Hvorfor er protein og energi så vigtig når vi genoptræner ældre og patienter

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SECTION OF SPORT SCIENCE
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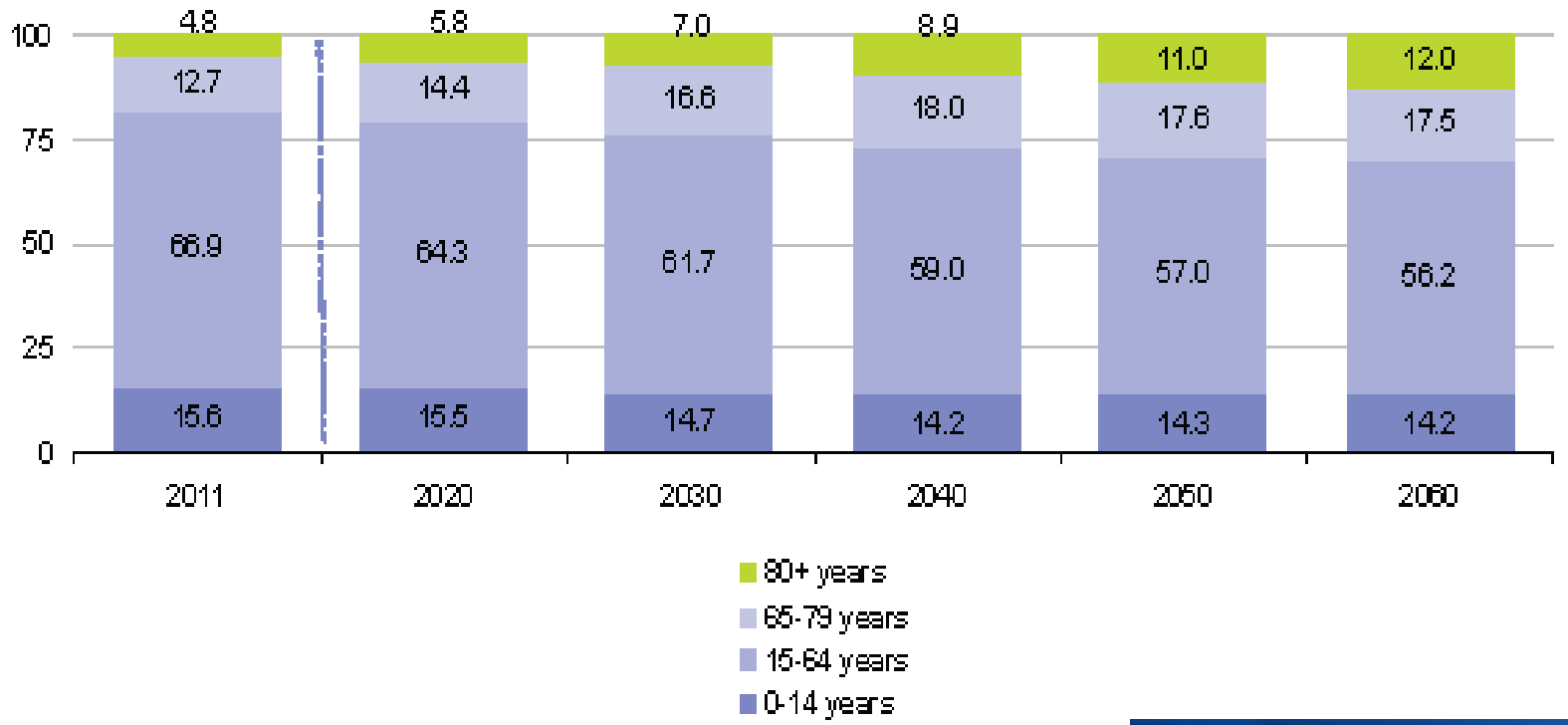
Okt 2013

EU: THE PORPORTION OF ELDERLY GROW



(1) 2011, provisional; 2020-2060 data are projections (EUROPOP2010 convergence scenario).
Source: Eurostat (online data codes: demo_pjanind and proj_10c2150p)

European Commission
eurostat

- Hos ældre er BMI mellem 24 og 29 forbundet med en lang levetid, afhængig af den undersøgte population

Cornoni-Huntley JC, et al, J Clin Epidemiol 1991, Dey DK, et al, Eur J Clin Nutr 2001
Folsom AR, et al, JAMA 1993, Heitmann BL, et al Int J Obes Relat Metab Disord 2000, Stevens J, et al, N Engl J Med 1998,

- Hos ældre på sygehus synes det "ideelle BMI" at være højere end for unge, når det gælder muligheden for at overleve sin sygdom

Flodin L, et al Clin Nutr 2000, Landi F, et al, Arch Intern Med 2000, Potter JF, et al, J Gerontol 1988

HØJT BMI ER TILSYNELADENDE GUNSTIGT FOR ÆLDRE, NÅR DET ER UDTRYK FOR ET HØJT INDHOLD AF MUSKELMASSE

Zamboni et al. 2005: 20 studier fra 1997 to 2004 med mindst 4.5 års follow-up

› Meget central fedt og tab af fedt-fri-masse er bedre prædiktorer for risiko for tidlig død end BMI

Wannamethee et al, 2007: 6 års followup studie, raske mænd 60-79 år, n=4107

› Lille muskelmasse (armomkreds) associeret med øget risiko for at dø
› Efter justering af armomkreds – højt taljemål (> 102 cm) og høj talje/hofte ratio associeret med øget risiko for at dø tidligt

Srikanthan et al. 2009: Velfungerende ældre (> 70 år

› Taljemål bedre en BMI I forhold til at forudsige risiko for tidlig død

Janssen et al. 2005: Ældre – 9 followup

- Efter justering for taljeomkreds – jo højere BMI jo mindre risiko for tidlig død
- Efter justering for BMI – jo højere taljeomkreds jo større risiko for tidlig død

DAILY ACTIVITIES

WALKING
STAIR CLIMBING
CHAIR RISING

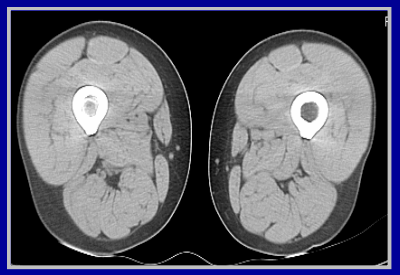
Physical function of the muscle skeletal system

- Flexibility
- Coordination / balance
- Muscle endurance capacity

- Muscle strength
- Muscle power

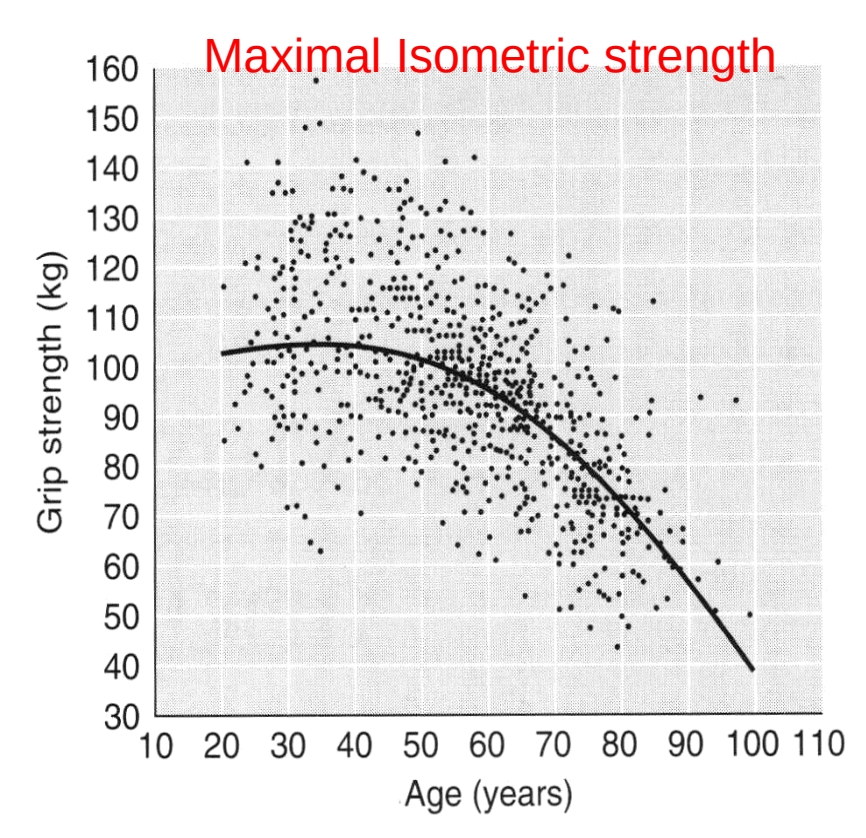
Muscle mass

& Neural factors



REDUCTION IN: STRENGTH

Reduced by 1-1.5% /yr from 60-65 yrs

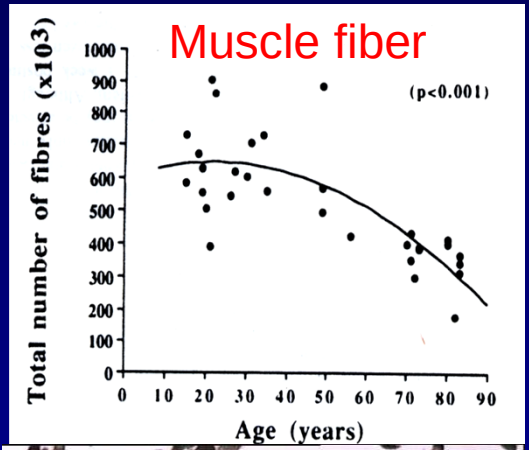


Vandervoort & McComas 1986, Spirdoso 1995

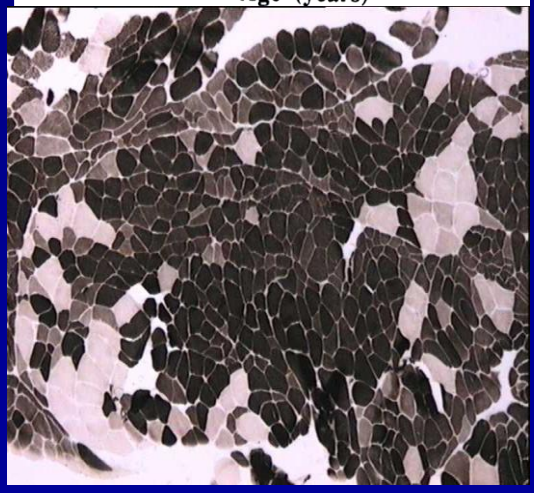
Spirduso, Physical dimensions of Ageing, 1995

