follow-up supports compliance.

‡Prospective studies targeting these high protein intakes in older hemodialysis/peritoneal dialysis patients are not available.

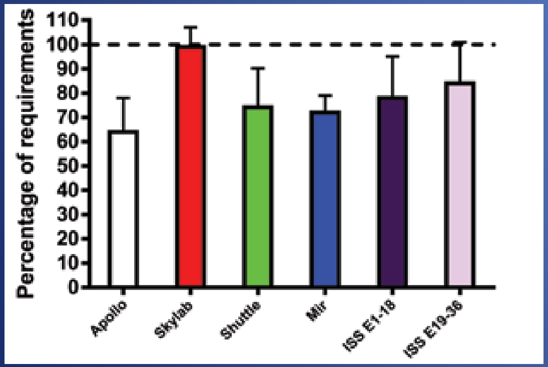
Data from previous space flight missions

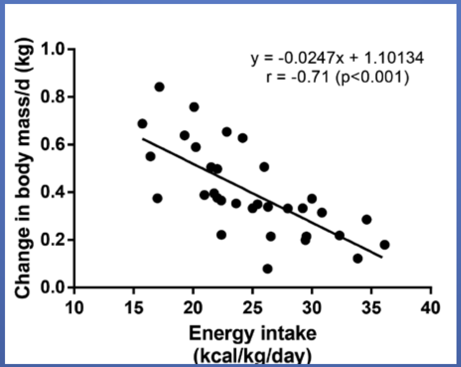


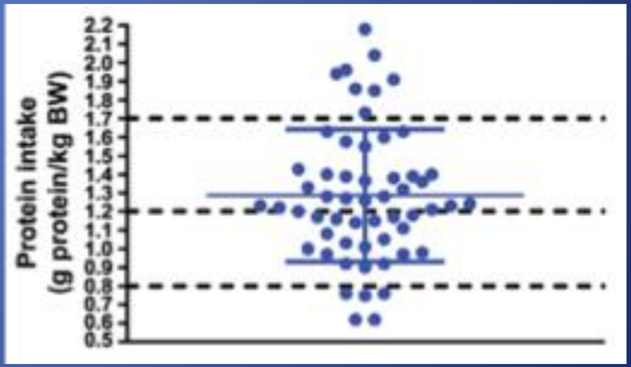
Body mass losses of 1-5% of preflight body mass have been a typical finding in the history of spaceflight



Changes in body weight on the day of landing relative to before flight.







US and Russian space programs

the Space Shuttle (N=25), Skylab (N=9), Mir (N=19), ISS Expeditions 1-18 (N=26), Expeditions 19-36 (N=31).

MISURAZIONI DI POPOLAZIONE

PANGEA
TELESNA AKTIVNOST IN PREHRANA ZA KAKOVOSTNO STARANJE
ATTIVITÀ FISICA E NUTRIZIONE PER UN INVECCHIAMENTO DI QUALITÀ

- Capodistria ✔☐
- Lubiana ✔☐
- Kranj ✔☐
- Udine ✔☐
- Trieste ✔
- Ferrara ✔

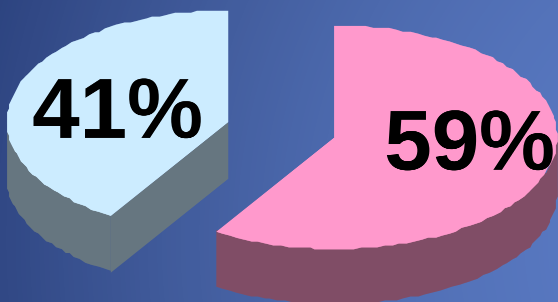
CRITERI PER L'ADESIONE

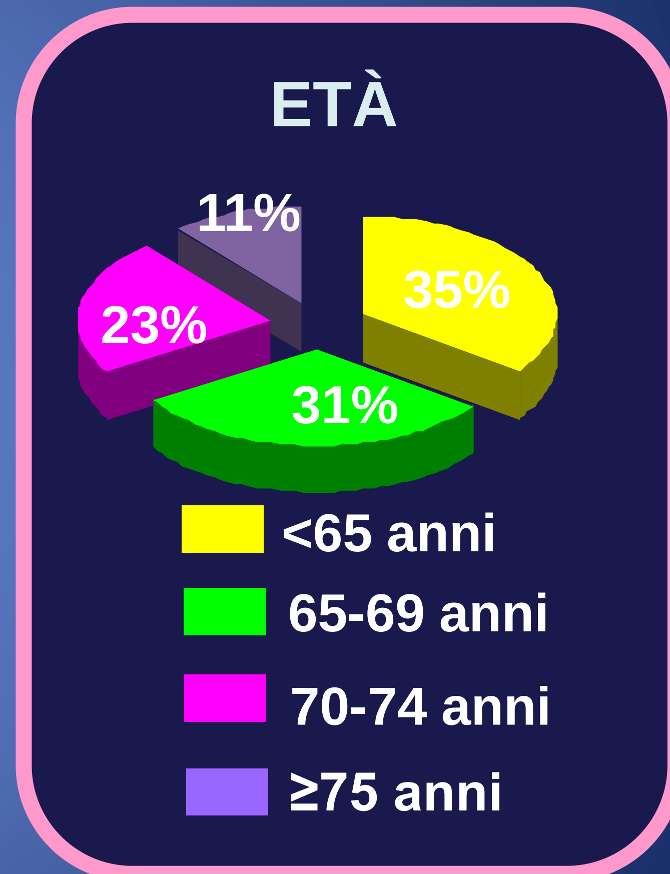
-**ETÀ** (non inferiore a 60 anni)
-**CAPACITÀ DI CAMMINO PER 2 KM**

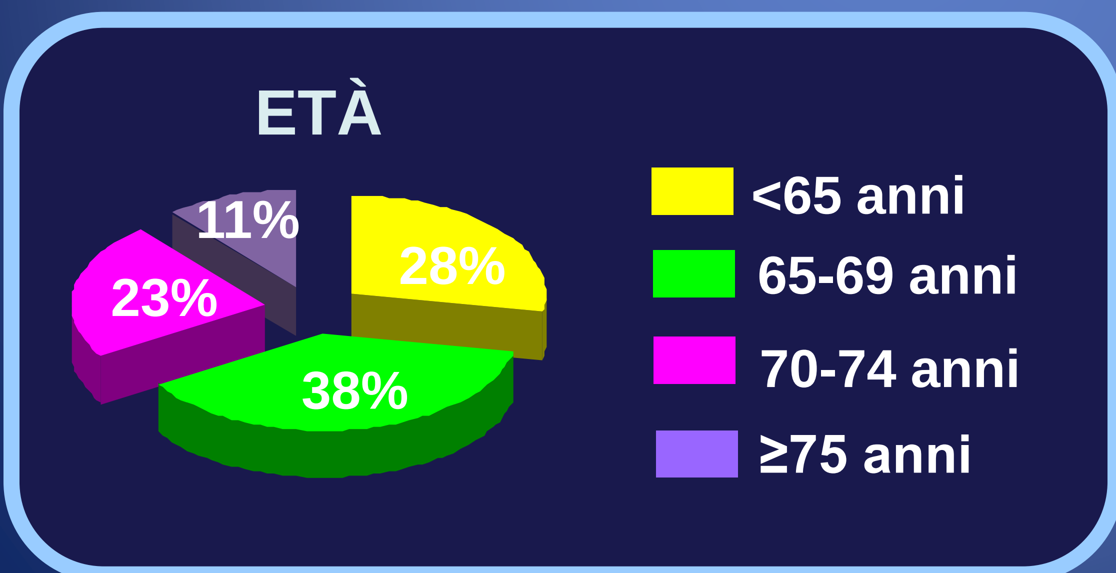
SOGGETTI SELEZIONATI

Femmine (range età: 60-78 anni)

Maschi (range età: 60-77 anni)







STUDIO DI POPOLAZIONE

COMPLEX
Questionnaire
Urine
Blood
Anthropometrics, bioimpedance
Ultrasound visceral fat measurement
ECG
Cardiovascular capabilities
Flexibility
Maximum force and balance
Gait
Reaction time, attention, memory, logic capabilities

circa 3h

BASIC
Short questionnaire
Anthropometrics, bioimpedance
Immediate annalisys of capillary blood
2 km walking test
dinamometrcs
10 m walking (3 repetitions)
flexibility – bent on a bench

circa 1,5h

ABITUDINI ALIMENTARI

24 HOUR RECALL (x2) e
QUESTIONARI DI FREQUENZA DI CONSUMO

DATA DI NASCITA________
GENERE - UOMO □ DONNA □

PASTI	ORA	LUOGO	CIBI E BEVANDE: TIPO, QUANTITÀ, CONDIMENTI
Colazione			
Merenda mattina e spuntini			
Pranzo			
Merenda pomeriggio e spuntini			
Cena			
Dopocena			

ATLANTE FOTOGRAFICO DELLE PORZIONI E DEI PESI

		
Latte 200 ml	Cornflakes 30 g	Zucchero Cucchiaino = 5 grammi Cucchiaio da tè = 10 grammi Bustina = 5 grammi
		
Pane 60 g	100 g	Olio: cucchiaio da minestra

QUESTIONARIO ALIMENTARE DI FREQUENZA DEI CONSUMI

DATA

NOME E COGNOME...CODICE..

Il questionario valuta quanto spesso i cibi elencati sono stati assunti nel corso dell'ultimo anno
(per frutta e verdura fare riferimento alla stagione, ad es: Quando è stagione di ciliegie, quanto spesso le consuma?)

GRUPPO LATTE E LATTICINI	Più volte al giorno	1x giorno	5-6x settimana	2-4x settimana	1x settimana	1-3x mese	MAI
A - Latte (al naturale, con caffè, orzo, al cioccolato, al cacao, ecc.)	1	2	3	4	5	6	7
B - Yogurt, latte acido, kefir	1	2	3	4	5	6	7
C - Formaggio, ricotta, formaggini	1	2	3	4	5	6	7
D - Panna, panna acida	1	2	3	4	5	6	7
E - Budini al latte, gelato al latte	1	2	3	4	5	6	7
F - *Frico*	1	2	3	4	5	6	7
G - Grana, parmigiano o stravecchio sui primi piatti	1	2	3	4	5	6	7

CONDIMENTI E GRASSI	Più volte al giorno	1x giorno	5-6x settimana	2-4x settimana	1x settimana	1-3x mese	MAI
A - Burro	1	2	3	4	5	6	7
B - Margarina	1	2	3	4	5	6	7
C - Lardo, ciccioli	1	2	3	4	5	6	7
D - Maionese	1	2	3	4	5	6	7
E - Olio di semi	1	2	3	4	5	6	7
F - Olio di oliva	1	2	3	4	5	6	7

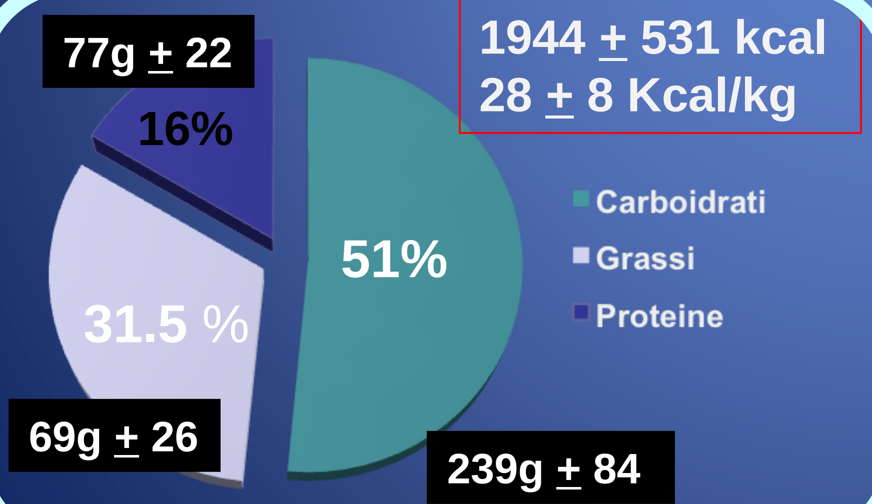
FRUTTA	Più volte al giorno	1x giorno	5-6x settimana	2-4x settimana	1x settimana	1-3x mese	MAI
A - Mele, pere	1	2	3	4	5	6	7
B - Pesche, albicocche, prugne	1	2	3	4	5	6	7
C - Uva	1	2	3	4	5	6	7
D - Banane	1	2	3	4	5	6	7
E - Arance, mandarini	1	2	3	4	5	6	7
F - Fragole, , mirtilli, ciliegie (*in stagione*)	1	2	3	4	5	6	7
G - Anguria , melone (*in stagione*)	1	2	3	4	5	6	7
H - Kiwi	1	2	3	4	5	6	7
I - Frutta secca zuccherina, tipo prugne, albicocche,ecc.	1	2	3	4	5	6	7
J - Frutta cotta o composta	1	2	3	4	5	6	7
K - Frutta secca oleosa	1	2	3	4	5	6	7
L - *Cachi*	1	2	3	4	5	6	7

VERDURE	Più volte al giorno	1x giorno	5-6x settimana	2-4x settimana	1x settimana	1-3x mese	MAI
A - Fagioli	1	2	3	4	5	6	7
B - Fagiolini	1	2	3	4	5	6	7
C - Piselli	1	2	3	4	5	6	7
D - Cavolfiori, broccoli	1	2	3	4	5	6	7
E - Carote, cavolo rapa	1	2	3	4	5	6	7
F - Spinaci, biete	1	2	3	4	5	6	7
G - Mais	1	2	3	4	5	6	7
H - Patate	1	2	3	4	5	6	7
I - Pomodori, peperoni	1	2	3	4	5	6	7
J - Crauti, brovada (rape)	1	2	3	4	5	6	7
K - Cavolo capuccio,verza	1	2	3	4	5	6	7
L - Zucchine, cetrioli, melanzane	1	2	3	4	5	6	7
M - Insalata, radicchio (tutti i tipi),	1	2	3	4	5	6	7
N - Barbabietola rossa	1	2	3	4	5	6	7