MUSCLE MASS

Reduced by 0.5-2% /yr from 50-80 yrs



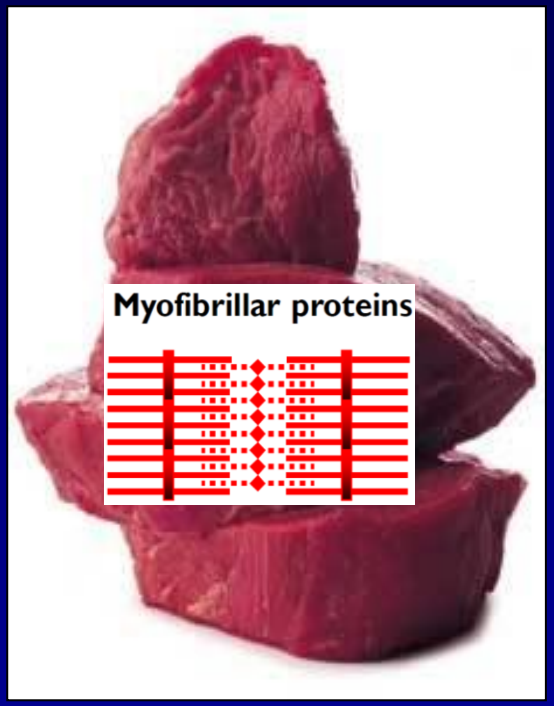
Loss of muscle fiber

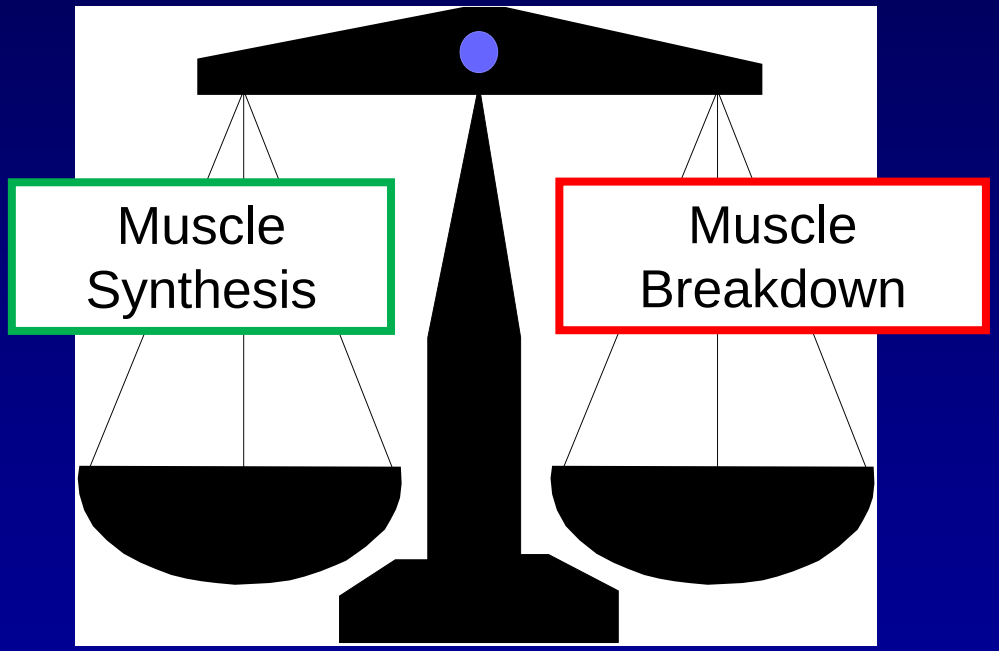


Smaller muscle fiber

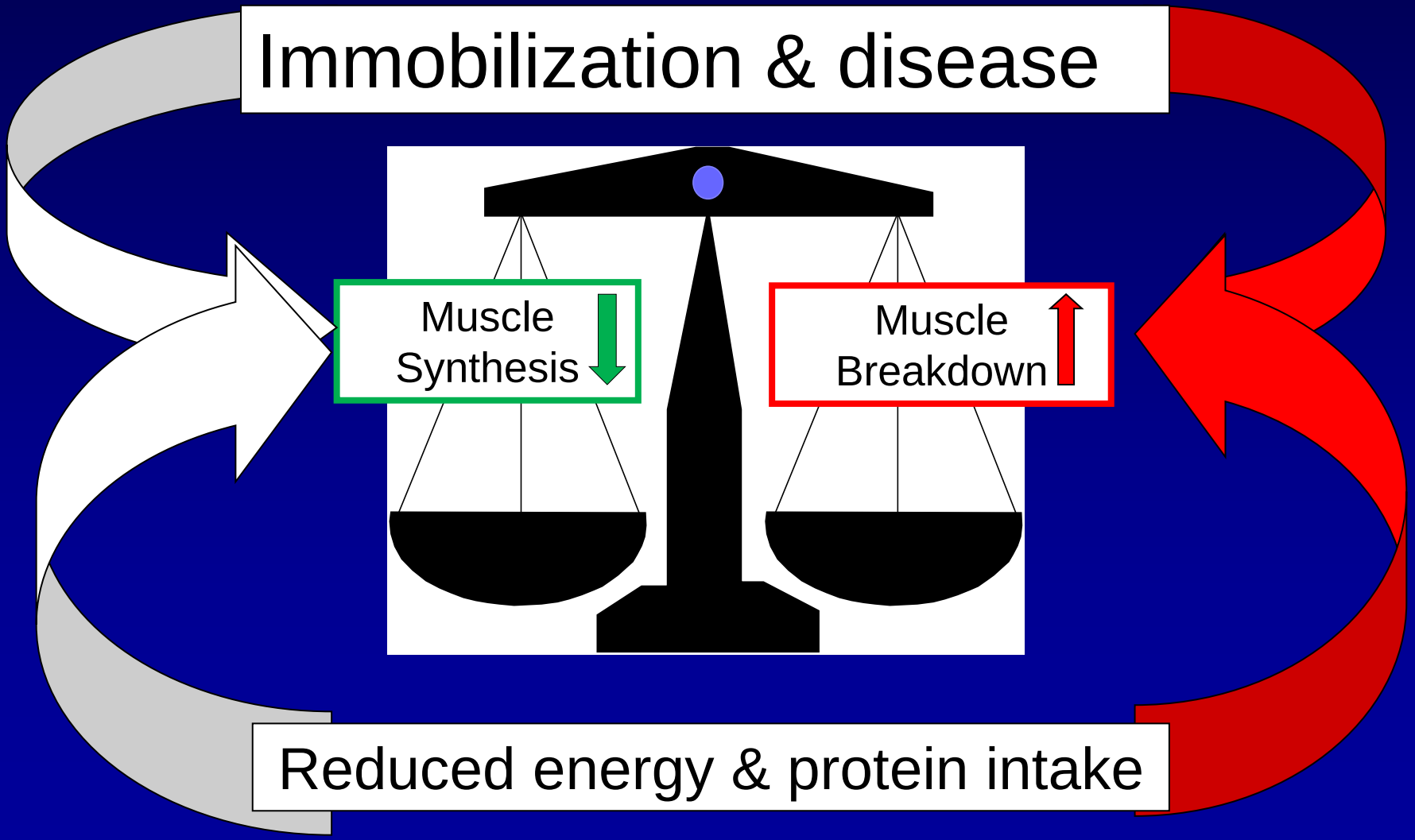
Parise & Yarasheski, Curr Opin Clin Nutr Metab Care, 2000

MUSCLE PROTEIN BALANCE



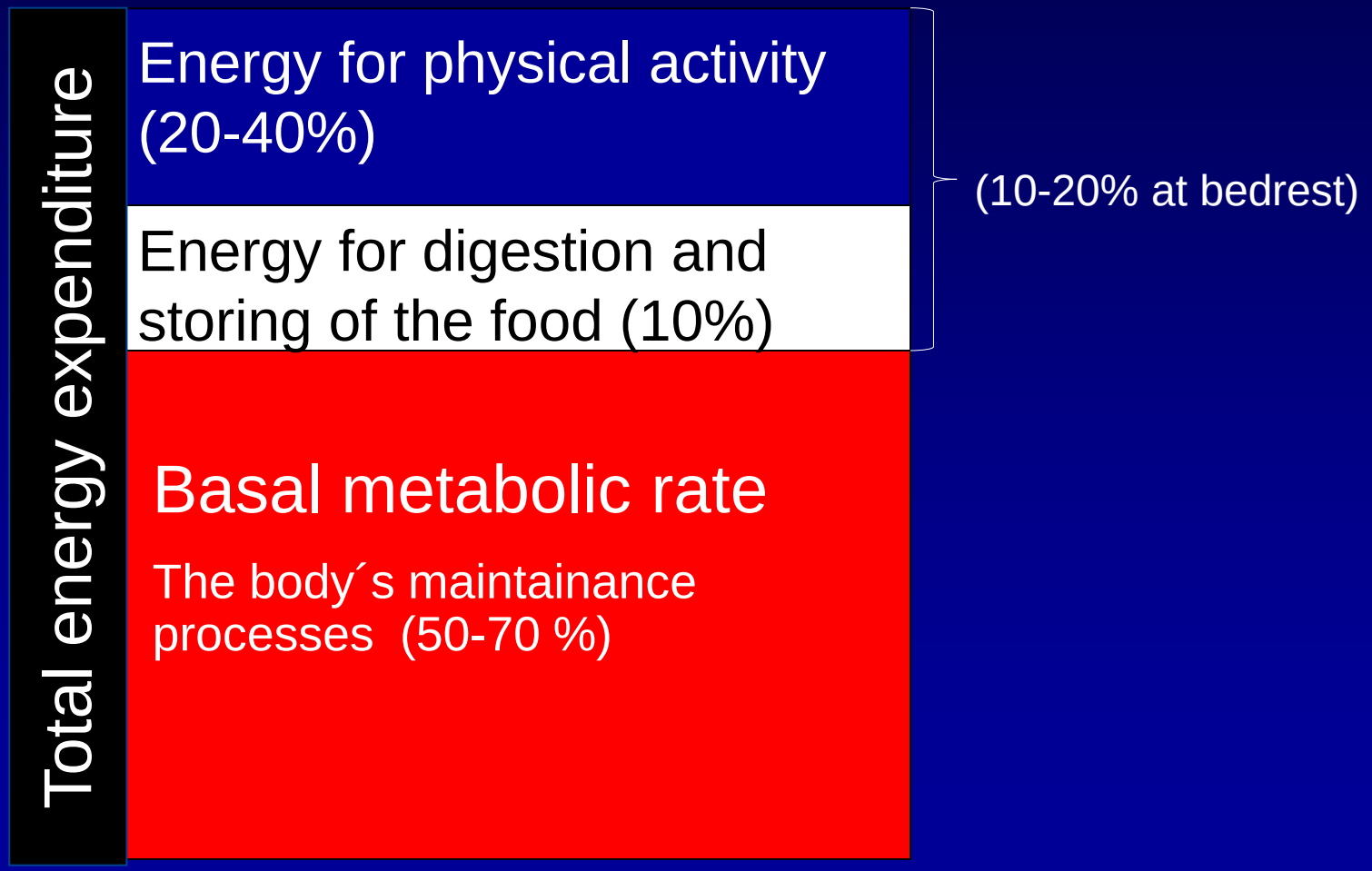


MUSCLE PROTEIN BALANCE

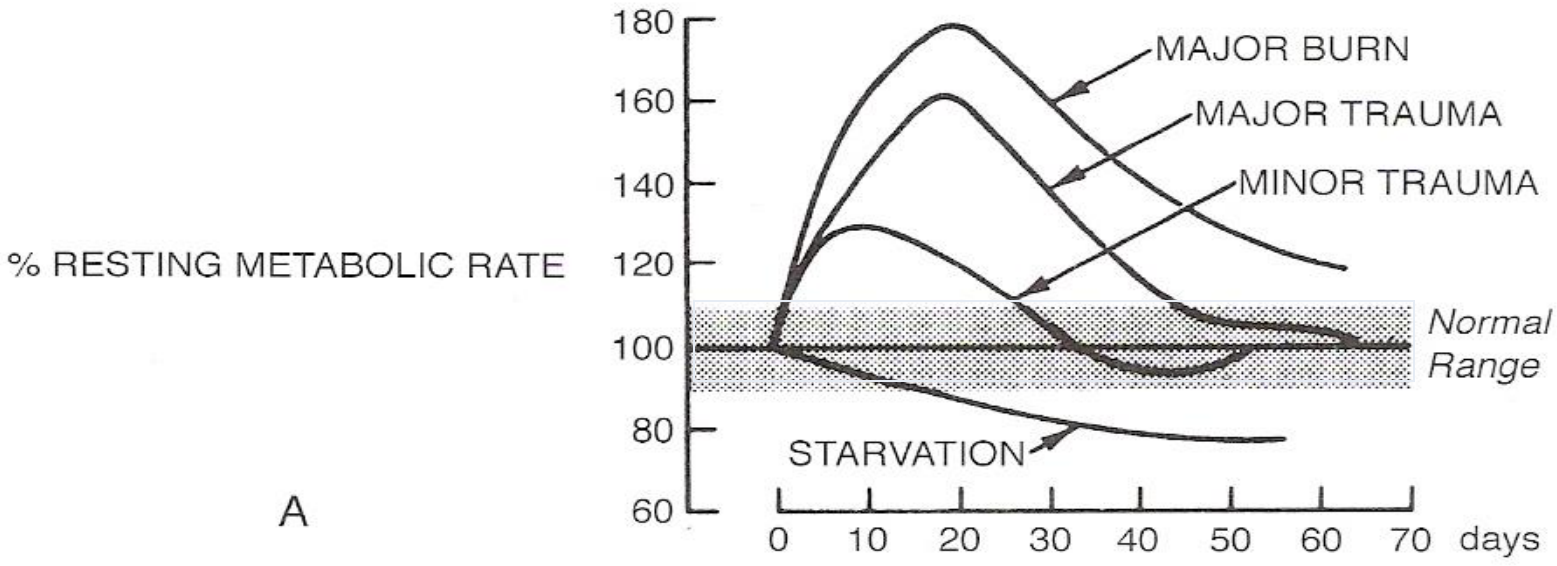


ENERGY EXPENDITURE

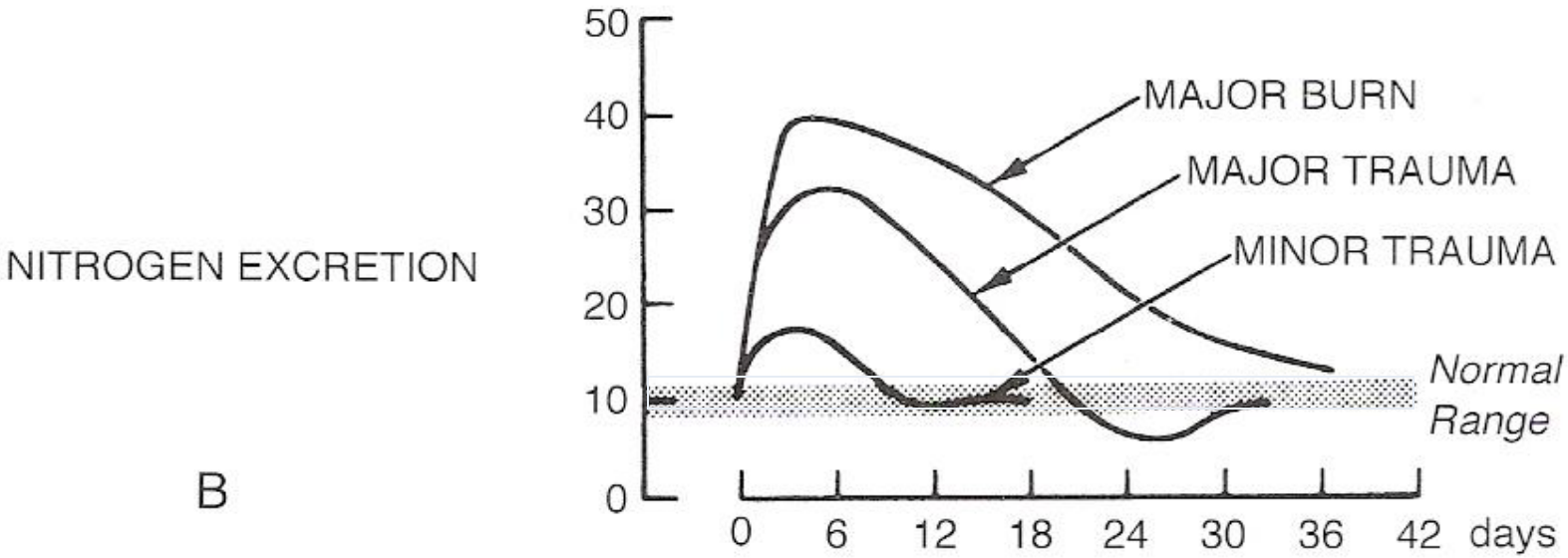
BASAL METABOLIC RATE + ENERGY FOR AKTIVITET + DIGESTIBILITY & STORING OF THE NUTRIENTS



HYPERCATABOLIC STATE

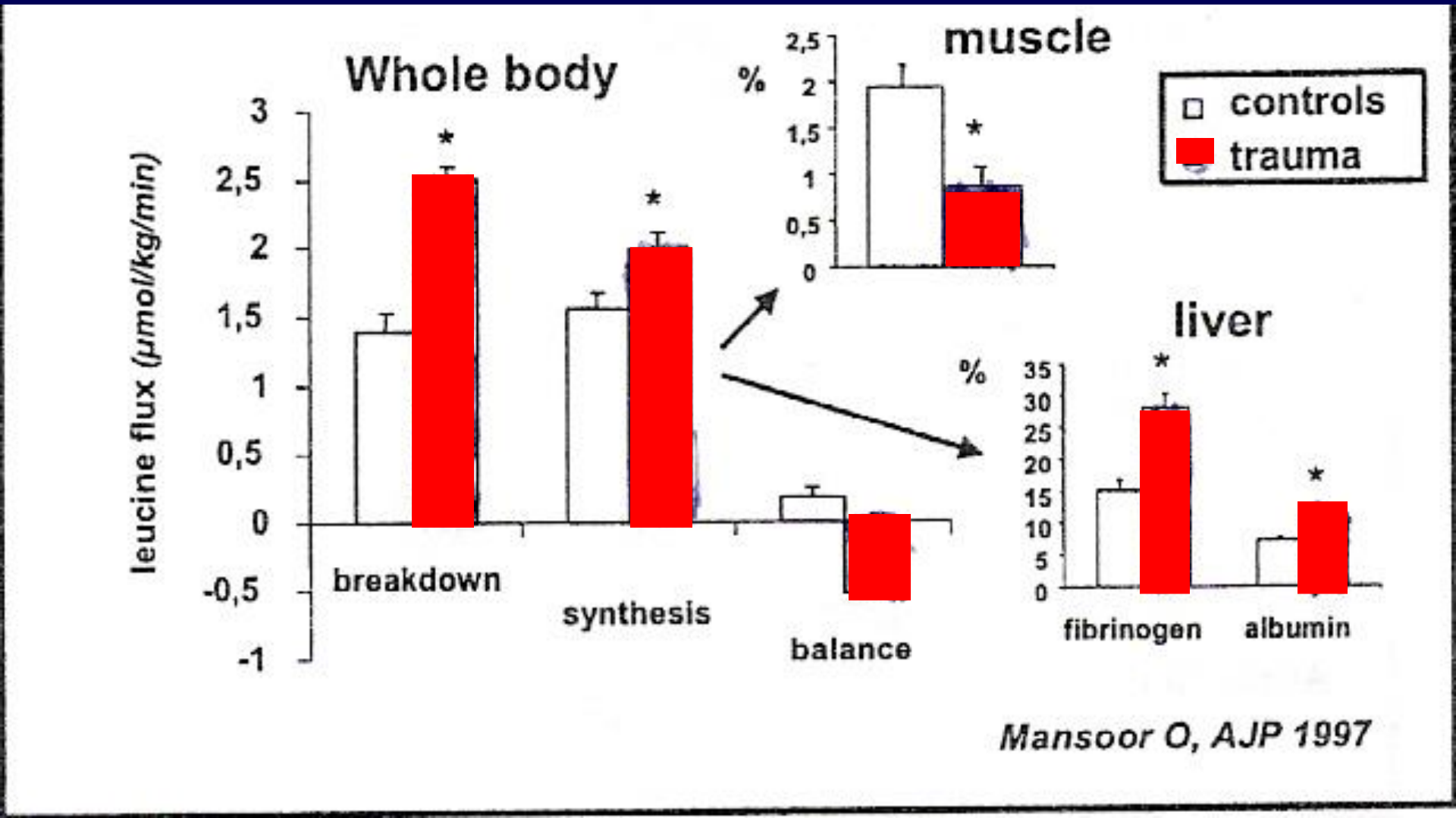


A



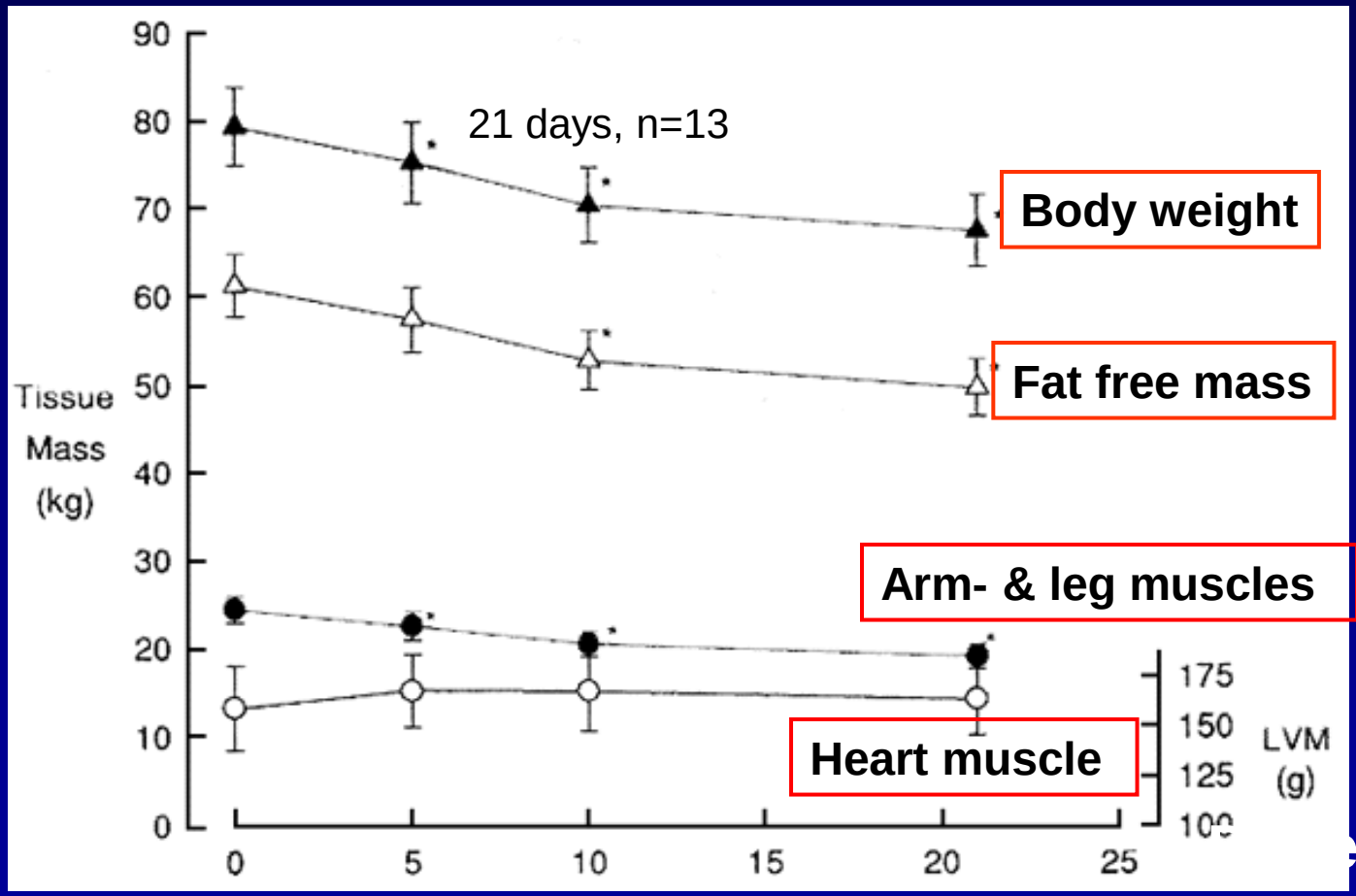
B

WHOLE BODY AND TISSUE PROTEIN TURNOVER RATES ARE DIFFERENTLY IMPAIRED IN HEAD TRAUMA PATIENTS



Mansoor O, AJP 1997

ELECTIVE ABDOMINAL SURGERY DEPRESSES MUSCLE PROTEIN SYNTHESIS AND ACCELERATE MUSCLE LOSS



↓11.8 kg

↓11.5 kg

↓5.3 kg

Petersson et al 1990

FOCUS ON PATIENTS NUTRITION STATUS

- Acute disease state/operation → survival
- Rehabilitation phase
  - Underweight patients: focus on energy balance and maintainance/building up muascle mass
  - Sarcopenic obese patients: focus on maintainance of muscle mass during weight loss