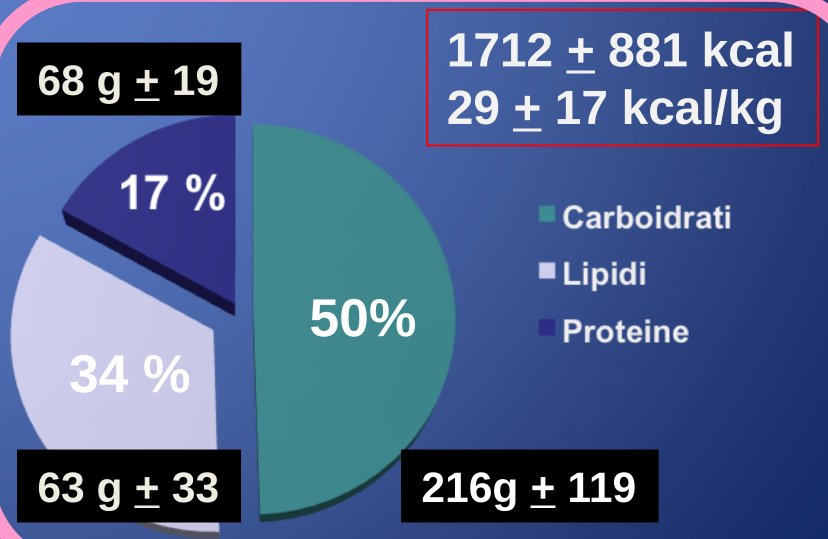
CALORIE TOTALI e NUTRIENTI (%)

EFSA European Food Safety Authority (2010) IOM	
CARBOIDRATI	45-65% (≥130 g/giorno)
PROTEINE	10-35%
GRASSI	20-35 %

UOMINI



DONNE



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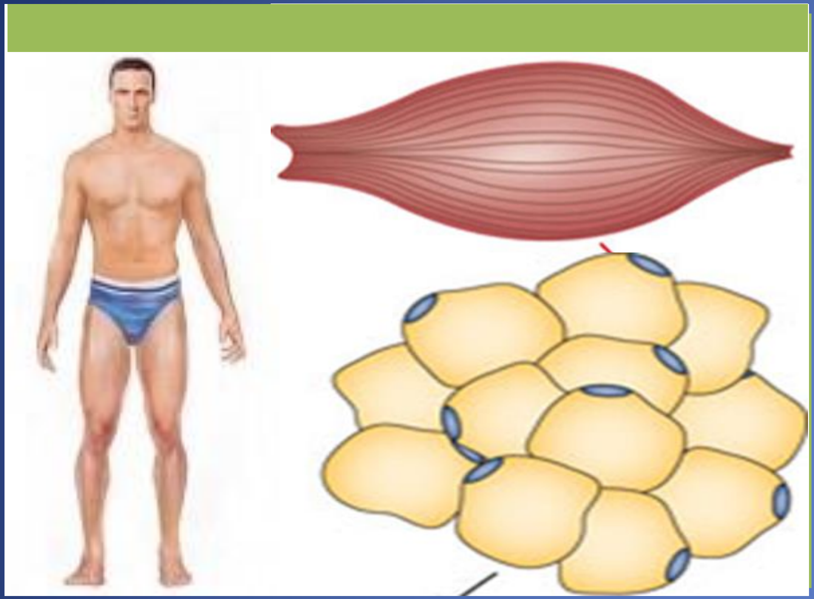
- Protein source, timing of intake, and amino acid supplementation may be considered when making recommendations for dietary protein intake by older adults.
- More research studies with better methodologies are desired to fine tune protein needs in older adults.

JAMDA 14 (2013) 542–559

PROTEINE (g/kg PESO IDEALE)



RACCOMANDAZIONI

EFSA 0.83 g/kg
LARN 0.9 g/kg
PROT-AGE 1-1.2 g/kg

Anziani attivi: 1.2 g /kg minimo

Proteine g/kg	UOMINI (%)	DONNE (%)
< 0.8 g/kg$_{PI}$ insufficiente	6	11
0.8 – 1.0 g/kg$_{PI}$ EFSA - LARN	32	18
1.0 – 1.2 g/kg$_{PI}$ PROT-AGE	28	33
>1.2 – g/kg$_{PI}$ soggetti attivi	34	34
FONTI ANIMALI/VEGETALI (%)	60 / 40	60 / 40

MEDIA g/kg

Uomini 1.13 ± 0.32
Donne 1.18 ± 0.34

FREQUENZA DI CONSUMO DI ALIMENTI PROTEICI

	2-4 sett.	MAI
M:	31 %	14 %
F:	24 %	10 %

	2-4 sett.	MAI
M:	38 %	6 %
F:	24 %	7 %

	2-4 sett.	MAI
M:	40 %	5 %
F:	45 %	5 %

	2-4 sett.	MAI
M:	17 %	26 %
F:	9 %	29 %

	2-4 sett.	MAI
M:	45 %	0 %
F:	49 %	0 %

	2-4 sett.	MAI
M:	40 %	6 %
F:	44 %	3 %

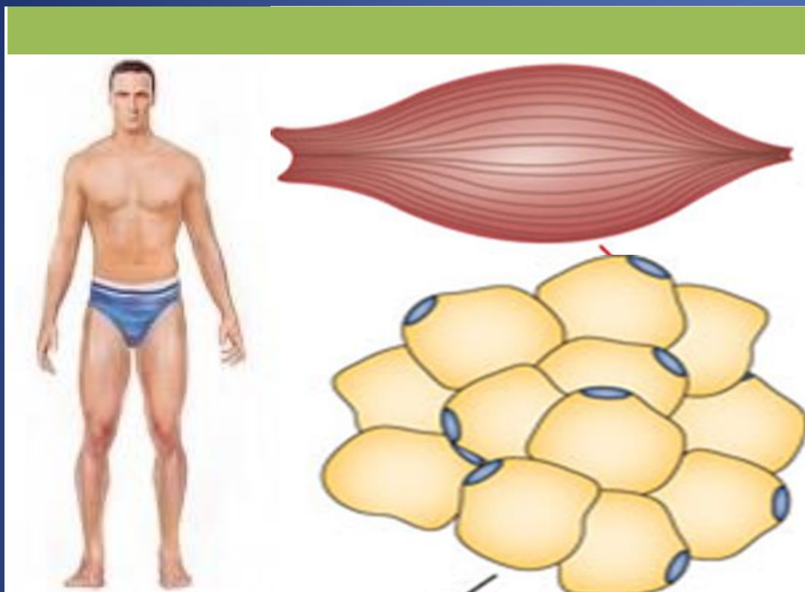
	2-4 sett.	MAI
M:	22 %	11 %
F:	20 %	11 %

24 HOUR RECALL e
QUESTIONARI DI FREQUENZA DI CONSUMO (x2)

ATLANTE FOTOGRAFICO DELLE PORZIONI E DEI PESI

		
Latte 200 ml	**Corn flakes 30 g**	**Zucchero** **Cucchiaino = 5 grammi** **Cucchiaio da tè = 10 grammi** **Bustina = 5 grammi**
		
Pane 60 g	**100 g**	**Olio: cucchiaio da minestra**
		

PROTEINE (g/kg PESO IDEALE)



MEDIA g/kg

Uomini 1.13 ± 0.32
Donne 1.18 ± 0.34

RACCOMANDAZIONI

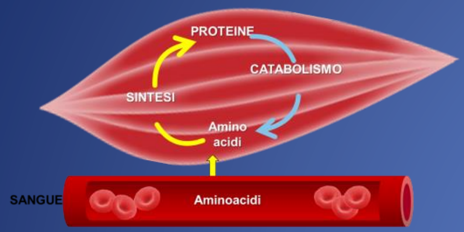
EFSA	**0.83 g/kg**
LARN	**0.9 g/kg**
PROT-AGE	**1-1.2 g/kg**

Anziani attivi: 1.2 g /kg minimo

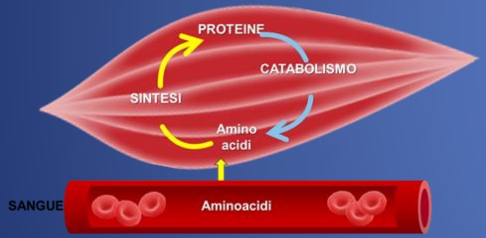
Proteine g/kg	Uomini %	Donne %
< 1	38	30
1-1.2	28	33
> 1.2	34	37

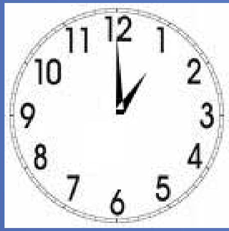
LE PROTEINE AI PASTI

PROT-AGE: 25-30 g proteine ai tre principali pasti della giornata

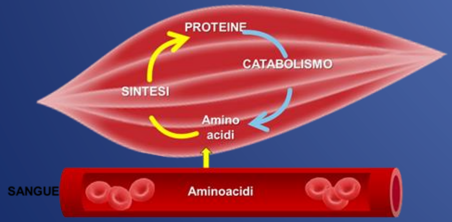


COLAZIONE

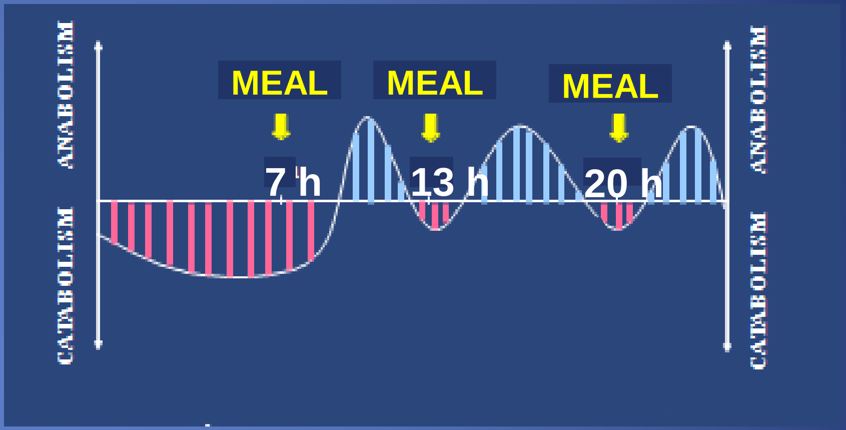




PRANZO



CENA



	Uomini	Donne
Media proteine nei 3 pasti (g)	25.6	22.0
soggetti < 25 g/pasto (%)	40	77

>70 years do not assume the current RDA of proteins (0.8 g/kg/day).

The phenomenon depends upon several factors:

- **ODONTOSTOMATOLOGICAL PROBLEMS** → alteration of the masticatory function → influence in the choice of foods;
- **DELAYED GASTRIC EMPTYING**, associated with a reduced gallbladder contractility and higher serum levels of the hormone cholecystokinin (CCK) and neuropeptide Y (PYY) (facilitating a ***long-lasting satiety***);
- **HIGHER BLOOD CONCENTRATION OF LEPTIN** in the elderly (showing that the anorexigenic signal prevails over the orexigenic one);

protein quality

- **amino acid composition**
- **absorption kinetics**

Concentration of major milk proteins

Protein	Concentration (g/l) Cow	Human
Total caseins	26.0	2.7
α-Casein	13.0	
β-Casein	9.3	
κ-Casein	3.3	
Total whey protein	6.3	67.3
β-Lactoglobulin	3.2	
α-Lactalbumin	1.2	1.9
Immunoglobulins (A, M, and G)	0.7	1.3
Serum albumin	0.4	0.4
Lactoferrin	0.1	1.5
Lactoperoxidase	0.03	
Lysozyme	0.0004	0.1
Miscellaneous	0.8	1.1
Proteose-peptone	1.2	
Glycomacropeptide	1.2	

Milk Biologically Active Componentsas Nutraceuticals: Review

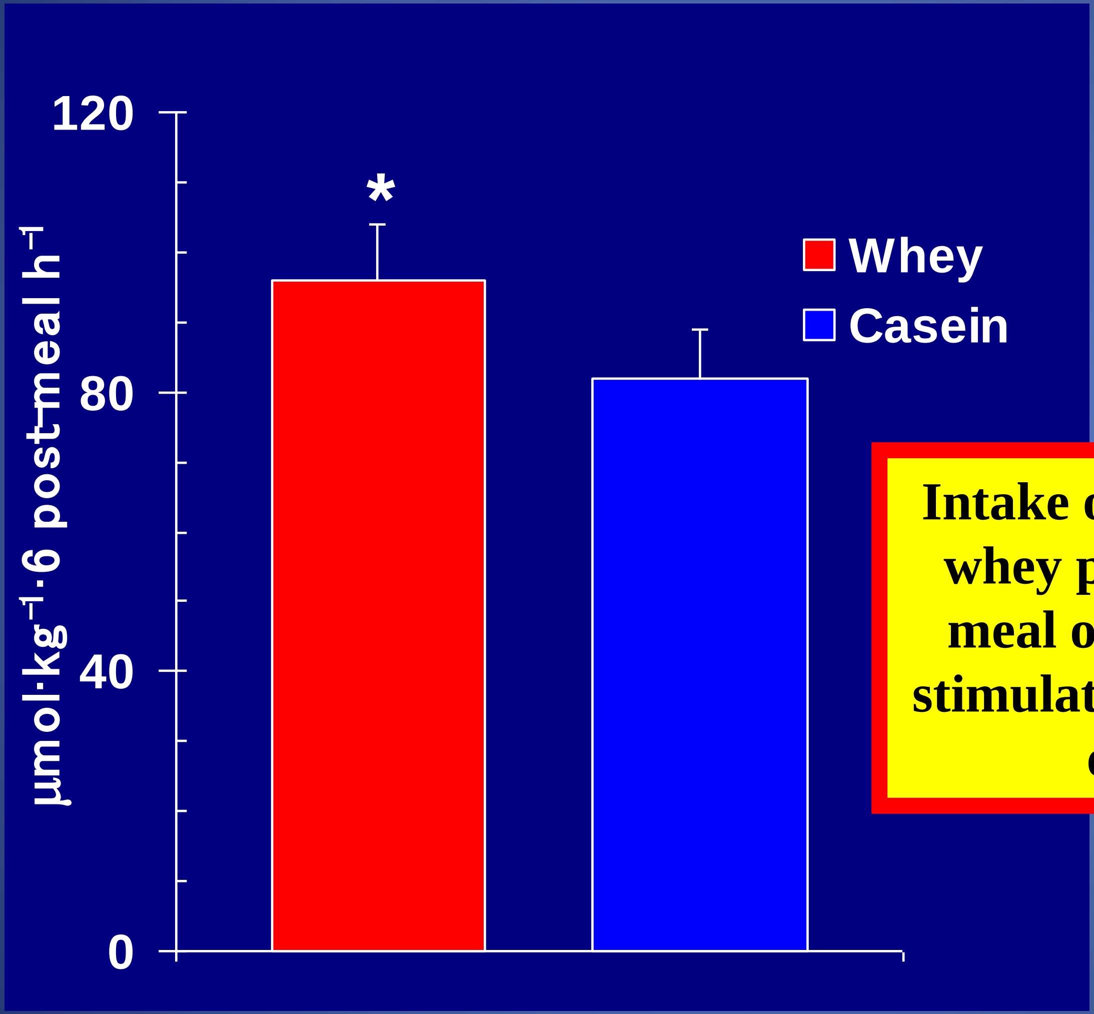
***Critical Reviews in Food Science and Nutrition*, 45:645–656 (2005)**

Amino acid composition of whey and casein

J. Nutr. 2008

WHEY PROTEIN INGESTION ENHANCES POSTPRANDIAL ANABOLISM DURING SHORT-TERM BED REST IN YOUNG MEN

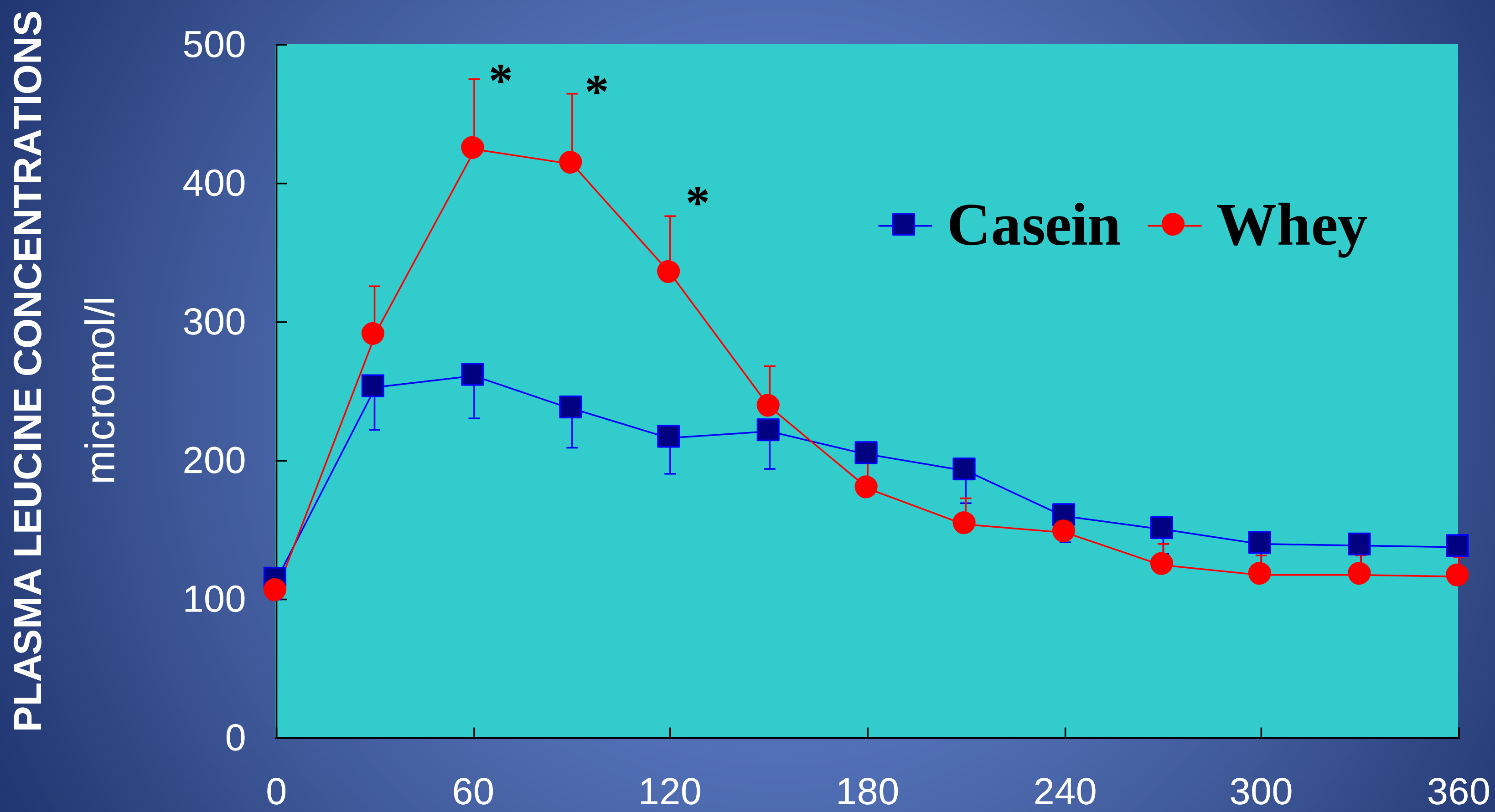
Antonione et al., J Nutr 2008



Intake of the rapidly absorbed whey protein within a mixed meal optimizes postprandial stimulation of protein synthesis during bed rest.

Effects of whey and casein meals on whole body phenylalanine utilization for protein synthesis during bed rest

CASEIN AND WHEY ABSORPTION KINETICS



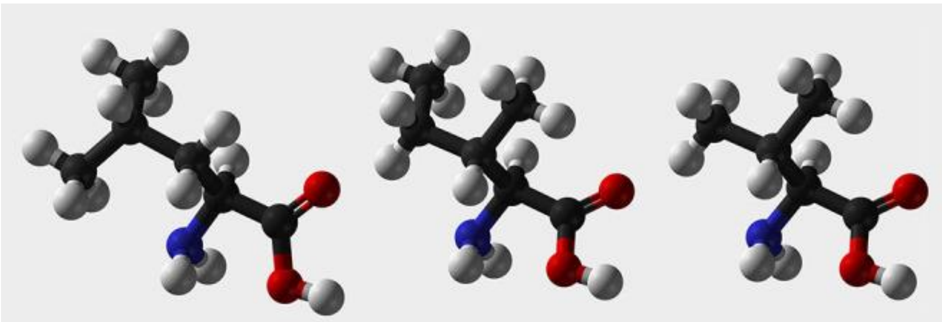
Test Meal
0.4 g/kg whey or casein
0.27 g/kg sucrose

J Nutr 2008

Amino Acids

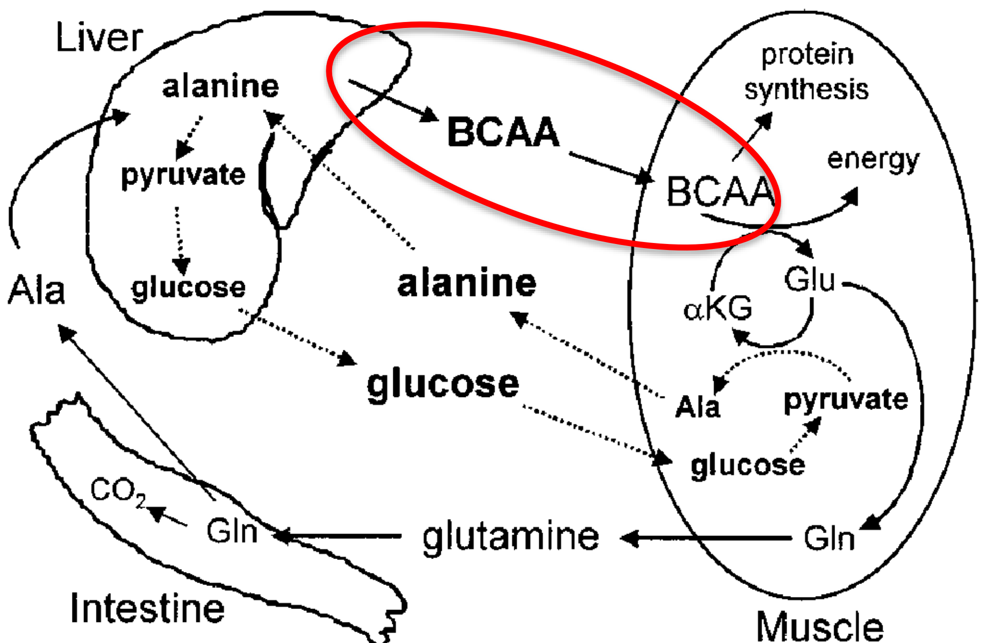
BRANCHED CHAIN AMINO ACIDS (BCAA)

- Essential amino acids

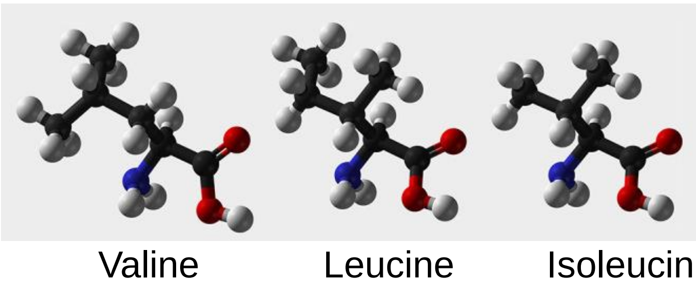


Valine Leucine Isoleucin

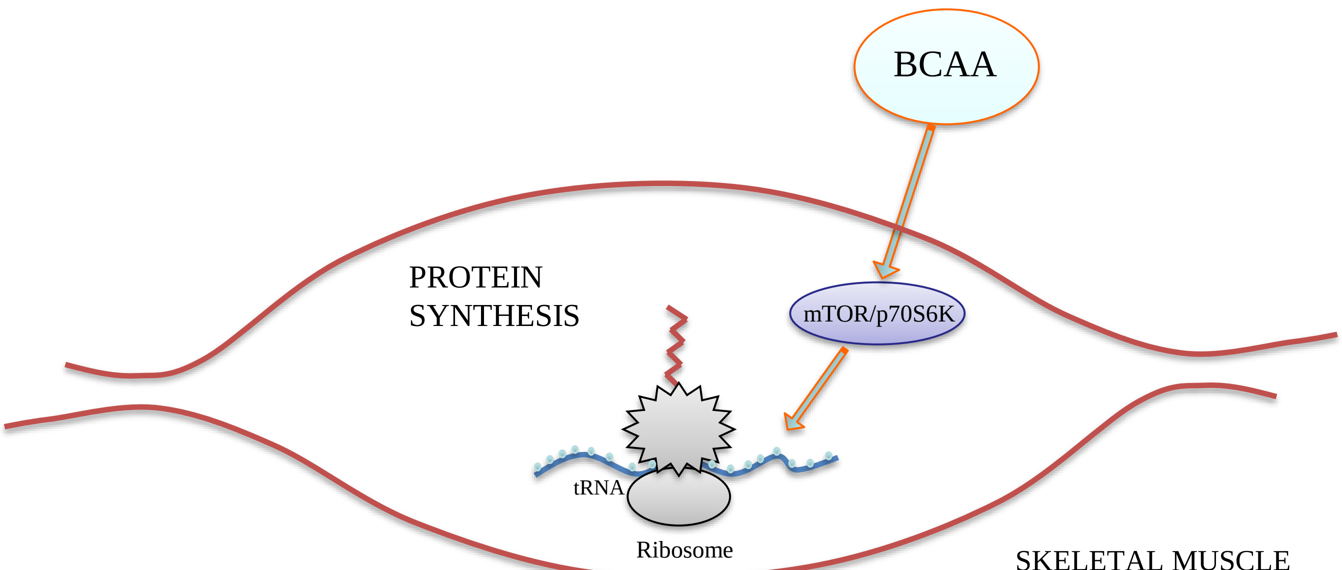
- BCAAs in humans elevates the phosphorylation and the activation of p70S6 kinase and 4E-BP1 in skeletal muscle



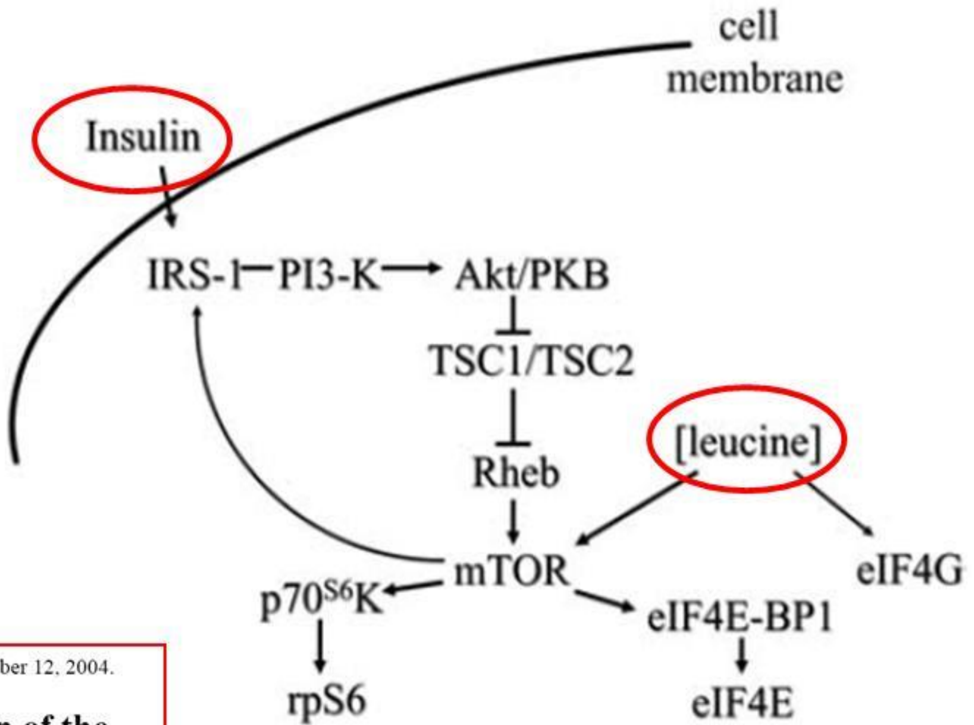
BRANCHED CHAIN AMINO ACIDS (BCAA)



- BCAAs in humans elevates the phosphorylation and the activation of p70S6 kinase and 4E-BP1, downstream components of the mTOR signaling pathway, which controls RNA translation and synthesis of proteins, and which is recognized as the central node to support muscle hypertrophy



Leucine enhances the insulin stimulatory effect on mTOR under conditions of hormonal resistance



Layman & Walker 2006

The FASEB Journal express article 10.1096/fj.03-1409fje. Published online October 12, 2004.

Amino acids and leucine allow insulin activation of the PKB/mTOR pathway in normal adipocytes treated with wortmannin and in adipocytes from *db/db* mice

Charlotte Hinault,* Isabelle Mothe-Satney,* Nadine Gautier,* John C. Lawrence, Jr.,† and Emmanuel Van Obberghen *

Am J Physiol Endocrinol Metab 291: E381–E387, 2006.
First published February 28, 2006; doi:10.1152/ajpendo.00488.2005.