USE OF ENTERAL NUTRITIONAL SUPPLEMENTS POSTOPERATIVELY IN MALNOURISHED SURGICAL PATIENTS

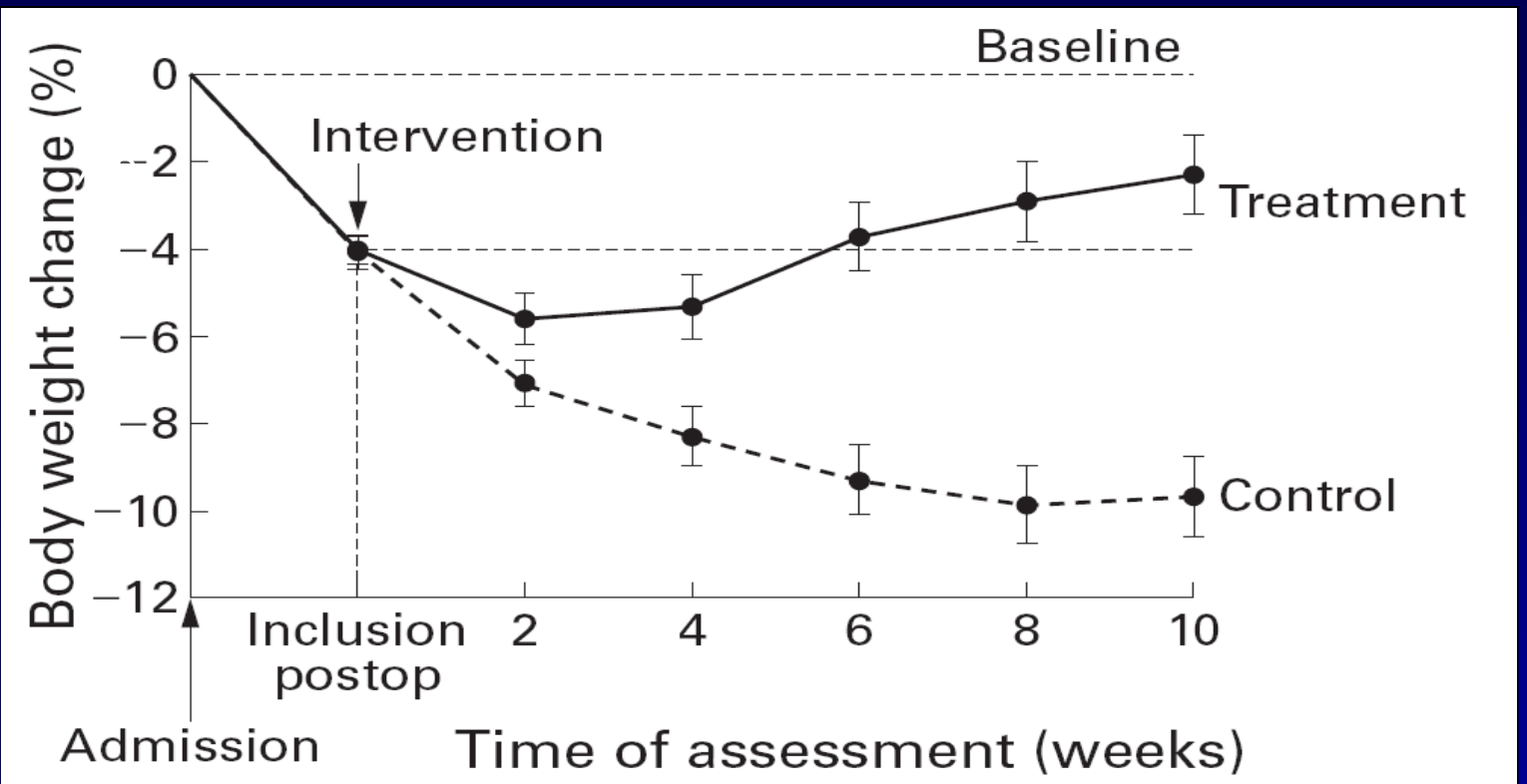


Figure 2 Percentage change in body weight in the control and treatment groups on admission to hospital, at inclusion in the study, and then at two weekly intervals for 10 weeks.

400 ml Nutrient-rich supplement drink

~ 2400 KJ

24 g protein

Grip strength

QOL

significant diff. Between groups ($p<0.001$).

Use of antibiotics

7/52 vs 15/49

Beattie AH, et al GUT 2000

COCHRANE REVIEW: EFFECT OG ENERGY-PROTEIN SUPPL. TO ELDERLY PATIENTS

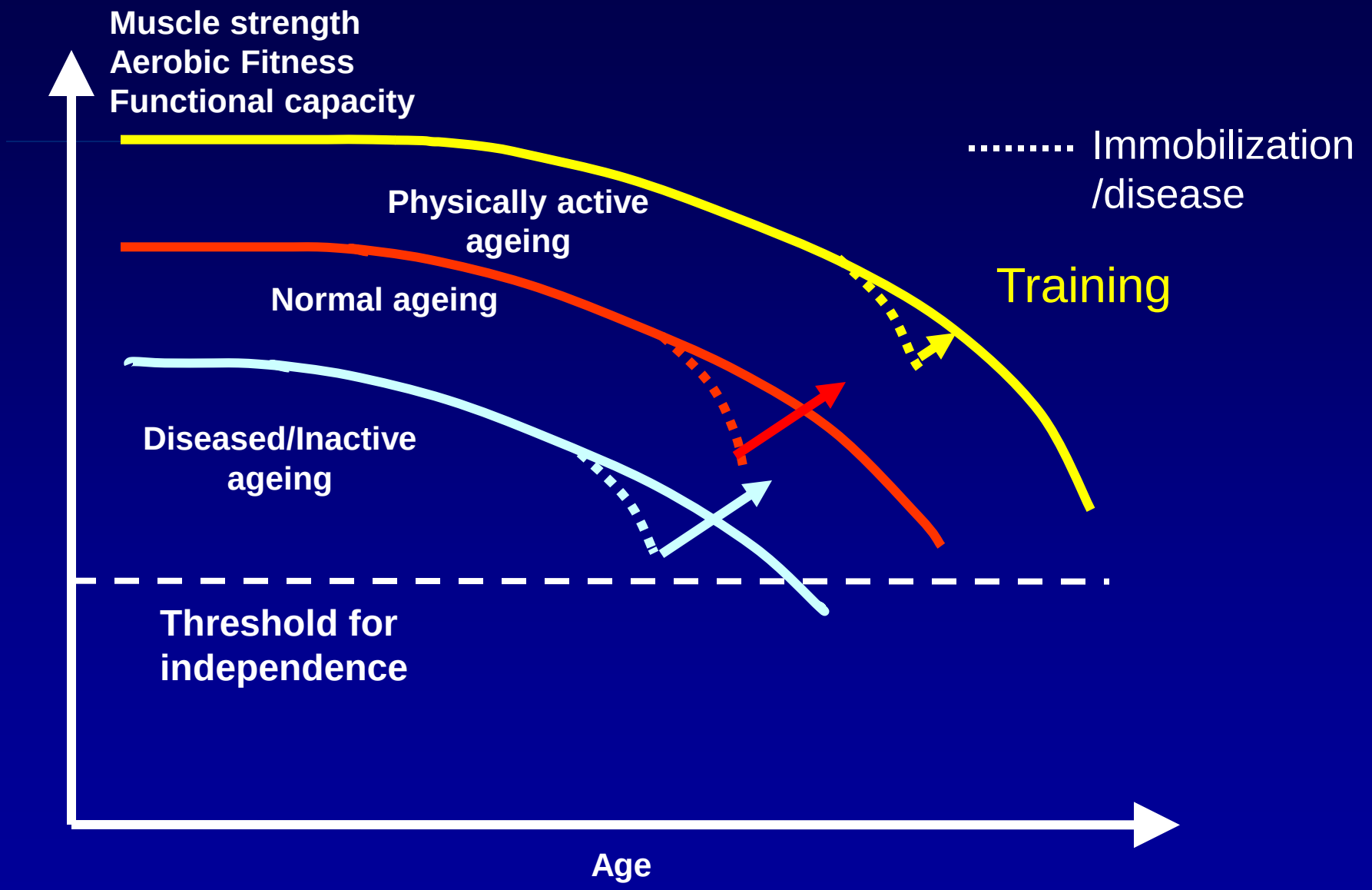
62 RANDOMISED CONTROLLED STUDIES (N=10187 PATIENTS)

Adverse effects included nausea (kvalme) or diarrhea.

Studies in general of poor quality, and low in compliance

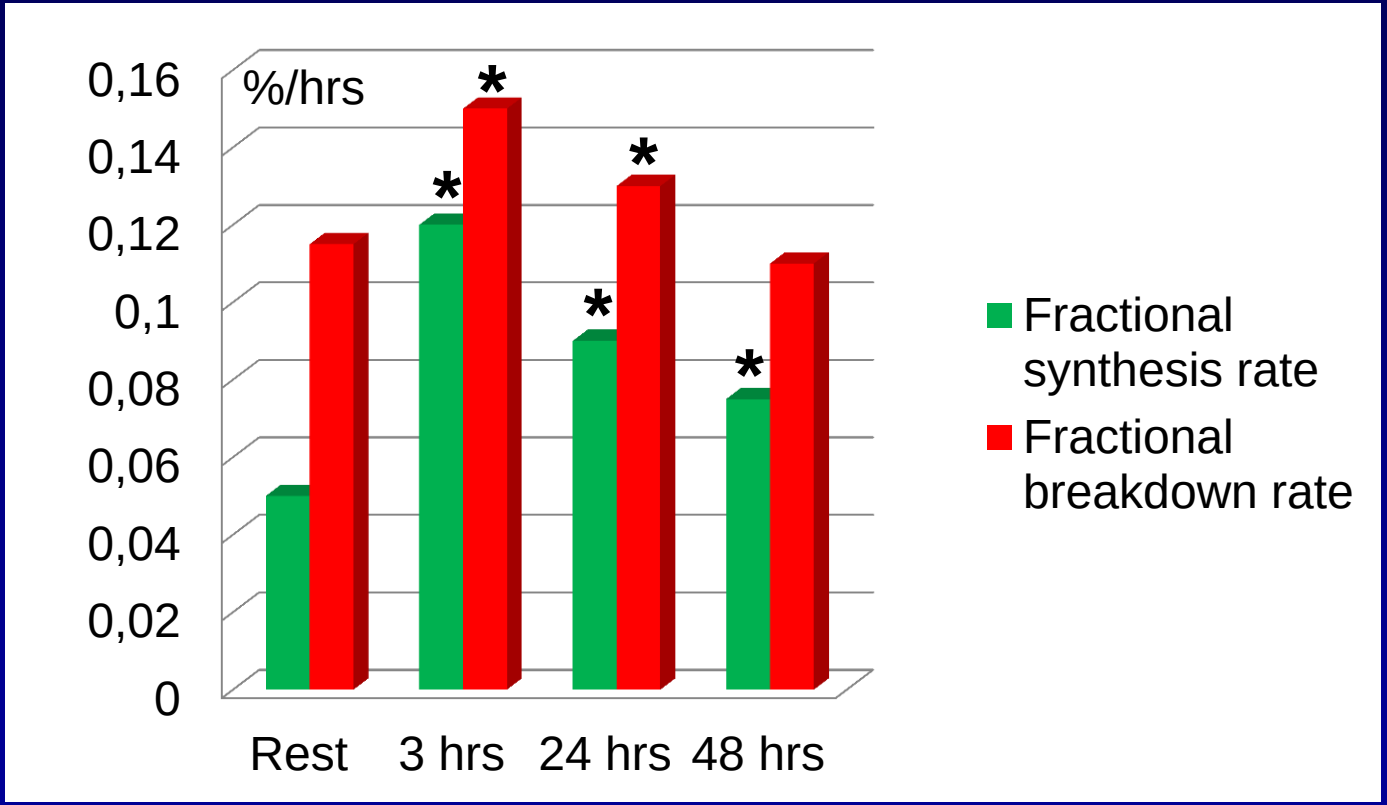
- Weight change 2,2% benefit of supplementation (95%CI 1.8 - 2.5)(n=42 studies)
- Mortality (mean) no effect: RR 0.92 (CI 0.81 to 1.04)(n=42 studies)
- Mortality (undernourished patients, N = 2461): RR 0.79 (95% CI 0.64 to 0.97).
- Risk of complications (n=24 studies): RR 0.86 (95% CI 0.75 to 0.99).
- Functional benefit from supplementation? To few studies

Milne AC et al, Cochrane Database Syst Rev. 2009


Muscle strength
Aerobic Fitness
Functional capacity
Immobilization
/disease
Physically active
ageing
Normal ageing
Training
Diseased/Inactive
ageing
Threshold for
independence
Age

N Beyer 2002

EFFECT OF ACUTE STRENGTH EXERCISE



8 sets of

8 rep 80% of 1RM

Philips *et al, 1997*

Underernærede ældre efter faldrelateret benfraktur

randomiseret kontrolleret studie

N=100

1) Kontrol (attention effekt, 3 ugentlige besøg)
2) Kosttilskud i 6 uger (Energitæt multi-næringsstoftilskud 580-800 ml for at dække energiforbrug, 630 kJ/100 ml)
3) Superviseret styrketræning i 12 uger (3/week)
4) Kosttilskud + superviseret styrketræning

Miller MD *et al*, Clin Rehabil.,2006

Underernærede ældre efter benfraktur

randomiseret kontrolleret studie N=100

Resultat:

Vægttab efter 12 uger

- Kontrol -5.2% (-9.0, -1.5)
- Næringstilskud -6.2% (-8.4, -4.0)
- Styrketræning -6.3% (-8.3, -4.3)
- Næringstilskud + styrketræning -4.7% (-7.4, -2.0)