A high proportion of leucine is required for optimal stimulation of the rate of muscle protein synthesis by essential amino acids in the elderly

Christos S. Katsanos,[1] Hisamine Kobayashi,[2] Melinda Sheffield-Moore,[3] Asle Aarsland,[4] and Robert R. Wolfe[1]

Departments of [1]Surgery and Shriners Hospitals for Children-Galveston, [3]Internal Medicine, and [4]Anesthesiology, University of Texas Medical Branch, Galveston, Texas; and [2]AminoScience Laboratories, Ajinomoto Company, Incorporated, Kawasaki, Japan

MUSCLE PROTEIN SYNTHESIS

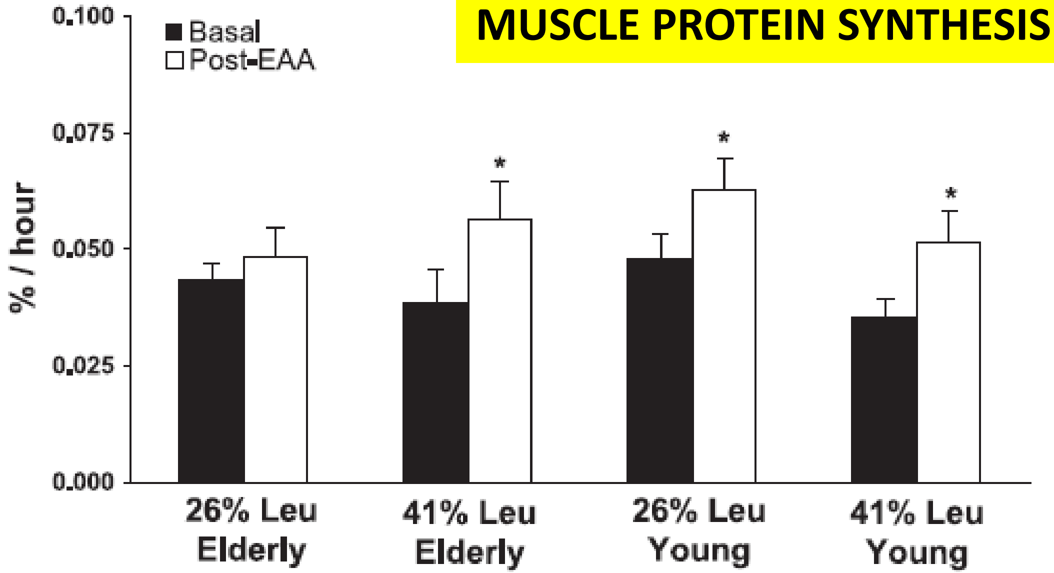


Fig. 5. Fractional synthetic rate (%/h) of mixed muscle protein in the basal state (Basal) and after the ingestion of 6.7 g of EAA (Post-EAA) containing either 1.7 (26% Leu) or 2.8 (41% Leu) g of leucine. *Significantly different from the corresponding basal value ($P < 0.05$).

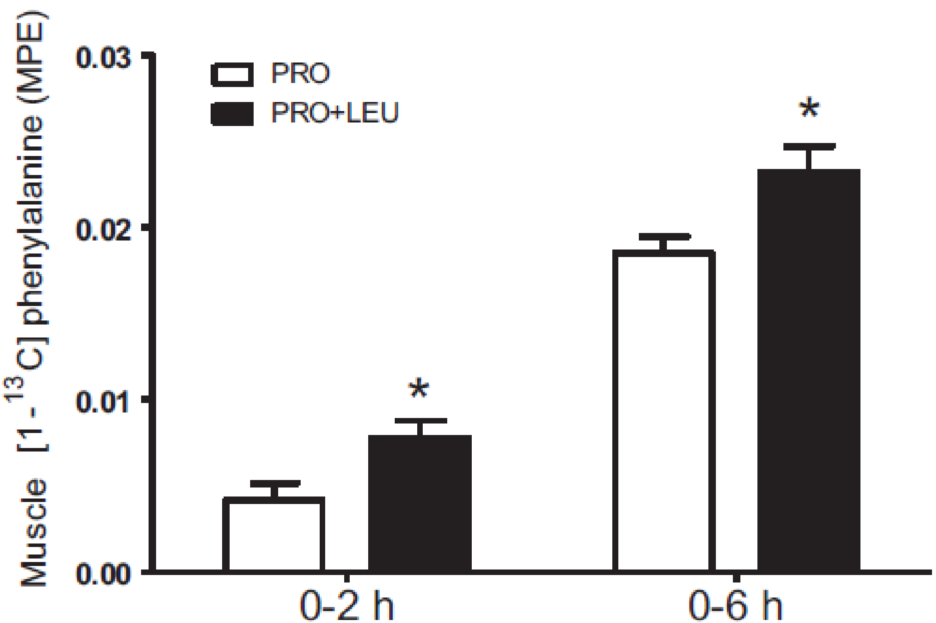
Leucine co-ingestion improves post-prandial muscle protein accretion in elderly men

Benjamin T. Wall, Henrike M. Hamer, Anneke de Lange, Alexandra Kiskini, Bart B.L. Groen, Joan M.G. Senden, Annemie P. Gijsen, Lex B. Verdijk, Luc J.C. van Loon*

Department of Human Movement Sciences, NUTRIM School for Nutrition, Toxicology and Metabolism, Maastricht University Medical Centre, PO Box 616, Maastricht, 6200 MD, The Netherlands

Clinical Nutrition 32 (2013) 412–419

Methods: Twenty-four elderly men (74.3 ± 1.0 y) were randomly assigned to ingest 20 g intrinsically L-[1-^{13}C]phenylalanine-labeled casein protein with (PRO + LEU) or without (PRO) 2.5 g crystalline leucine.



Mean (±SEM) delta protein-bound L-[1-^{13}C]phenylalanine enrichments (MPE) during a 2 and 6 h incorporation period following the ingestion of 20 g intrinsically L-[1-^{13}C]phenylalanine-labeled casein with (PRO + LEU; $n = 12$) or without (PRO; $n = 12$) 2.5 g crystalline leucine in healthy, elderly men. Data were analyzed with an unpaired, two-tailed Student's t-test. *$P < 0.05$ compared with corresponding time point in the PRO group.

Long-term leucine supplementation does not increase muscle mass or strength in healthy elderly men[1–3]

Suzanne Verhoeven, Kristof Vanschoonbeek, Lex B Verdijk, René Koopman, Will KWH Wodzig, Paul Dendale, and Luc JC van Loon

Am J Clin Nutr 2009;89:1468–75.

Leucine or placebo (2.5 g) was administered with each main meal during a 3-mo intervention period.

Body composition[1]

	Placebo (n = 14)		Leucine (n = 15)	
	Before	After	Before	After
Lean mass (kg)	55.8 ± 0.9	56.2 ± 1.1	54.6 ± 1.0	55.0 ± 1.5
Fat mass (kg)	19.8 ± 1.7	19.2 ± 2.0	20.0 ± 1.4	20.0 ± 1.3
Body fat (%)	24.5 ± 1.7	23.9 ± 1.9	25.3 ± 1.2	25.4 ± 1.2
Leg lean mass (kg)	17.6 ± 0.4	18.0 ± 0.4	17.1 ± 0.5	17.6 ± 0.4
Leg fat (%)	18.9 ± 1.5	19.4 ± 1.6	19.6 ± 1.2	19.8 ± 1.2
CSA (cm^2)	71 ± 3	71 ± 3	71 ± 2	71 ± 2
Leg volume (L)	7.5 ± 1.9	7.5 ± 1.7	8.1 ± 3.0	7.8 ± 4.1

[1] All values are means ± SEMs. CSA, cross-sectional area. Data were analyzed by using repeated-measures ANOVA. No significant differences were observed between groups or over time.

Results: No changes in skeletal muscle mass or strength were observed over time in either the leucine- or placebo-supplemented group. No improvements in indexes of whole-body insulin sensitivity (oral glucose insulin sensitivity index and the homeostasis model assessment of insulin resistance), blood glycated hemoglobin content, or the plasma lipid profile were observed.

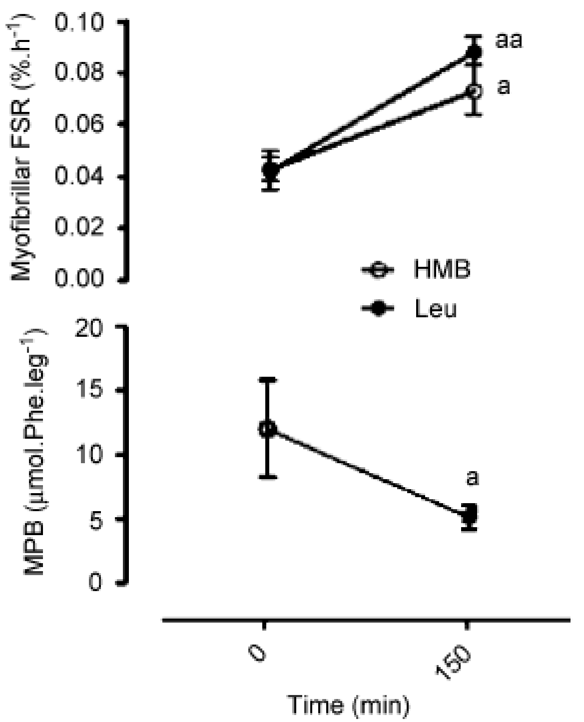
Glycemic control[1]

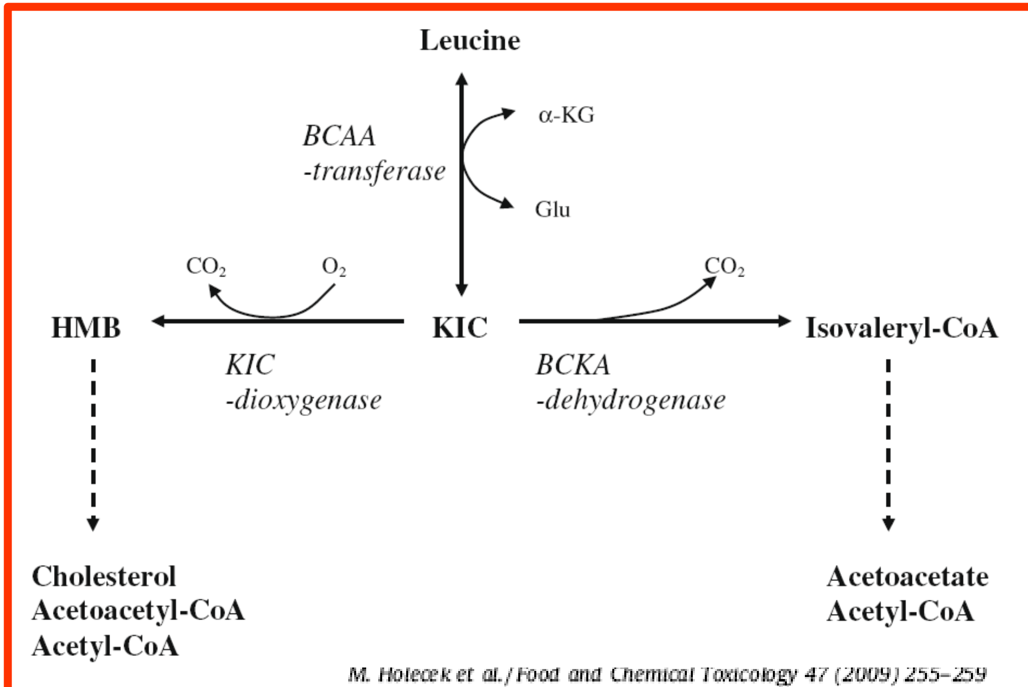
	Placebo (n = 14)					Leucine (n = 15)				
	0	2	4	8	12	0	2	4	8	12
Plasma glucose (mmol/L)	5.54 ± 0.11	5.63 ± 0.13	5.62 ± 0.12	5.75 ± 0.13	5.49 ± 0.10	5.69 ± 0.18	5.77 ± 0.18	5.86 ± 0.15	5.85 ± 0.17	5.66 ± 0.16
Plasma insulin (mU/L)	6.04 ± 0.76	6.08 ± 0.82	4.66 ± 0.54	6.37 ± 1.04	6.15 ± 1.25	6.73 ± 0.68	8.22 ± 0.91	9.03 ± 1.45	8.34 ± 1.44	7.37 ± 1.17
Hb A_{1c} (%)	5.8 ± 0.1	5.6 ± 0.1	5.6 ± 0.1	5.6 ± 0.1	5.8 ± 0.1	5.9 ± 0.1	5.8 ± 0.1	5.8 ± 0.1	5.8 ± 0.1	5.9 ± 0.1
HOMA-IR	1.51 ± 0.21	1.55 ± 0.23	1.19 ± 0.16	1.66 ± 0.29	1.54 ± 0.33	1.74 ± 0.21	2.12 ± 0.26	2.38 ± 0.4	2.19 ± 0.39	1.89 ± 0.32
$Glucose_{120\ min}$ OGTT	7.16 ± 0.67	—	—	—	5.44 ± 0.49	6.76 ± 0.5	—	—	—	6.76 ± 0.65
OGIS ($mL \cdot min^{-1} \cdot m^{-2}$)	876 ± 40	—	—	—	939 ± 40	924 ± 44	—	—	—	906 ± 42

[1] All values are means ± SEMs. HOMA-IR, homeostasis model assessment of insulin resistance; OGIS, oral glucose insulin sensitivity; OGTT, oral-glucose-tolerance test; Hb A_{1c}, glycated hemoglobin. Data were analyzed by using repeated-measures ANOVA. No significant differences were observed between groups or over time.

Effects of leucine and its metabolite β-hydroxy-β-methylbutyrate on human skeletal muscle protein metabolism

J Physiol 591.11 (2013) pp 2911–2923





Consumption of small amounts (∼2–3 g) of either Leu or its metabolite HMB resulted in the acute increase of MPS to a degree comparable to that seen after a mixed meal, with HMB also suppressing MPB.

Randomized control trials

Effect of β-hydroxy-β-methylbutyrate (HMB) on lean body mass during 10 days of bed rest in older adults

Nicolaas E.P. Deutz[a,*], Suzette L. Pereira[b], Nicholas P. Hays[a], Jeffery S. Oliver[b], Neile K. Edens[b], Chris M. Evans[a], Robert R. Wolfe[a]

[a] Center for Translational Research in Aging & Longevity, Donald W. Reynolds Institute on Aging, University of Arkansas for Medical Sciences, Little Rock, AR, USA
[b] Abbott Nutrition, Columbus, OH, USA

Clinical Nutrition 32 (2013) 704–712

Design: A randomized, controlled, double-blinded, parallel-group design study was carried out in 24 healthy (SPPB ≥ 9) older adult subjects (20 women, 4 men), confined to complete bed rest for ten days, followed by resistance training rehabilitation for eight weeks. Subjects in the experimental group were treated with HMB (calcium salt, 1.5 g twice daily – total 3 g/day). Control subjects were treated with an inactive placebo powder. Treatments were provided starting 5 days prior to bed rest till the end rehabilitation phase. DXA was used to measure body composition.