} p<0.05

Ved høj comliance (35/42 tilskud) var vægttab forebygget ved samtidig styrketræning

Miller MD *et al*, Clin Rehabil.,2006

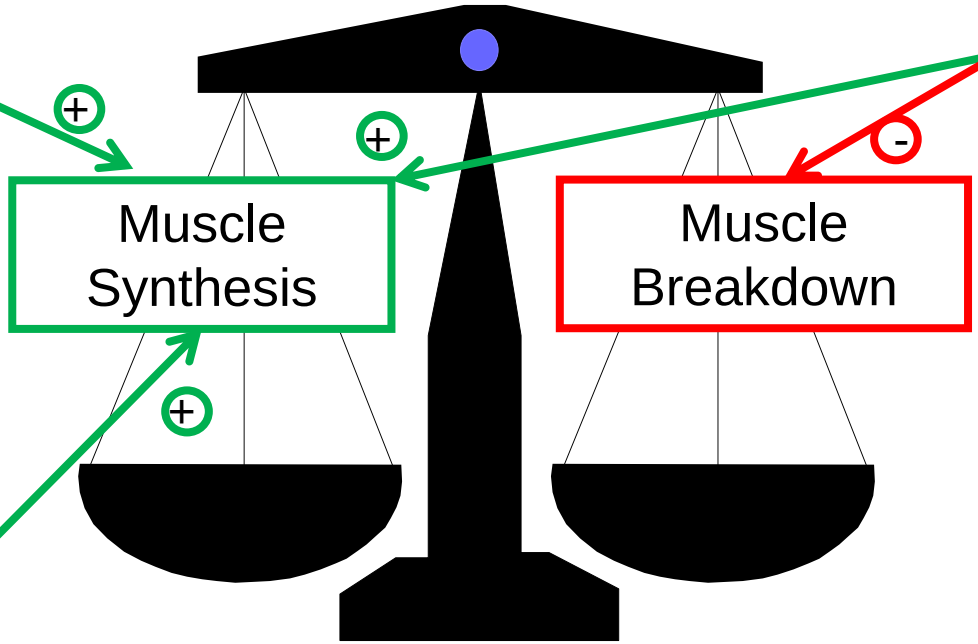
Lignende resultater for COPD patienter; Steiner et al 2003

MUSCLE PROTEIN BALANCE – EFFECT OF ENERGY & PROTEIN INTAKE

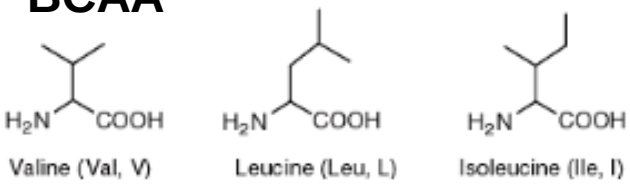
Amino Acids

Essential Acids (EAA)

Energy



BCAA



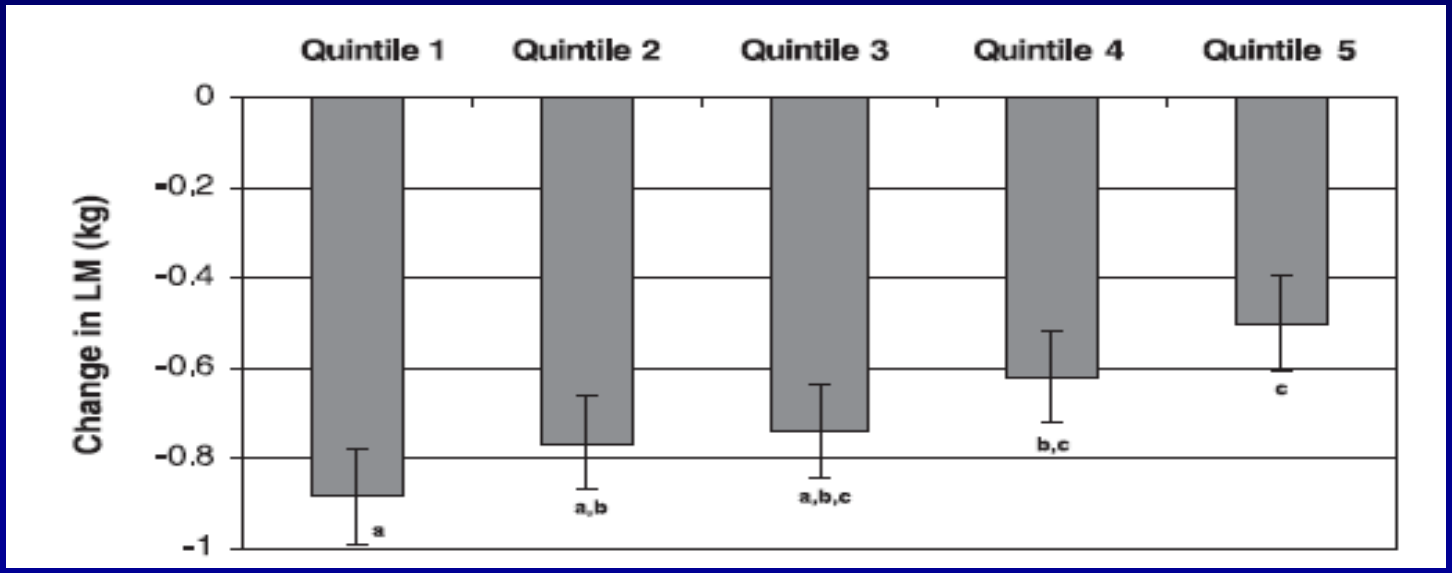
PROTEIN

- Protein quantity
- Protein quality (EAA, BCAA)
- Timing of protein intake
- Protein source

LOSS OF LEAN BODY MASS IN HEALTHY ELDERLY

N=2066, 70-79 YRS, 3-YEAR PERIOD Houston DK, et al, 2008

11.2	12.7	14.1	15.8	18	Energy%
0.7	0.7	0.8	0.9	1.1	g protein/kg/day



Gr 5 vs 1

40% reduced loss of LBM

Scientific evidence suggests that a protein intake moderately higher than the current RDA of 0.8 g/kg/day may help support muscle and bone health in the elderly.

Chaput et al, J. Nutr. Health Aging 11: 363, 2007. Meng, X., et al. J. Bone Miner. Res. 24: 1827, 2009.

PROTEIN

- *Protein quantity seems to matter*
- Protein quality (EAA, BCAA)
- Timing of protein intake
- Protein source

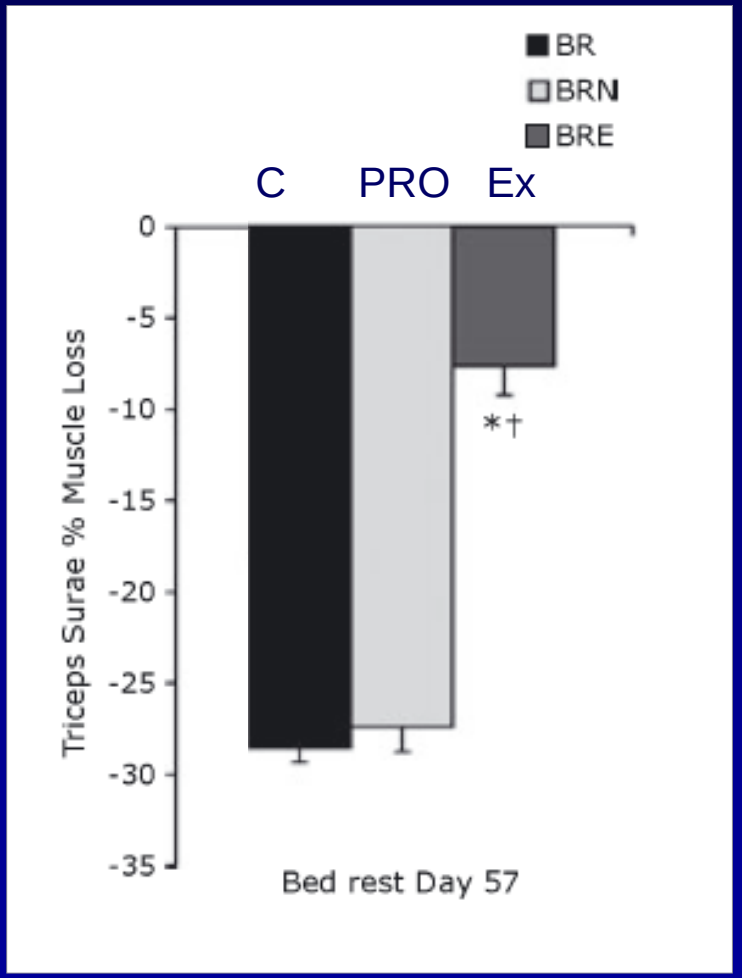
ENHANCED PROTEIN QUANTITY AND QUALITY DURING 60 DAYS BEDREST DO NOT REDUCE MUSCLE LOSS
(healthy young women)

3 Meals a day

Gr 1: 1.6 g protein/kg/day (incl.7.2 g extra BCAA)

Gr 2: 1 g protein/kg/day (isocaloric to gr 1)

Gr 3: 1 g protein/kg/day + Exercise in bed

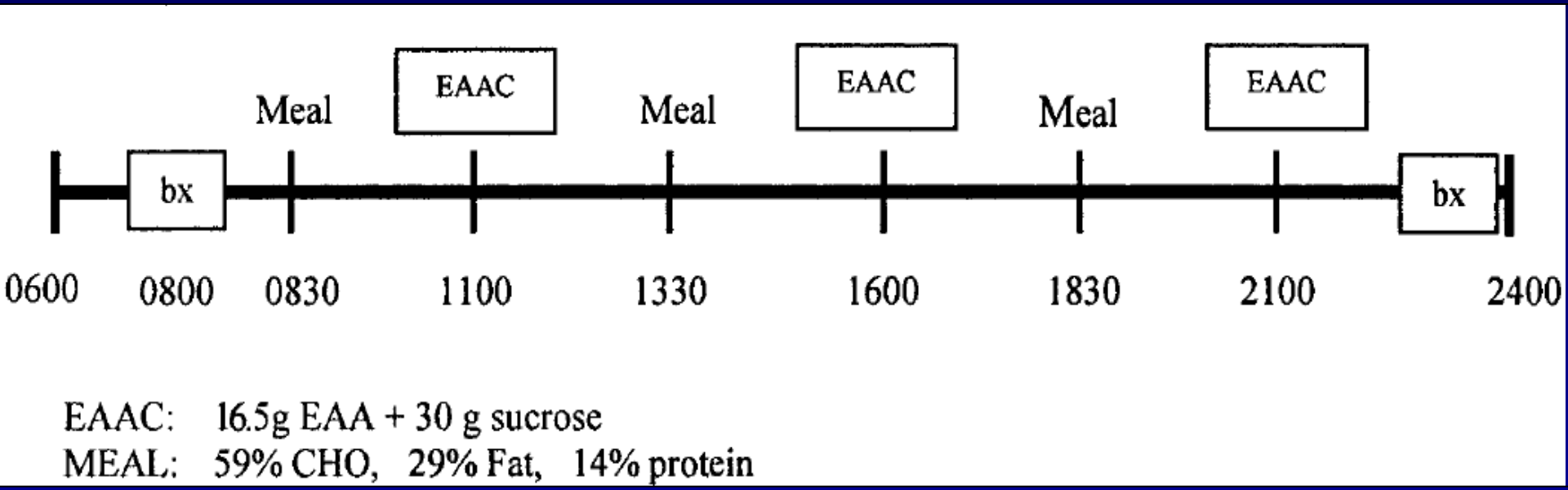


Trappe et al, Acta Physiol (2007)

PROTEIN

- Protein quantity seem to matter
- Protein quality (EAA, BCAA)
- Timing of protein intake
- Protein source

ENHANCED PROTEIN QUANTITY AND QUALITY DURING 28 DAYS BEDREST DO REDUCE MUSCLE LOSS
(healthy young men)