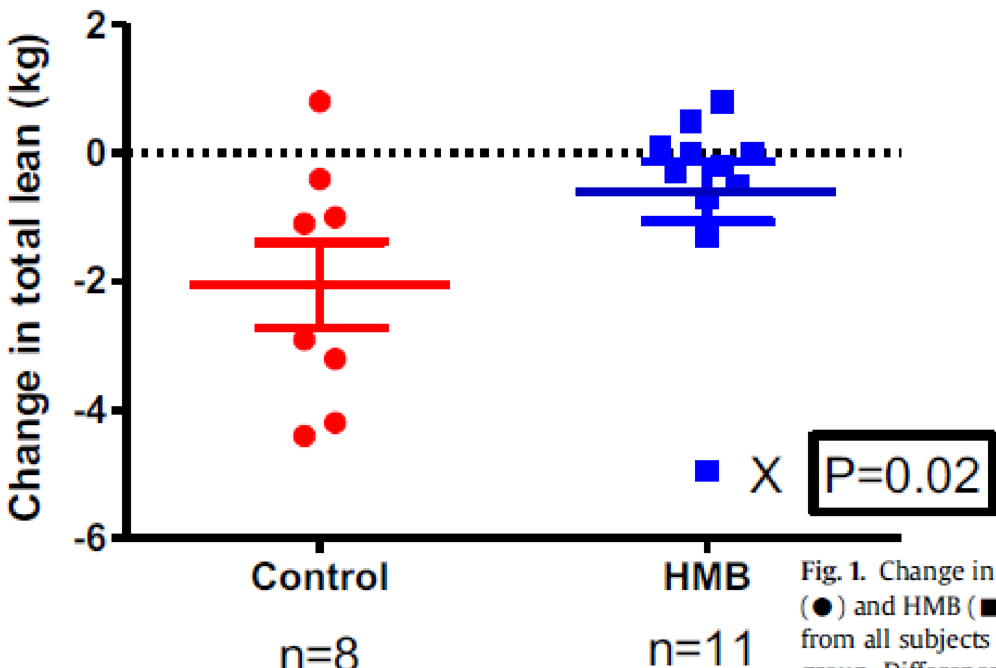


Fig. 1. Change in total lean mass in individual subjects over 10-day bed rest in Control (●) and HMB (■). Line with error bars represent mean ± SEM for each group. Values from all subjects (Control $n = 8$; HMB $n = 11$). X indicates potential outlier from HMB group. Difference between treatment groups was non-significant ($p = 0.16$, ANOVA). When data are analyzed from all Control subjects ($n = 8$) and HMB subjects excluding potential outlier, thus a total of 10 subjects, the difference between treatment groups is significant ($p = 0.02$, ANOVA).

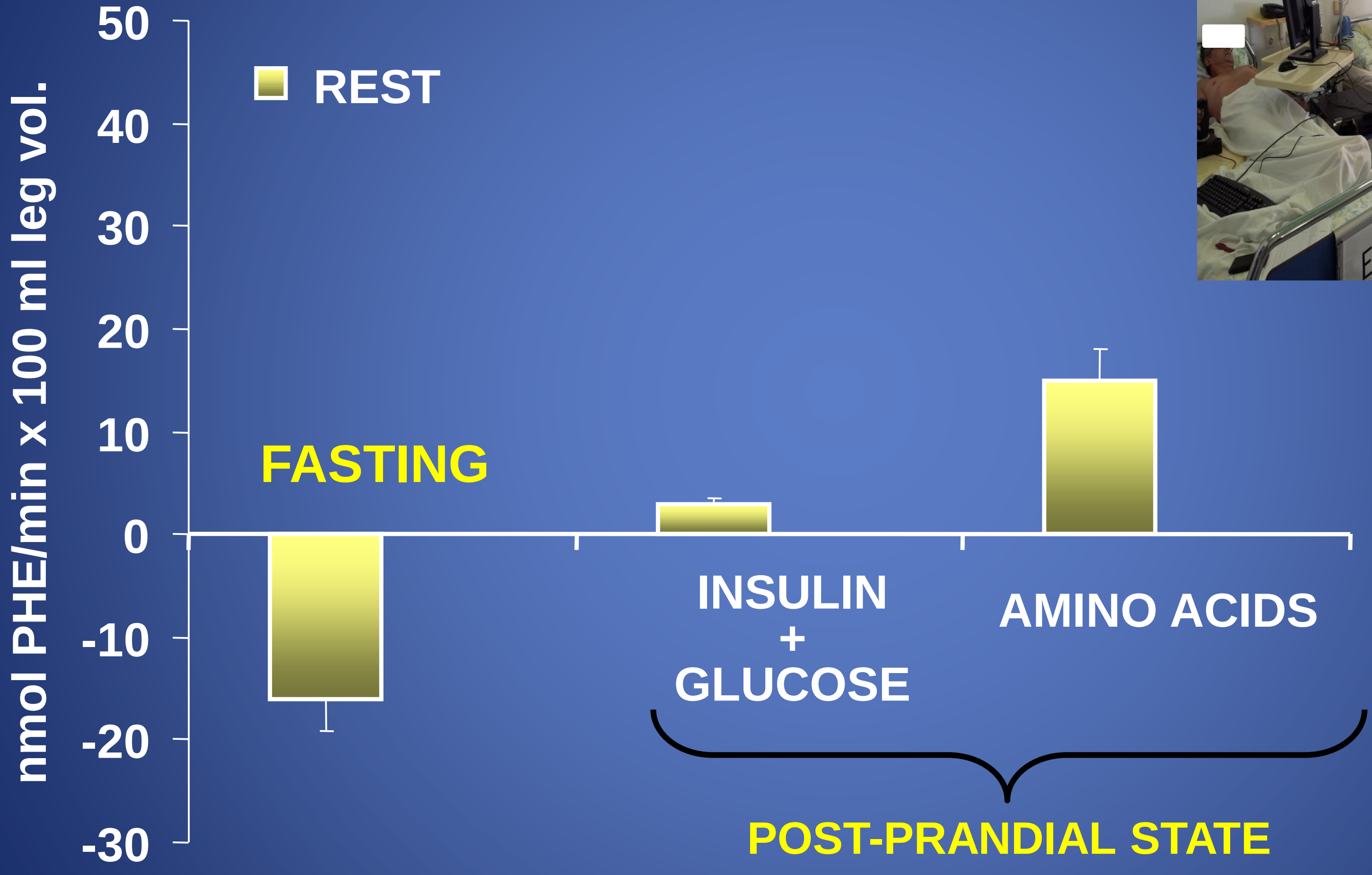
Author	Clinical setting	Subjects	Daily dose	Duration	Changes in body composition/function				Additional effects	Overall efficacy
					BM	FFM	FM	Strength		
Hsieh et al. (2010)	Old age-related wasting	79 bed-ridden elderly receiving tube feeding (43 M, 36 F)	2 g HMB (nasogastric feeding tube)	2 or 4 wk (39 subjects continued the study for another 14 days)	=(2 wk or 4 wk)	NA	NA	NA	Waist circumference: (+) (2, or 4 weeks) Red blood cells: −(2 week) Hemoglobin: −(2 weeks) BUN: −(2 weeks) UUN: −(2 or 4 weeks) Calf circumference: + (4 weeks) Plasma uric acid: −(4 weeks)	Y
Vukovich et al. (2001a, b)	Old age-related wasting	31 old adults (15 M, 16 F)	3 g HMB	8 wk (during training)	=	(+)	−	(+)	Plasma HMB: +	Y
Baier et al. (2009)	Old age-related wasting	77 elderly subjects (38 M, 39 F)	2 g or 3 g HMB (if >68 kg)/5 or 7.5 g ARG (if >68 kg)/1.5 or 2.25 g LYS (if >68 kg)/0.1 g ascorbic acid	1 year	+	+	=	=	BCM: + TBW: + ICW: + ECW: = Functionality: = Protein synthesis: + Protein breakdown: + Protein turnover: + Dietary intake: = Psychological well-being: = Quality of life: = Blood chemistry/hematology: =	Y
Flakoll et al. (2004)	Old age-related wasting	50 elderly subjects (50 F)	2 g HMB/5 g ARG/1.5 g LYS/0.5 g ascorbic acid	12 wk	=	(+)	=	+	"Get-up-and-go" functionality test: + Average limb circumferences: + Abdomen and hip circumferences: (−) UUN: − Proteolysis: = Net protein gain: = Protein synthesis: + Plasma arginine: (+) Dietary intake: = Plasma hormones/amino acids: =	Y
Fuller et al. (2011a, b)	Old age-related wasting	77 elderly subjects (38 M, 39 F)	2 g HMB/5 g ARG/1.5 g LYS (1.5 × dosage if weighing >68 kg)	1 year	NA	+	NA	+		Y
Williams et al. (2002)	Collagen deposition	35 healthy elderly subjects (8 M, 27 F)	3 g HMB/14 g ARG/14 g GLN	2 wk	NA	NA	NA	NA	Plasma arginine: + Plasma ornithine: + Collagen accumulation: + OHP content: + Total protein deposition: = α-AN: =	Y

Beta-hydroxy-beta-methylbutyrate supplementation in health and disease: a systematic review of randomized trials

Alessio Molfino · Gianfranco Gioia · Filippo Rossi Fanelli · Maurizio Muscaritoli

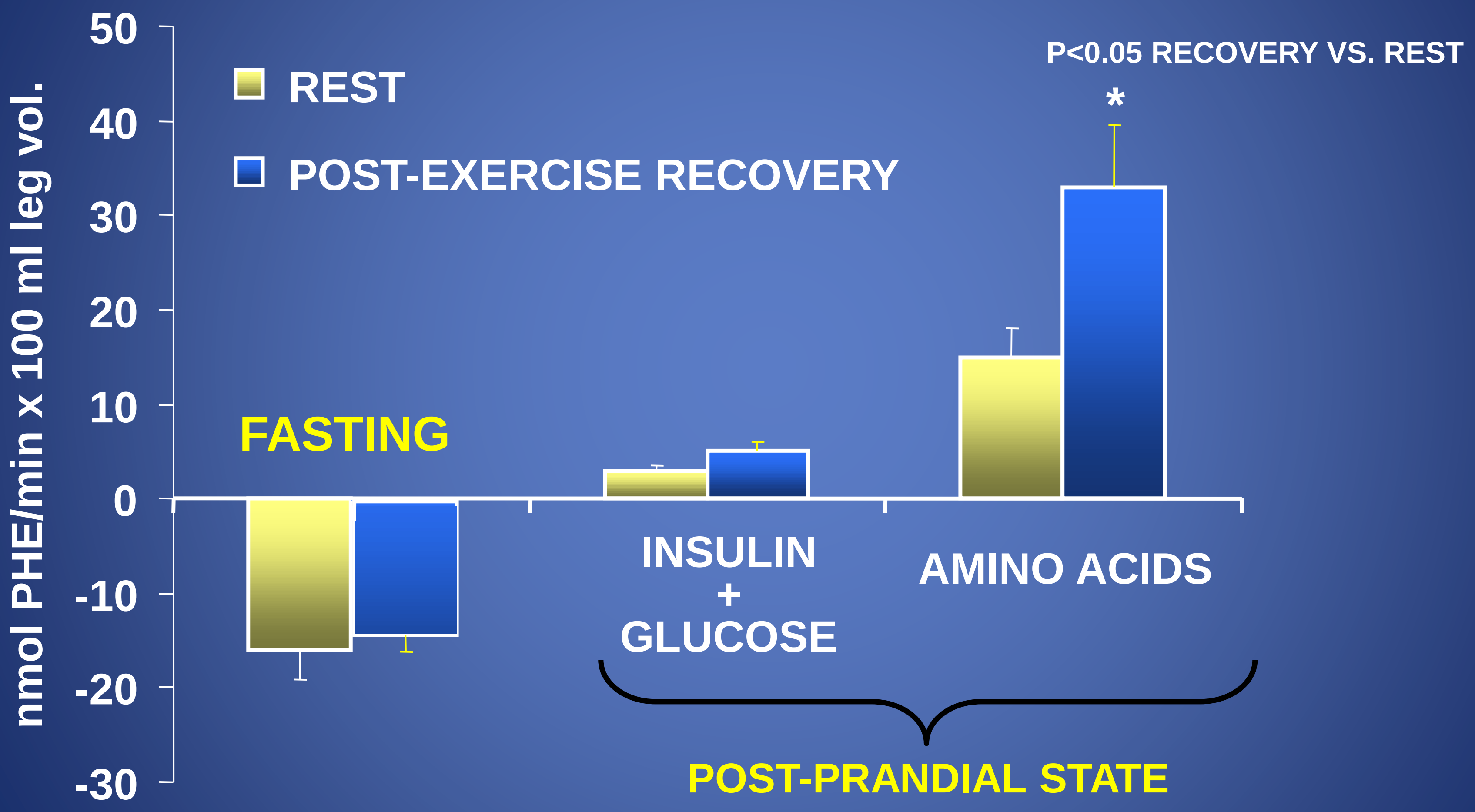
Amino Acids 2013
DOI 10.1007/s00726-013-1592-z

Regulation of muscle protein balance in the fasting and postprandial states



AJPENDO 1995, AJPENDO 1997, Diabetes 1999

Regulation of muscle protein balace in the fasting and postprandial states at rest and after exercise

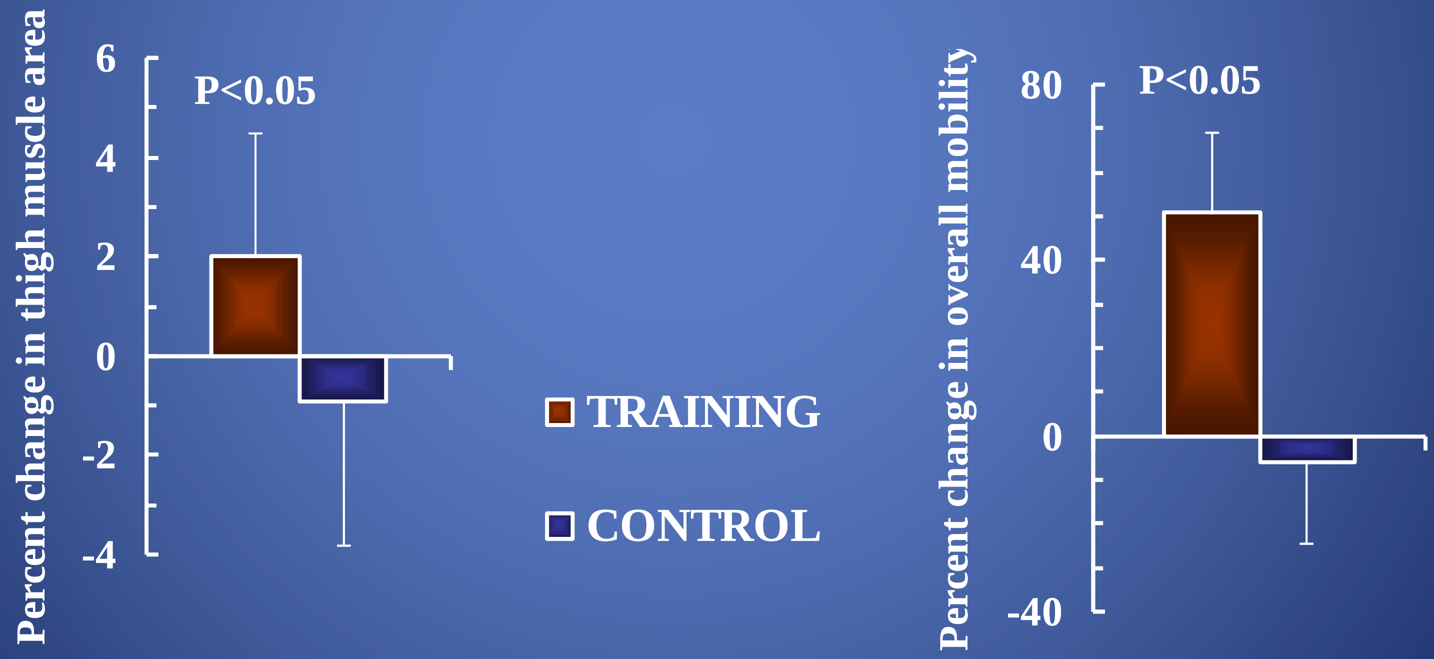


AJPENDO 1995, AJPENDO 1997, Diabetes 1999

Exercise Training for Physical Frailty in Very Elderly People

Fiatarone et al., New Engl J Med 1994

Randomized, placebo-controlled trial. 100 frail nursing home residents. Progressive resistance exercise training over a 10-week period.