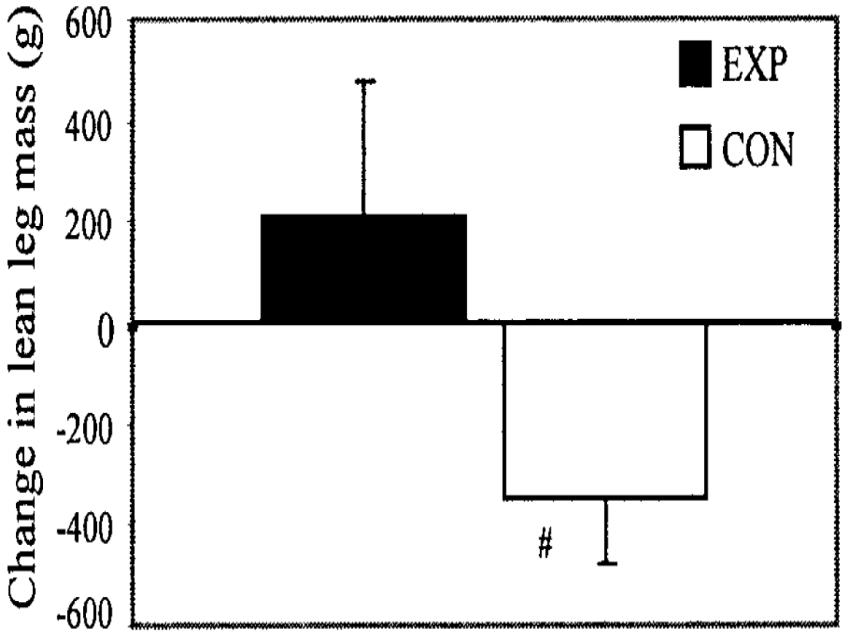


EAAC: 16.5g EAA + 30 g sucrose
MEAL: 59% CHO, 29% Fat, 14% protein

Paddon-Jones D et al, *J Clin Endocrinol Metab* (2004) 89: 4351–4358

ENHANCED PROTEIN QUANTITY AND QUALITY DURING 28 DAYS BEDREST DO REDUCE MUSCLE LOSS (healthy young men)

Muscle mass



4. Change in lean leg mass (determined by DEXA) after bedrest. ignificant reduction ($P < 0.05$).

Muscle strength

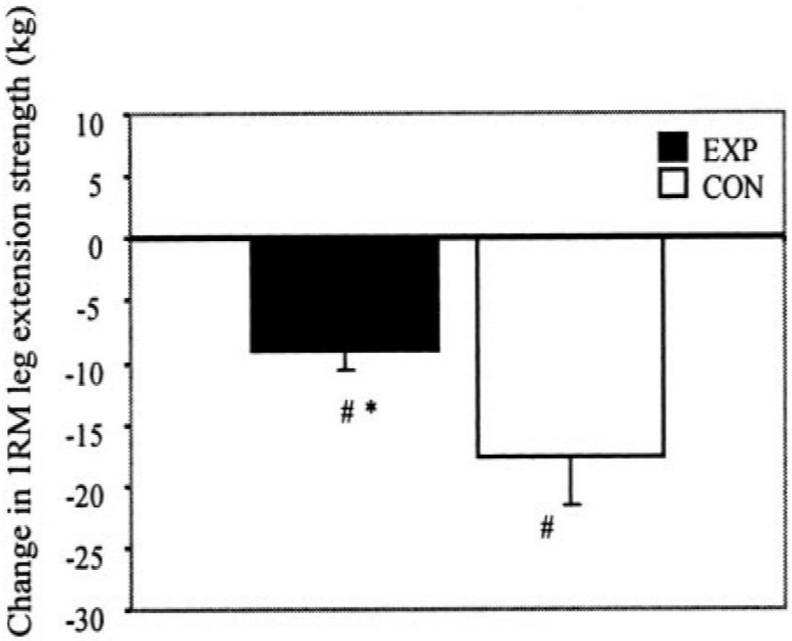
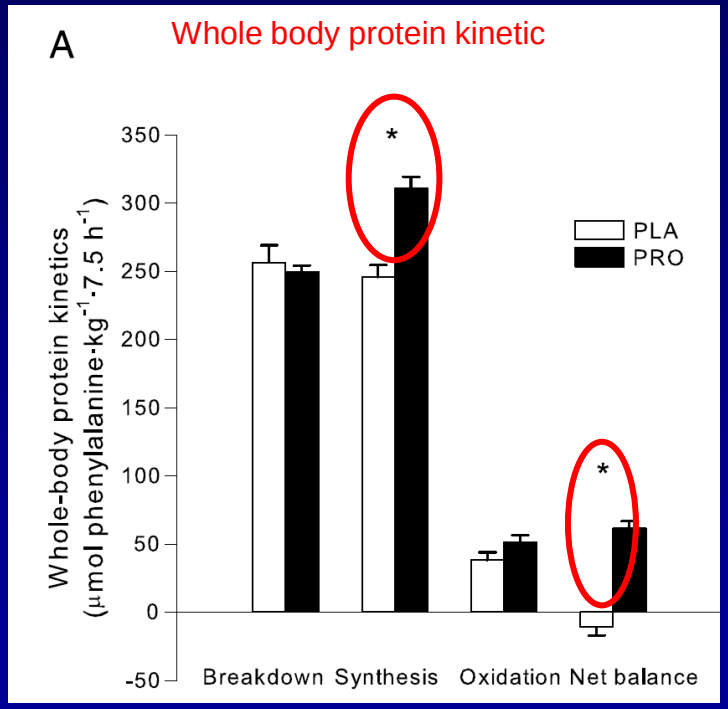


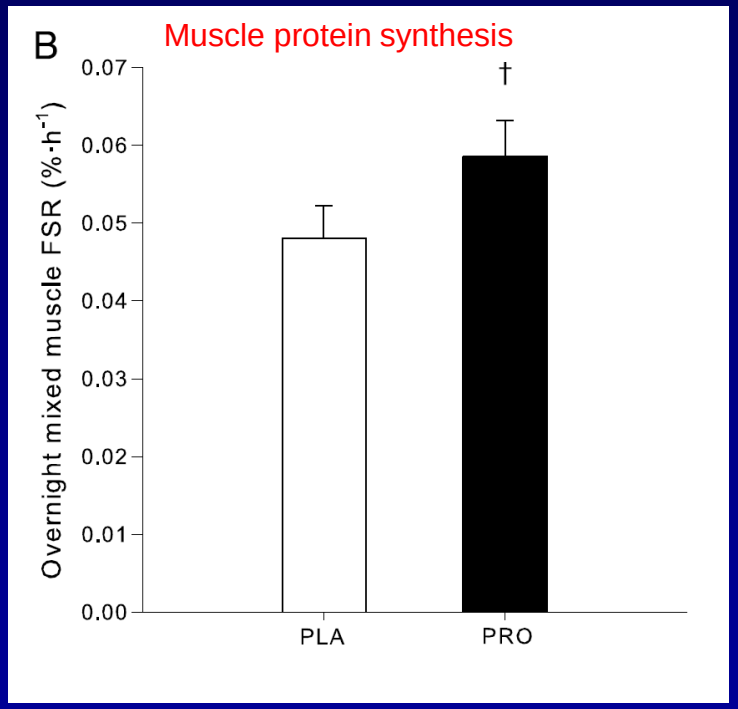
FIG. 5. Change in 1RM leg extension strength after bedrest. *, Significant between-group difference, EXP *vs.* CON ($P < 0.05$). #, Significant reduction ($P < 0.05$).

Paddon-Jones D et al, *J Clin Endocrinol Metab* (2004) 89: 4351–4358

PROTEIN INGESTION DURING SLEEP IMPROVES WHOLE-BODY & MUSCLE PROTEIN BALANCE OVERNIGHT Res et al MSSE (2012) 44(8): 1560-9

40 g casein protein ½ hr before sleep



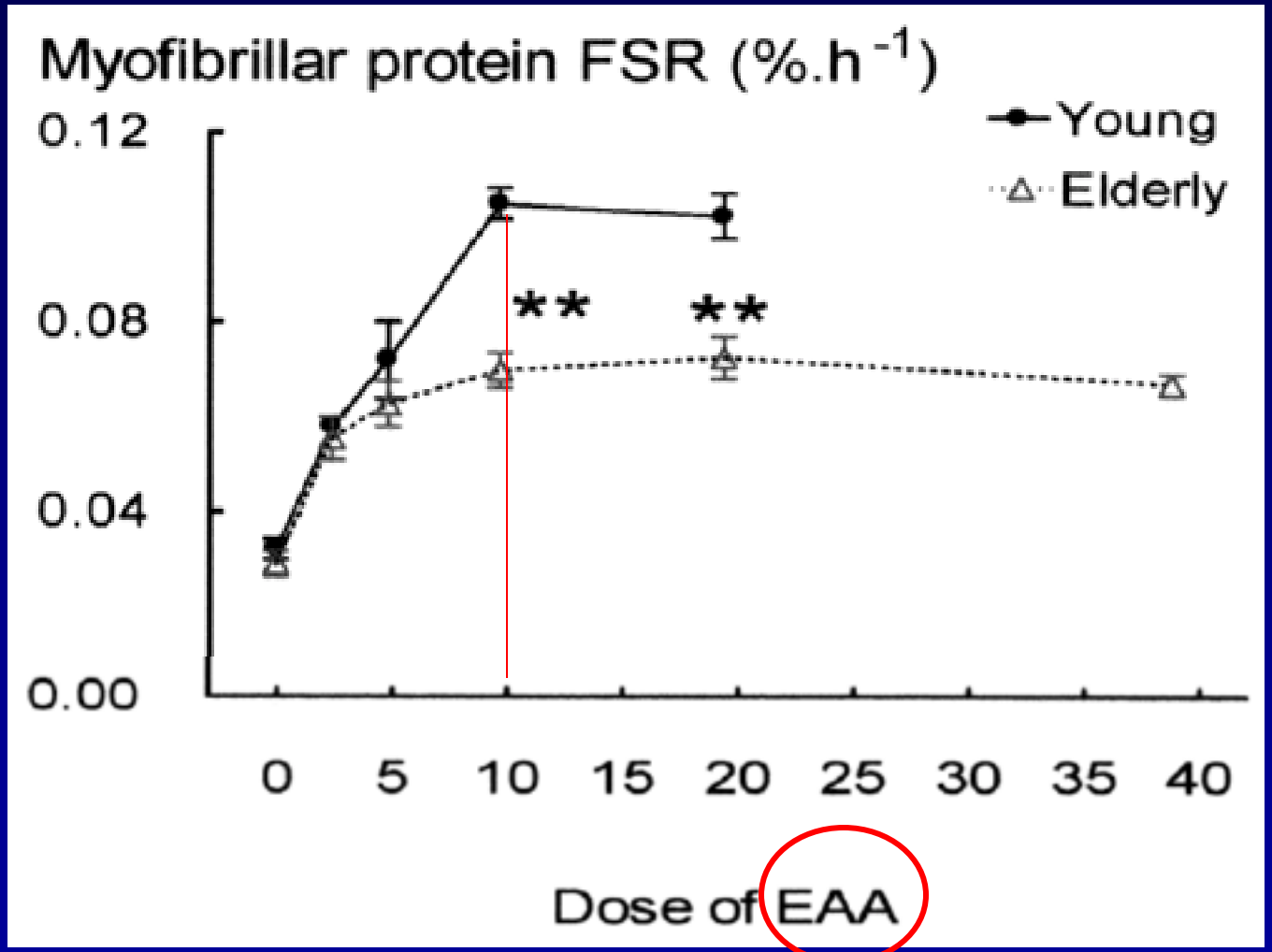


Similar findings in elderly men after 40 g casein protein via nasogastric tupe during night sleep

Groen BBL et al Am J physiol Endocrinol Metab (2012) 302: E52-60

How much protein do we need to maximize muscle protein syntheis rate?

10 g EAA MAXIMIZE MYOFIBRILLAR PROTEIN SYNTHESIS



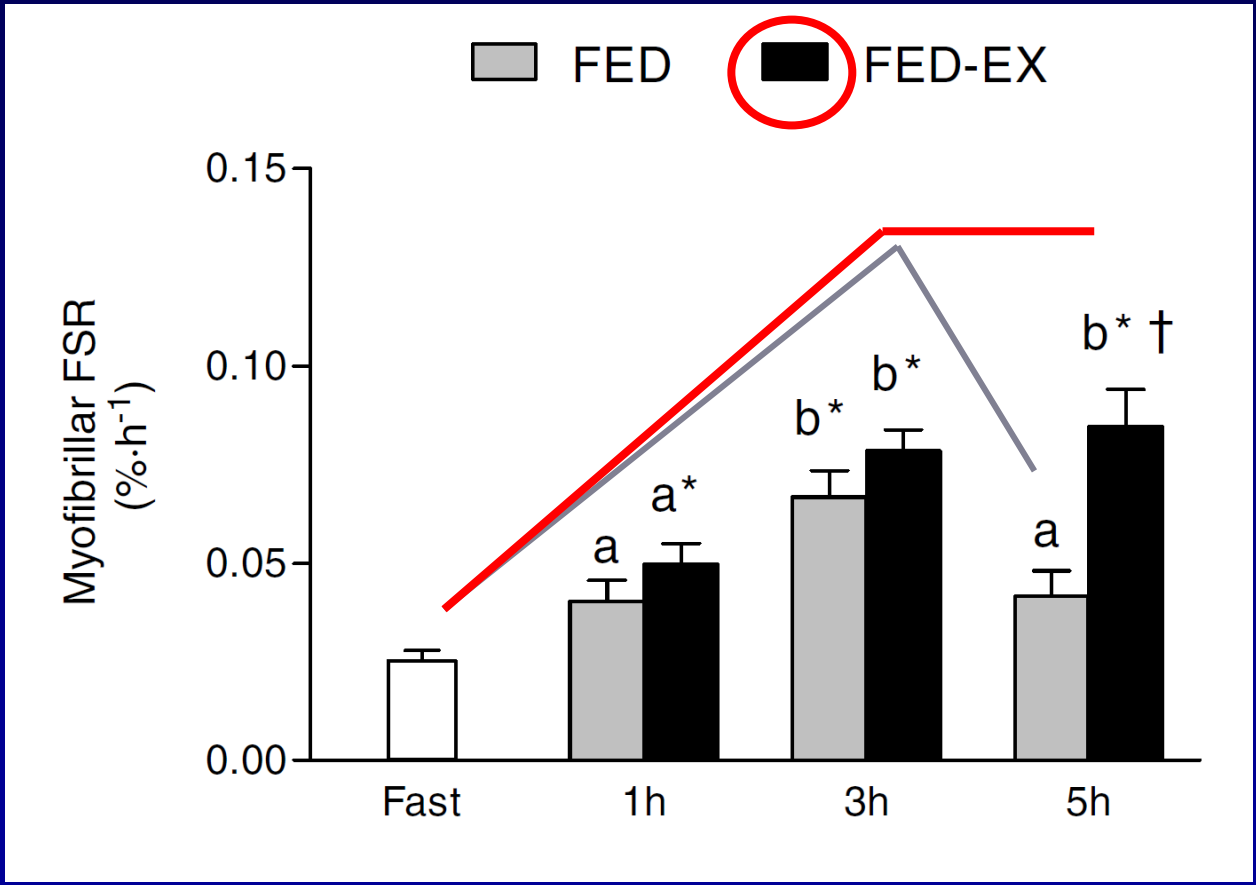
~20-25 g of high quality protein (milk, eeg, meat, fish)

Cuthbertson et al, *FASEB J* (2005) 19(3): 422-4

?

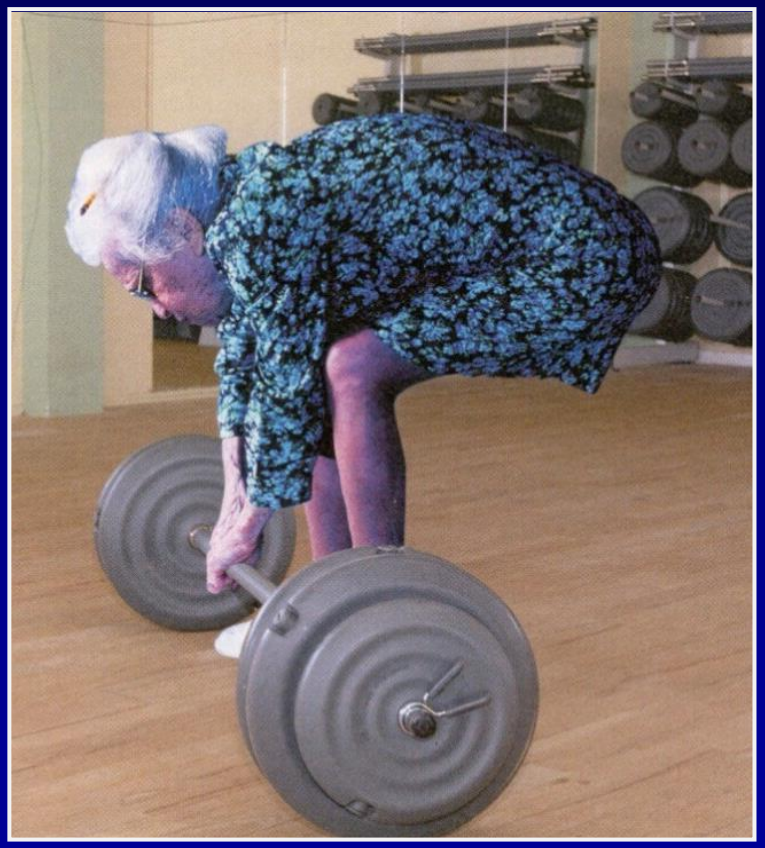
+ PROTEIN =

RESISTANCE EXERCISE PROLONGED THE PERIOD OF ENHANCED MYOFIBRILLAR PROTEIN SYNTHESIS RATE



Moore DR et al, *J Physiol* (2009) 587(4): 897-904

TIMING OF PROTEIN & TRAINING



TIMING OF POSTEXERCISE PROTEIN INTAKE IS IMPORTANT FOR MUSCLE HYPEORTROPHY (elderly men)

12 week of strength training (3 times per week)

10g protein + 7g CHO + 3.3g fat

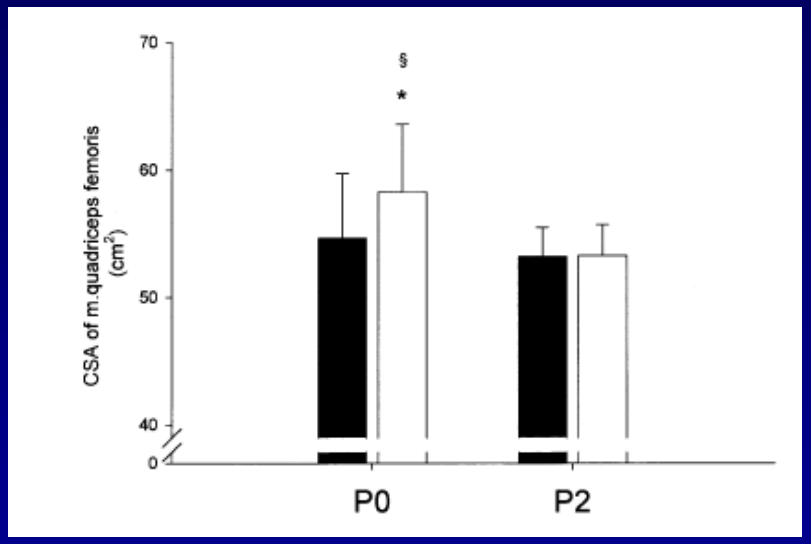
Gr 1 (P0) Time = 0 hr after exercise

Gr 2 (P2) Time = 2 hrs after exercise

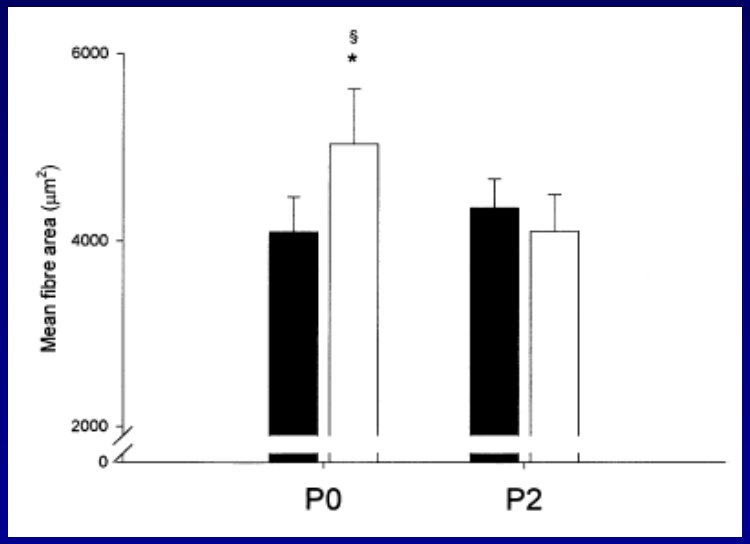
Esmarck B et al, *J Physiol* (2001) 535(1): 301-311

TIMING OF POSTEXERCISE PROTEIN INTAKE IS IMPORTANT FOR MUSCLE HYPEORTROPHY (elderly men)

Muscle CSA



Mean fiber areal



Dymanic strength (5 RM) improved in both groups

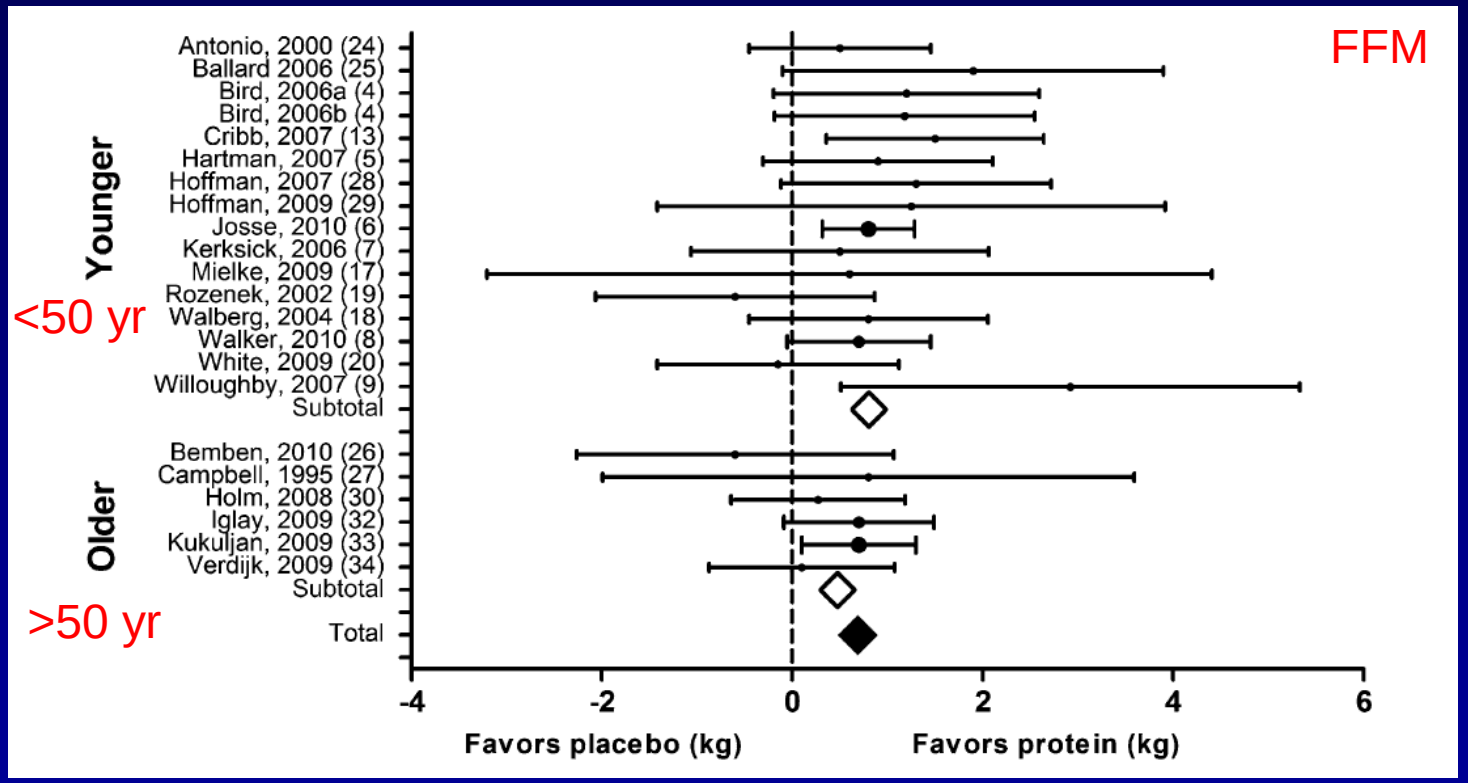
Isokinetic strength only improved in P0

Esmarck B et al, *J Physiol* (2001) 535(1): 301-311

Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training: a meta-analysis[1–3]

Naomi M Cermak, Peter T Res, Lisette CPGM de Groot, Wim HM Saris, and Luc JC van Loon