J Physiol 587.1 (2009) pp 211–217

RAPID REPORT

Age-related differences in the dose–response relationship of muscle protein synthesis to resistance exercise in young and old men

Vinod Kumar[1], Anna Selby[1], Debbie Rankin[1], Rekha Patel[1], Philip Atherton[1], Wulf Hildebrandt[1], John Williams[2], Kenneth Smith[1], Olivier Seynnes[3], Natalie Hiscock[4] and Michael J. Rennie[1]

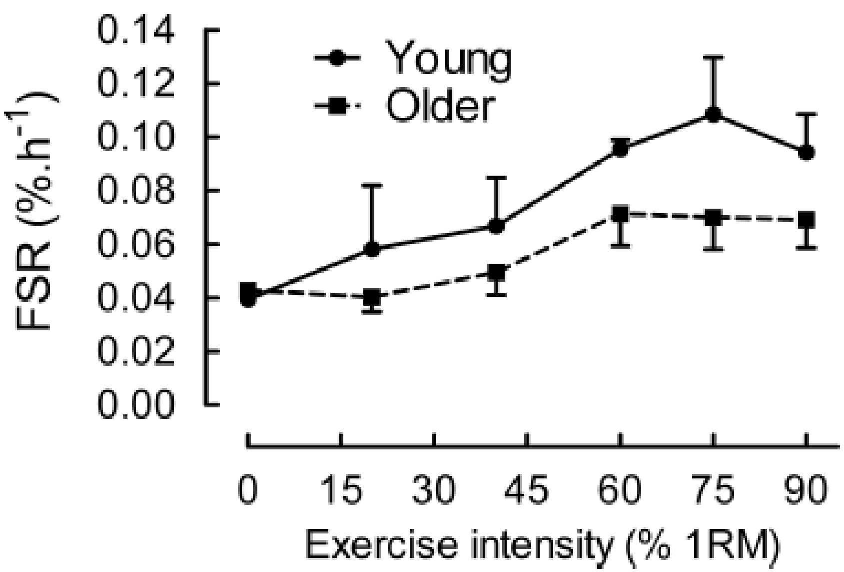


Figure 2. Dose–response relationship of myofibrillar protein synthesis (FSR, fractional synthetic rate, % h^{-1}) measured at 1–2 h post-exercise for 5 young men and 5 older men at each intensity

The responses of the young men overall were greater than those of the older men ($P < 0.04$). The responses between 60 and 90% of 1 RM in young and old were indistinguishable from each other but those in the young were together significantly higher than in the older men ($P < 0.01$) for 15 subjects in each group

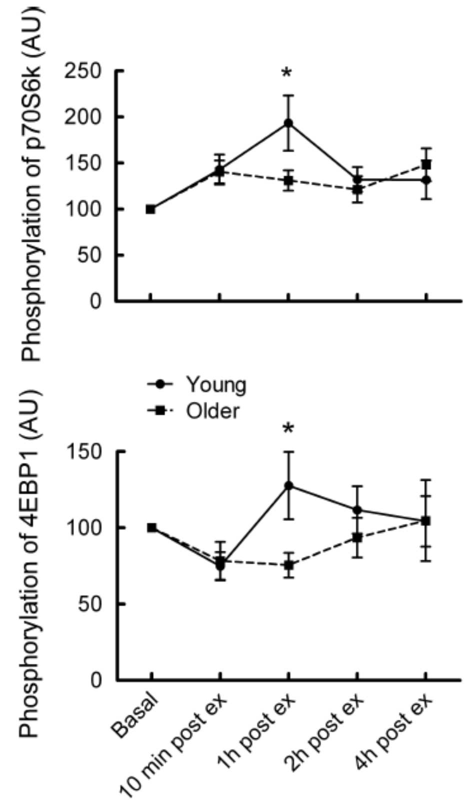


Figure 4. Time courses of the responses of phosphorylation of p70s6K and 4EBP1 (arbitrary units as percentage basal for each subject) averaged for intensities of 60–90% 1 RM

$n = 15$ in each group. $^*P < 0.05$.

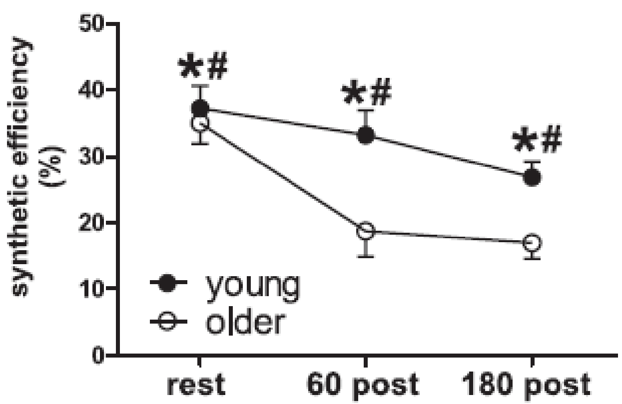
Older men show anabolic resistance of signalling and myofibrillar protein synthesis to resistance exercise.

The FASEB Journal • Research Communication

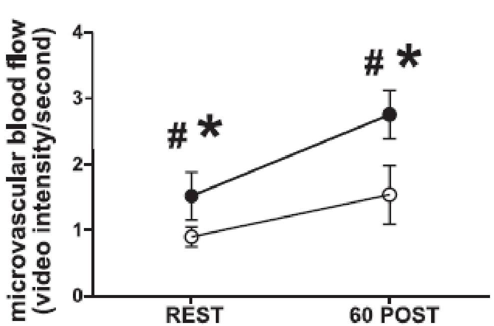
Age-related anabolic resistance after endurance-type exercise in healthy humans

William J. Durham,*[,1] Shanon L. Casperson,*[,1] Edgar L. Dillon,* Michelle A. Keske,[¶] Douglas Paddon-Jones,*[,†] Arthur P. Sanford,[‡] Robert C. Hickner,[‖] James J. Grady,[§] and Melinda Sheffield-Moore*[,2]

*Department of Internal Medicine, [†]Department of Physical Therapy, [‡]Department of Surgery, and [§]Department of Preventive Medicine and Community Health, The University of Texas Medical Branch, Galveston, Texas USA; [‖]Human Performance Laboratory, East Carolina University, Greenville, North Carolina, USA; and [¶]Menzies Research Institute, University of Tasmania, Hobart, Tasmania, Australia



Aging induces anabolic resistance following endurance exercise, manifested as reduced (by 40%) efficiency of muscle protein synthesis.



J Appl Physiol 107: 549–557, 2009.
First published May 28, 2009; doi:10.1152/japplphysiol.00280.2009.

A transient antioxidant stress response accompanies the onset of disuse atrophy in human skeletal muscle

Luciano Dalla Libera,[1] Barbara Ravara,[2] Valerio Gobbo,[1] Elena Tarricone,[2] Maurizio Vitadello,[1] Gianni Biolo,[3] Giorgio Vescovo,[4] and Luisa Gorza[2]

[1]Consiglio Nazionale delle Ricerche-Institute for Neuroscience, and [2]Department of Biomedical Sciences, University of Padova, Padova; [3]Department of Clinical, Technological and Morphological Sciences, Division of Internal Medicine, University of Trieste, Trieste; and [4]Division of Internal Medicine, San Bortolo Hospital, Vicenza, Italy

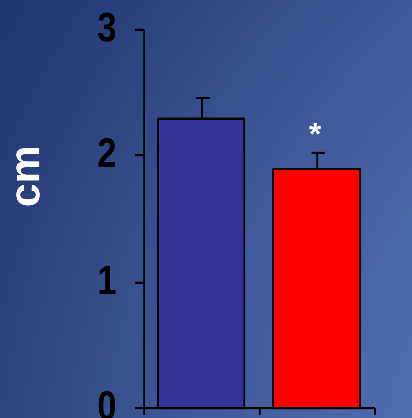
J Physiol 588.24 (2010) pp 5089–5104

Effects of inactivity on human muscle glutathione synthesis by a double-tracer and single-biopsy approach

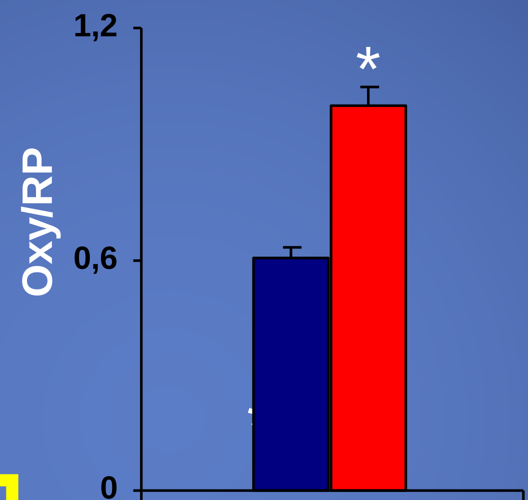
Francesco Agostini[1], Luciano Dalla Libera[2], Jörn Rittweger[3], Sara Mazzucco[1], Mihaela Jurdana[4], Igor B. Mekjavic[5], Rado Pišot[4], Luisa Gorza[2], Marco Narici[6] and Gianni Biolo[1]

[1]*Department of Medical, Technological and Translational Sciences, Division of Internal Medicine, University of Trieste, Trieste, Italy*
[2]*CNR-Institute for Neuroscience, Padova Section, and Department of Biomedical Sciences, University of Padova, Padova, Italy*
[3]*Institute of Aerospace Medicine, Department of Space Physiology, German Aerospace Center, Cologne, Germany*
[4]*Institute of Kinesiology Research, Science and research centre of Koper, University of Primorska, Koper, Slovenia*
[5]*Department of Automation, Biocybernetics and Robotics, Jozef Stefan Institute, Ljubljana, Slovenia*
[6]*Institute for Biomedical Research into Human Movement and Health, Manchester Metropolitan University, Manchester, UK*

Effects of 5-wk bed rest on muscle oxidative stress and anti-oxidant capacity

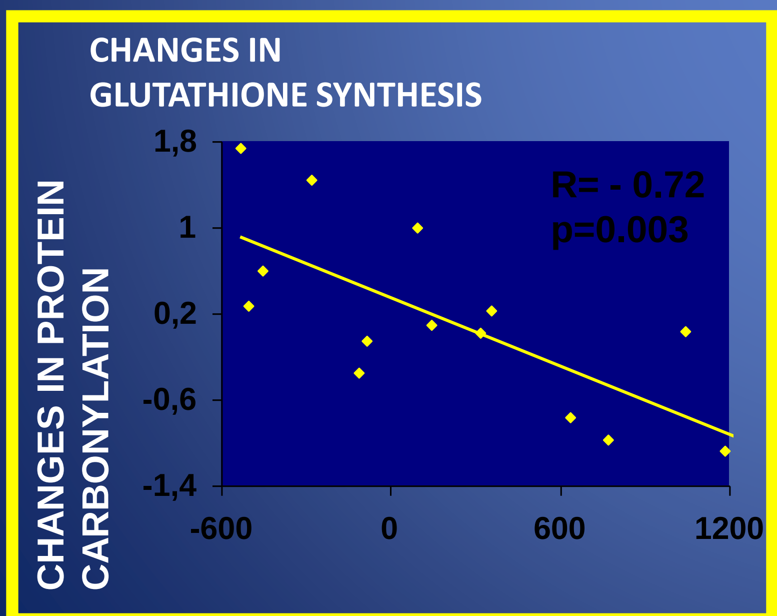


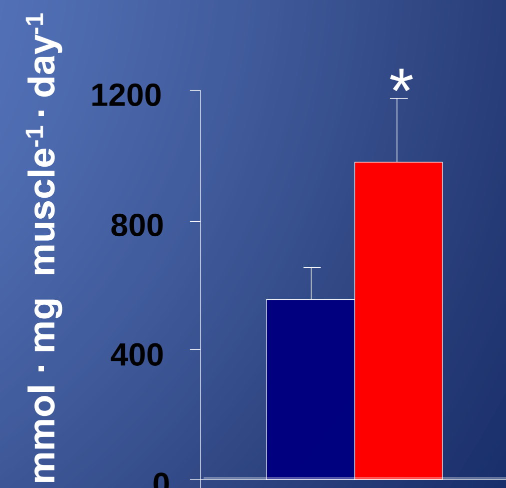
VASTUS LATERALIS THICKNESS



MUSCLE PROTEIN CARBONYLATION

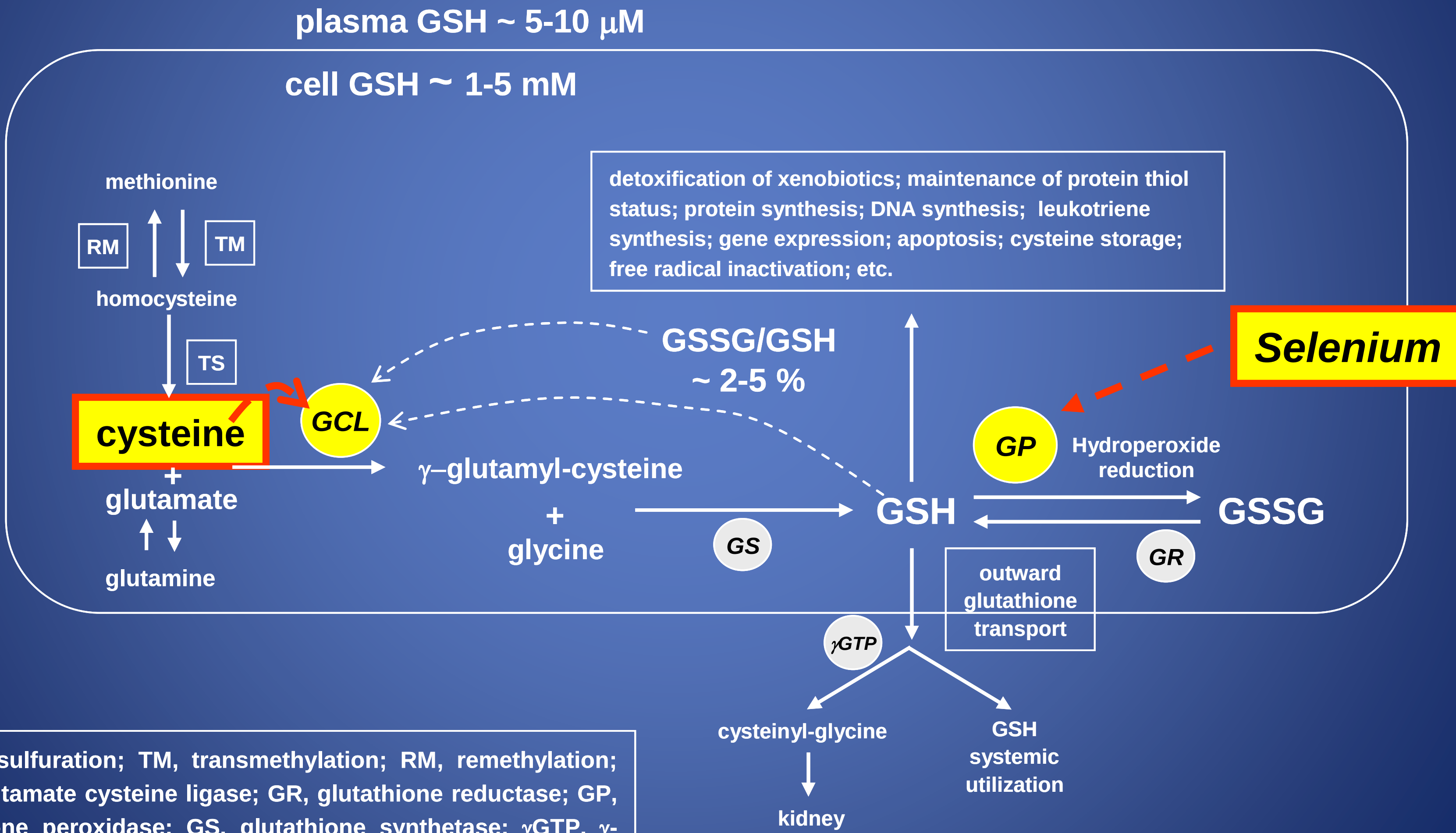
Ambulatory
Bed rest





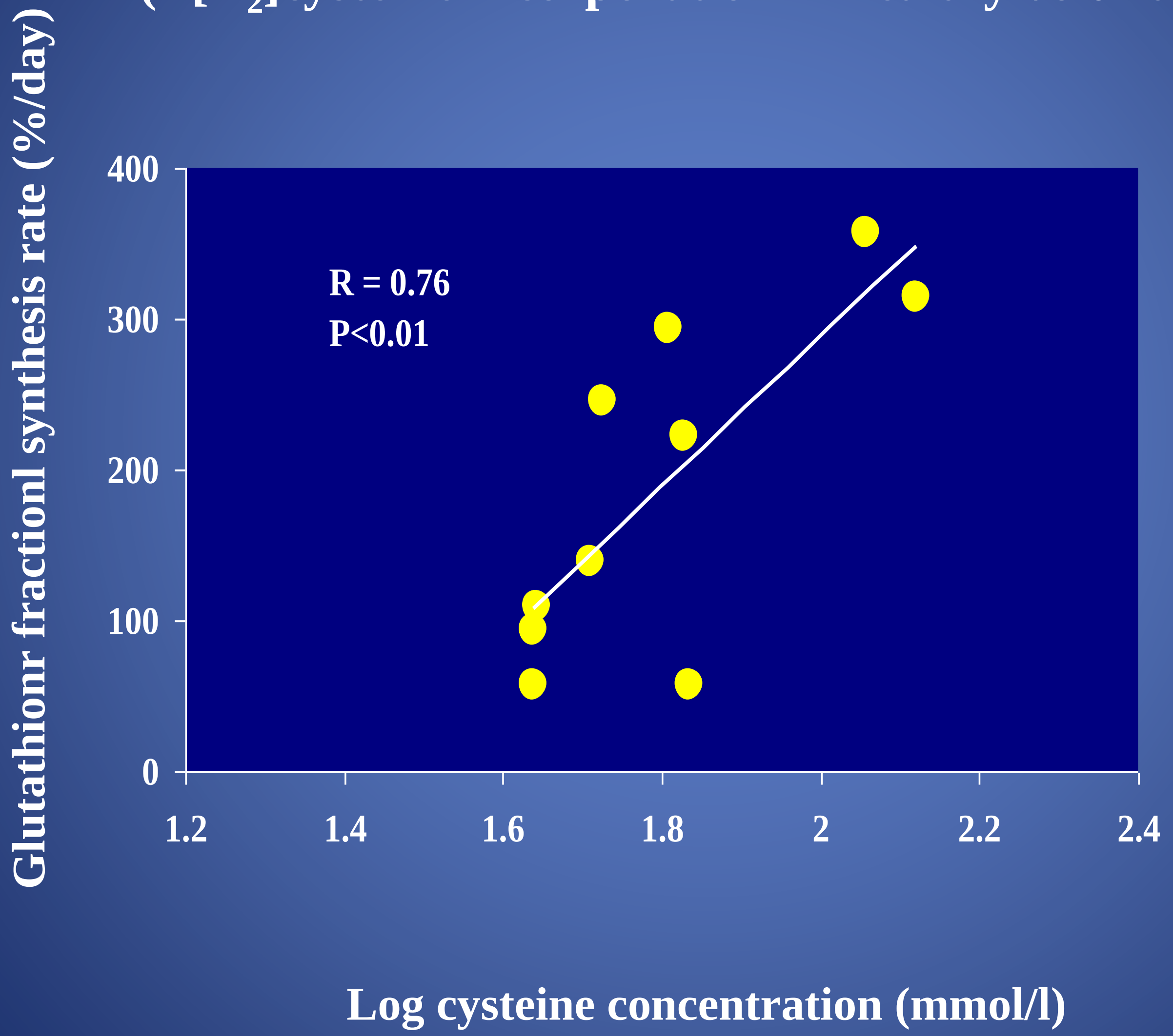
GLUTHATIONE SYNTHESIS RATE

RELATIONSHIPS BETWEEN PATHWAYS OF GLUTATHIONE SYNTHESIS AND DISPOSAL



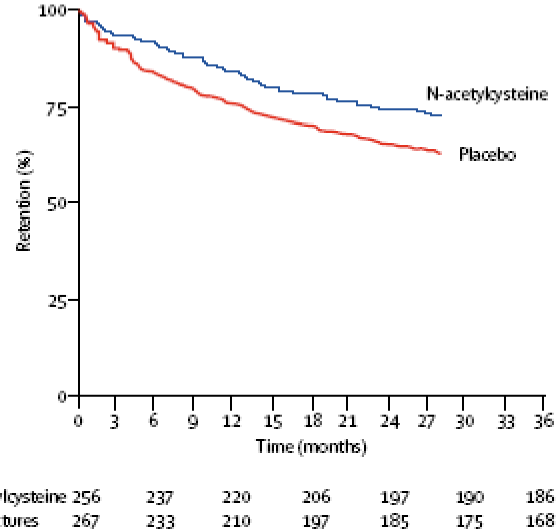
TS, transulfuration; TM, transmethylation; RM, remethylation; GCL, glutamate cysteine ligase; GR, glutathione reductase; GP, glutathione peroxidase; GS, glutathione synthetase; γGTP, γ-glutamyl transpeptidase.

Relationship between cysteine concentration and glutathione synthesis in erythrocytes (L[D_2]cysteine incorporation in healthy volunteers)



Effects of N-acetylcysteine on outcomes in chronic obstructive pulmonary disease (Bronchitis Randomized on NAC Cost-Utility Study, BRONCUS): a randomised placebo-controlled trial

Lancet 2005; 365: 1552–60



Effect of carbocisteine on acute exacerbation of chronic obstructive pulmonary disease (PEACE Study): a randomised placebo-controlled study

Lancet 2008; 371: 2013–18

	Risk ratio	95% CI	p
COPD stage			
Stage IV/stage II	1·44	1·07–1·94	0·015
Stage III/stage II	1·24	1·01–1·53	0·037
Treatment			
Carbocisteine/placebo	0·74	0·61–0·89	0·002

Table 2: Risk ratio of exacerbation affected by GOLD-defined COPD severity and treatment with carbocisteine

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Original article

Amino acid supplementation in L-dopa treated Parkinson's disease patients

A. Cucca [a], S. Mazzucco [b], A. Bursomanno [c], L. Antonutti [c], F.G. Di Girolamo [b], G. Pizzolato [c], N. Koscica [c], G.L. Gigli [a], M. Catalan [c], G. Biolo [b, *]

[a] University of Udine, Clinica Neurologica, Department of Experimental and Clinical Medical Sciences, Italy
[b] University of Trieste, Clinica Medica, Department of Medical, Surgical and Health Sciences, Italy
[c] University of Trieste, Clinica Neurologica, Department of Medical, Surgical and Health Sciences, Italy

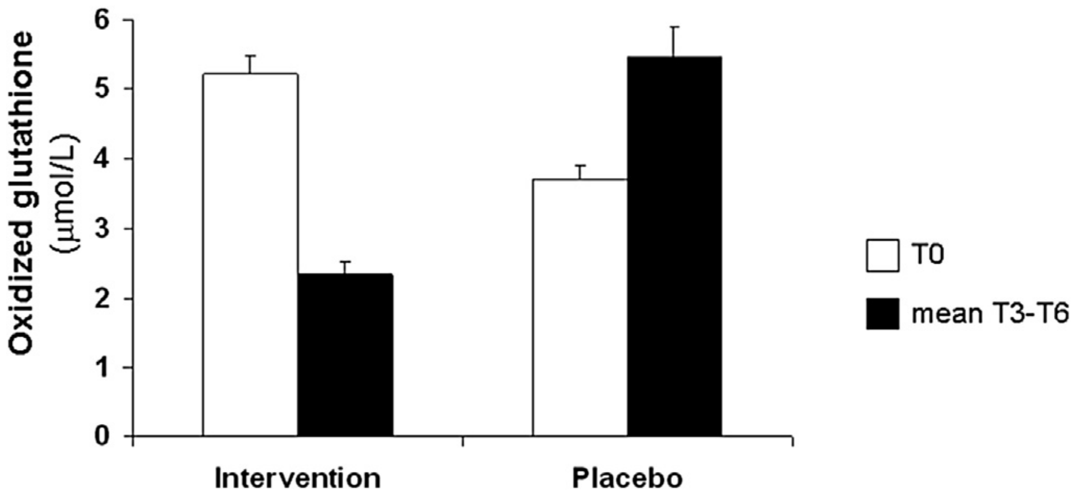


Fig. 2. Erythrocyte oxidized glutathione (GSSG) concentrations was reported at baseline (T0) and as mean of data collected after 3 and 6 months of treatment (mean T6-T3) with daily amino acid (Intervention group) or placebo (Placebo group) supplementation. There was a statistically significant time effect ($p = 0.05$) over the observation period as well as a statistically significant time × treatment interaction ($p = 0.05$), as determining using the repeated measure ANCOVA.

VALUTAZIONI ANTROPOMETRICHE

- **BILANCIA E STADIOMETRO:**
  - ✓ **Peso**
  - ✓ **Altezza**

→ **Indice di massa corporea (IMC) =**

(Peso, kg) / (Altezza, m)^2

Per una corretta valutazione si deve considerare anche l'ETÀ!

VALORI DI RIFERIMENTO IMC (popolazione anziana):

- **<21 kg/m^2: rischio malnutrizione**
- **21-23 kg/m^2: accettabile**
- **23-25 kg/m^2: ottimale**
- **25-30 kg/m^2: sovrappeso**

PANGEA
TELESNA AKTIVNOST IN PREHRANA ZA KAKOVOSTNO STARANJE
ATTIVITÀ FISICA E NUTRIZIONE PER UN INVECCHIAMENTO DI QUALITÀ

INDICE DI MASSA CORPOREA

Stesso indice di massa corporea ma differente proporzione tra massa muscolare e tessuto adiposo

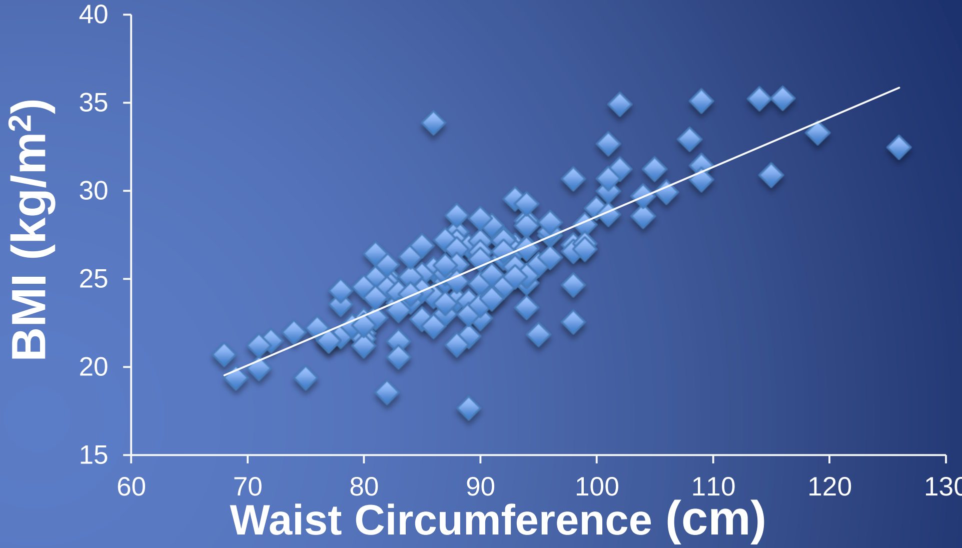
Measuring Technique for body composition

Body mass index (BMI):

- No distinction between Fat Mass and Fat-Free Mass
- No information about fat distribution
- Not very sensible in elderly subjects

Waist Circumference (WC):

- Highly correlation with BMI



Biolo et al. Clin Nutr 2015

Measuring techniques	Measurements	Comments
Muscle size		
CT Scan	Muscle cross-sectional area	Radiation exposure, expensive
MRI Scan	Muscle cross-sectional area	Expensive, availability of MRI
BIA	Tissue conductivity	? reliability
Muscle circumferences	Mid arm and calf circumference	Measurements effected by subcutaneous fat
DXA scan	Total skeletal muscle mass	Reliable, low radiation exposure

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging; BIA, bioelectric impedence analysis; DXA, dual energy X-ray absorptiometry; SPPB, Short Physical Performance Battery.

ABSI, a body shape index

$$\text{ABSI} = \frac{\text{Waist Circumference}}{\text{BMI}^{2/3} \times \text{Height}^{1/2}}$$

- New marker of abdominal fat deposition
- Unrelated to BMI
- Correlated to age

OPEN ACCESS Freely available online PLoS one

A New Body Shape Index Predicts Mortality Hazard Independently of Body Mass Index

Nir Y. Krakauer[1]*, Jesse C. Krakauer[2]

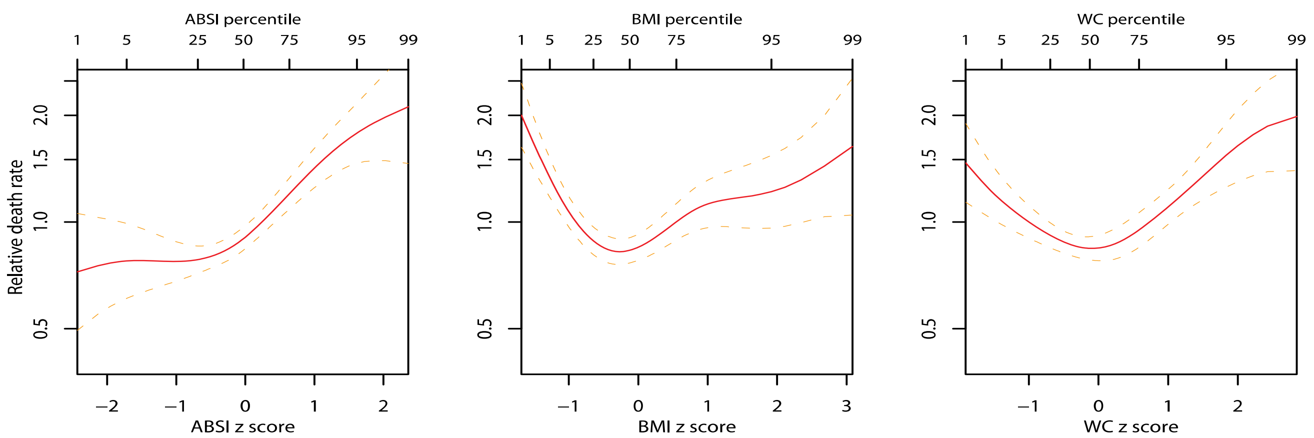


Figure 2. Mortality hazard by ABSI, BMI, and WC z score relative to age and sex specific normals. Estimates are from proportional hazard modeling where log mortality hazard is a smoothing-spline function in ABSI, BMI, or WC. Dashed curves show 95% confidence intervals. Corresponding population percentiles are given in the top axis; the range shown is the 1st through 99th percentiles. The vertical axis is logarithmic.
doi:10.1371/journal.pone.0039504.g002

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journal homepage: http://www.elsevier.com/locate/clnu

Short communication

Inverse relationship between "a body shape index" (ABSI) and fat-free mass in women and men: Insights into mechanisms of sarcopenic obesity

Gianni Biolo [a,*], Filippo Giorgio Di Girolamo [a], Andrea Breglia [a], Massimiliano Chiuc [a], Valeria Baglio [a], Pierandrea Vinci [a], Gabriele Toigo [b], Lucio Lucchin [c], Mihaela Jurdana [d], Zala J. Pražnikar [d], Ana Petelin [d], Sara Mazzucco [a], Roberta Situlin [a]

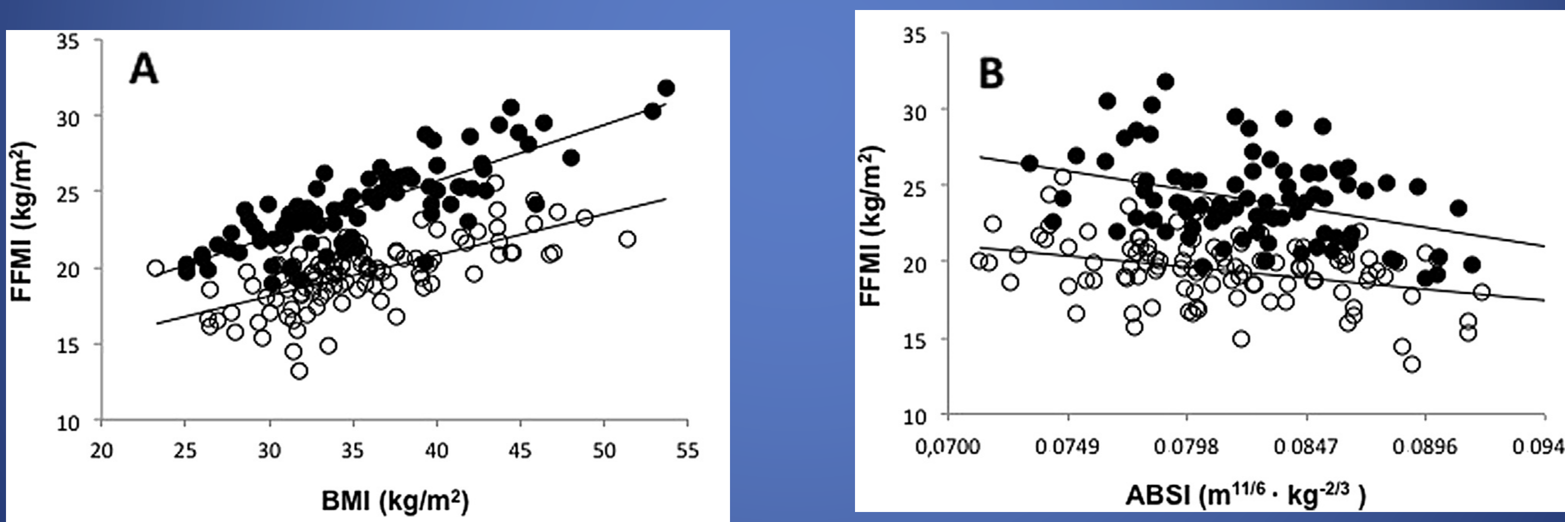


Fig. 1. Correlations of fat-free mass index (FFMI) with body mass index (BMI) (A) and with a body shape index (ABSI) (B), in women (○) and men (●). See Table 2 for Pearson's rank correlations. See Table 3 for results of multiple regression with FFMI as dependent variable and BMI and ABSI as independent variables.

PANGeA STUDY

Inclusion criteria

- Age ≥ 60
- Ability to walk at least 2 km continuously - without support

Maggiore Hospital, Trieste

159 enrolled volunteers

<u>94 Female</u>

- Age (y) 67 ± 5
- BMI (kg/m^2) 24,7 ± 3,6

<u>65 Male</u>

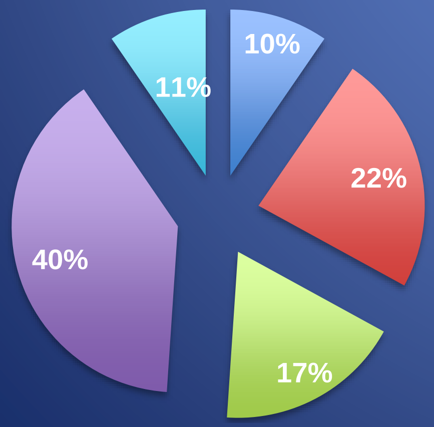
- Age (y) 68 ± 5
- BMI (kg/m^2) 25,7 ± 3,4

Field Survey Measurements
Questionnaire
Urine analysis
Blood analysis
Anthropometrics
Cardiovascular capabilities (ECG, VO_2 Max, 2km Walking test)
Flexibility
Maximum force
Reaction time,
Maximum balance
Attention, memory, logical
Maximum force and balance
Bioimpedance
…

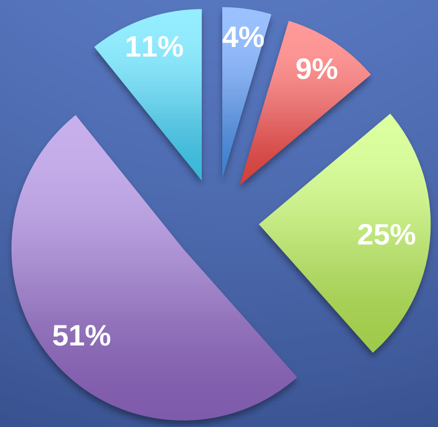
Subjects characteristics

Indexes	Women (94)	Men (65)	p value
Age (y)	67 ± 5	68 ± 5	0.5
BMI (kg/m²)	24.7 ± 3.6	25.7 ± 3.4	0.08
Fat-Free Mass, FFM (kg)	62 ± 5.8	70 ± 5.3	< 0.01
Fat Mass, FM (kg)	37.2 ± 5.8	29.3 ± 5.3	< 0.01
FM/FFM ratio	0.61 ± 0.15	0.42 ± 0.11	< 0.01
Muscle Mass (kg)	23.4 ± 2.5	34.4 ± 4.3	< 0.01
Waist Circumference, WC (cm)	86.30 ± 9.3	94.9 ± 9.2	< 0.05
Hand grip Strength (kg)	2.6 ± 0.47	4.5 ± 0.86	< 0.01

Women



Men



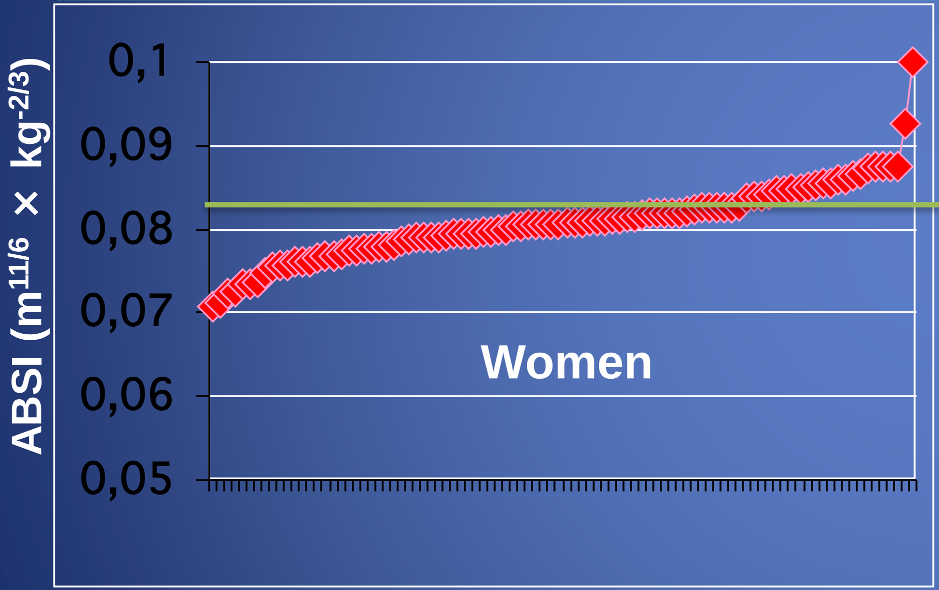
BMI, criteria for elderly

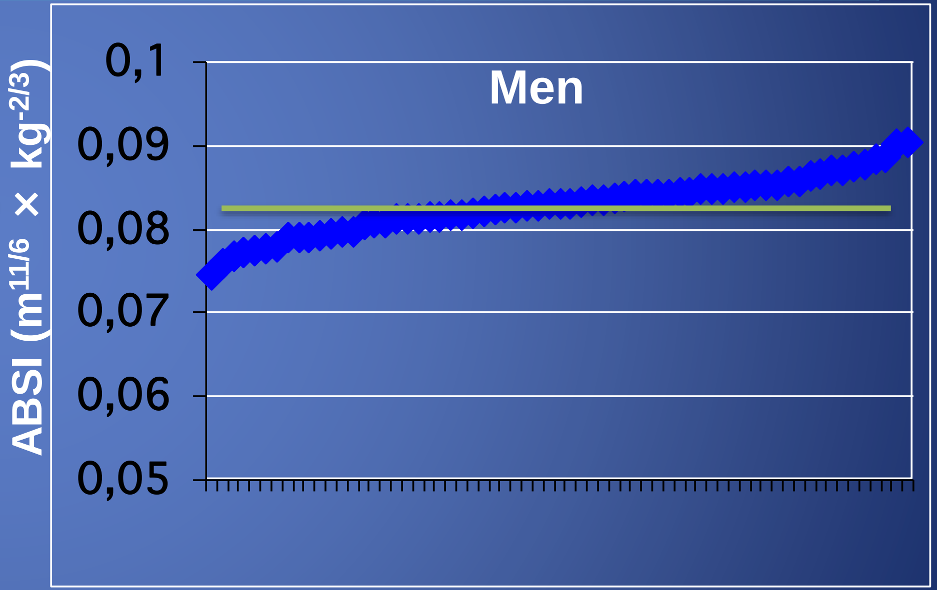
- Malnutrition IMC < 21
- Adequate IMC 21 – 23
- Optimal IMC 23 – 25
- Overweight IMC 25 – 30
- Obesity IMC ≥ 30

Biolo et al. Clin Nutr 2014

ABSI, “A Body Shape Index”

	Women (94)	Men (65)	p value
ABSI	0.081 ± 0,0005	0.082 ± 0,0003	< 0,05





Pearson’s correlation	ABSI (W)	ABSI (M)
BMI	R= +0.021 P= 0.84	R= -0.072 P= 0.57
Age	R= +0.29 P> 0.01	R +0.45 P> 0.03