- N=680 subjects, Resistance training > 6 weeks



~12 weeks resistance training + protein = +1 kg greater gain in FFM

Am J Clin Nutr (2012) 96:1454-64

Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training: a meta-analysis[1–3]

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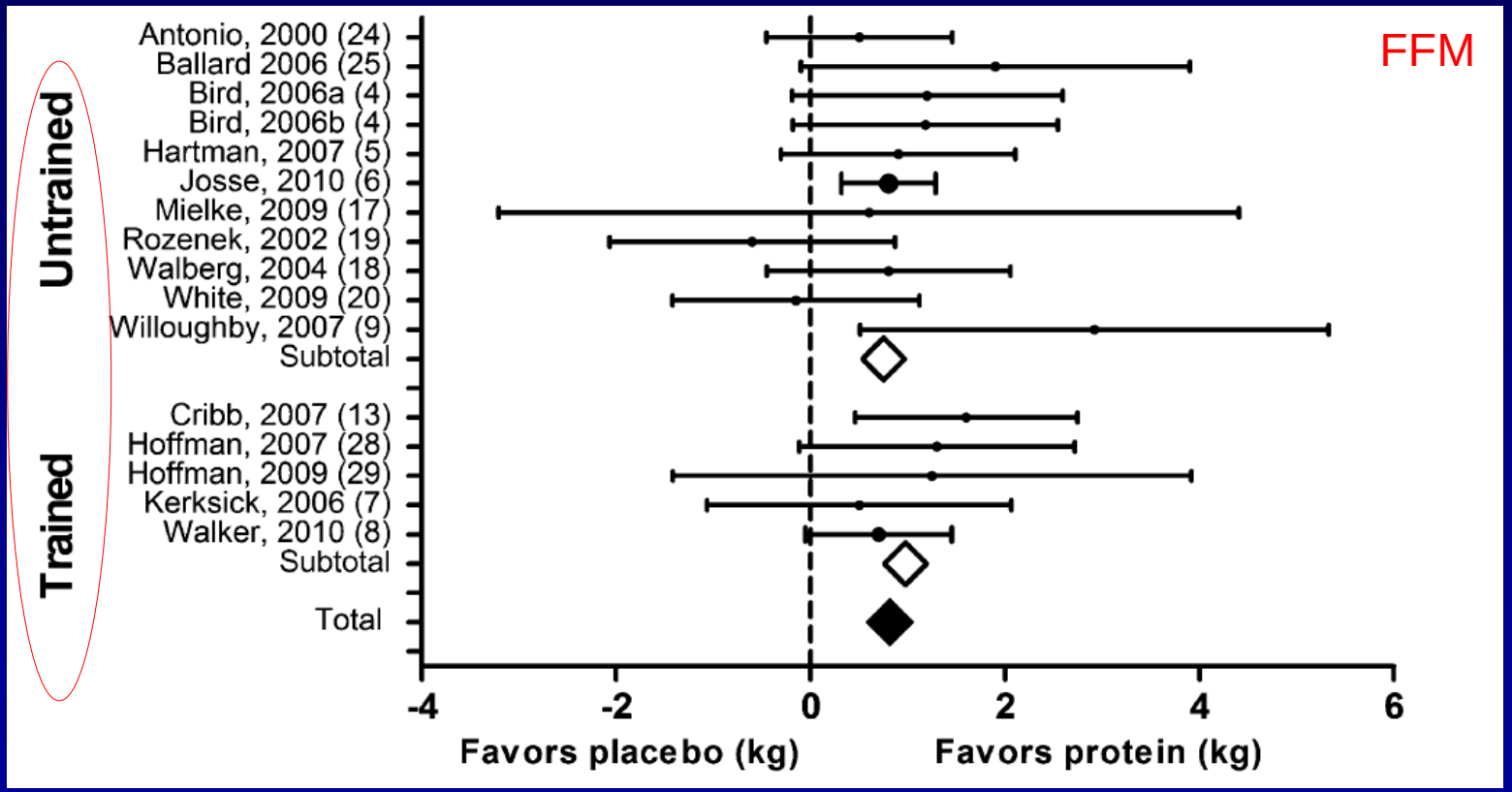
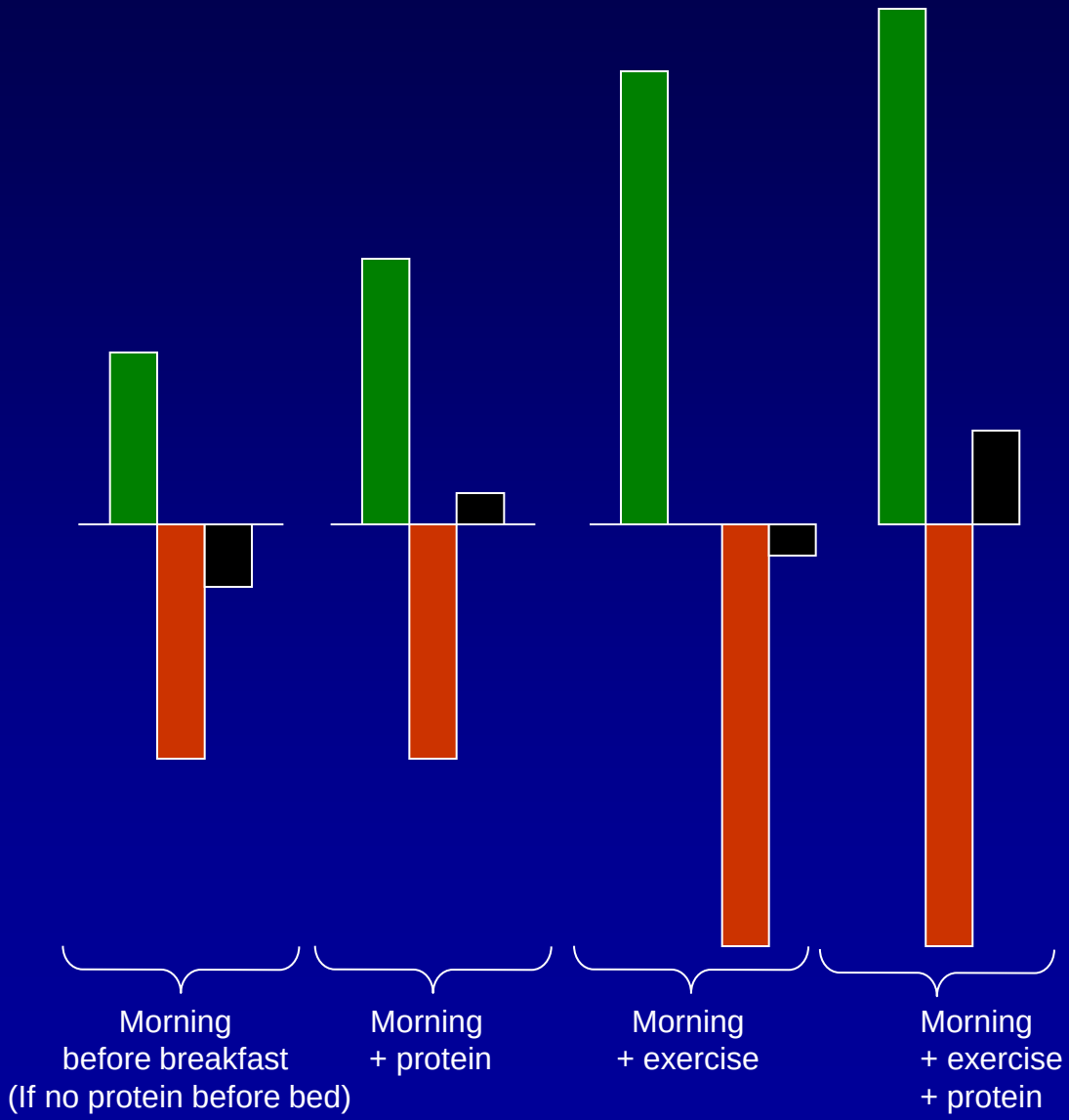


Am J Clin Nutr (2012) 96:1454-64

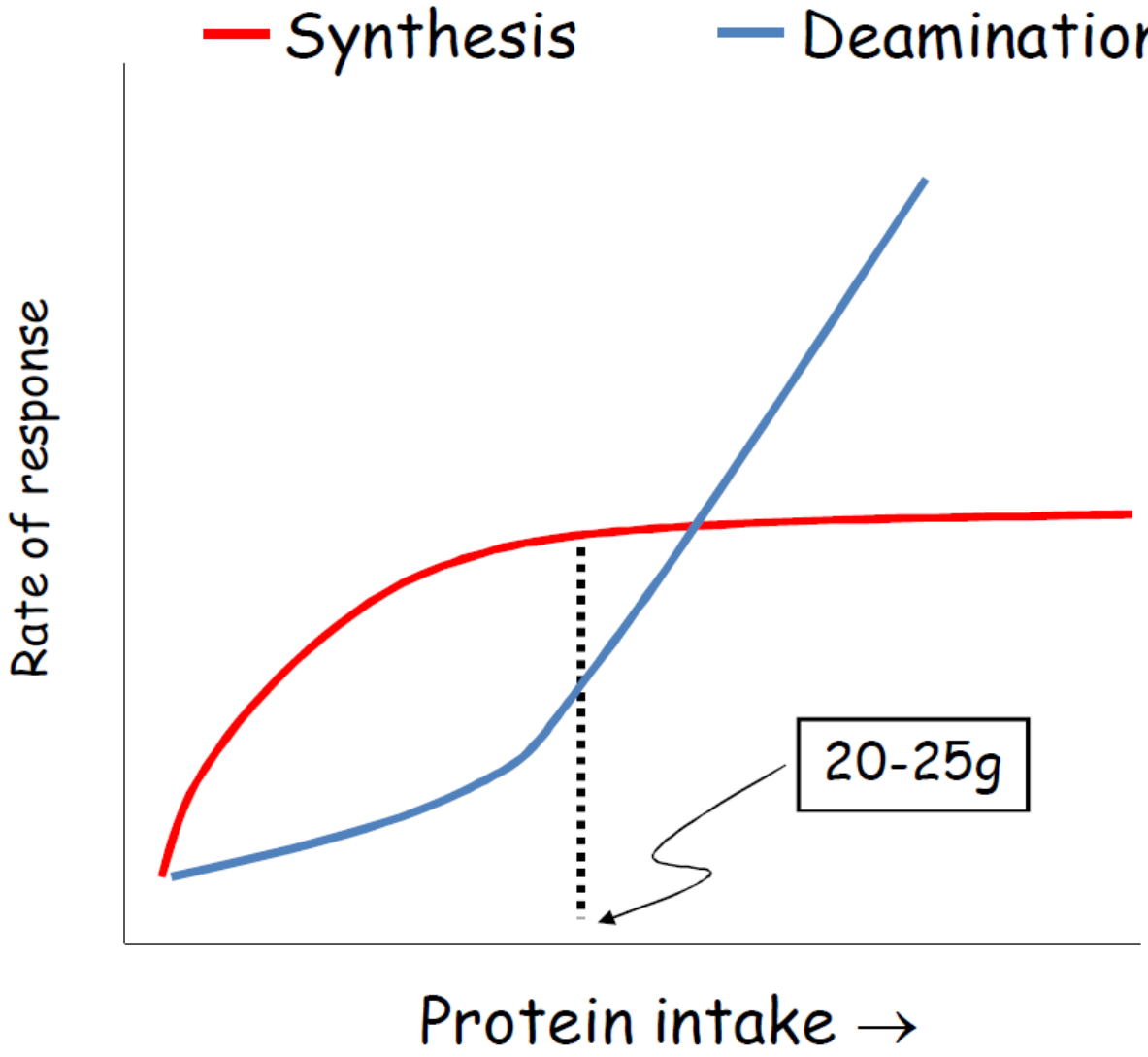
Synthesis

Balance

breakdown



20-25 G OF HIGH QUALITY PROTEIN MAXIMIZE MYOFIBRILLAR PROTEIN SYNTHESIS



Moore DR *et al.*, *AJCN* 2009

SUMMARY

- Energy needed to synthesis muscle proteins and change the hormonal profile to be more anabolic
-
- Protein quantity (recommendations)
  - *Optimal dose for counteracting muscle loss in elderly is probably higher than 0.8 g/kg/day*
- Protein quality (EAA, BCAA)
  - *High content of EAA and BCAA reduce the total amount of protein needed for maximal stimulus of muscle protein synthesis*
- Timing of protein intake
  - *Important for muscle maintenance (between meals, before sleep?)*
  - *20-25 g protein maximize muscle protein synthesis after/before hours of fasting*
  - *Important for muscle growth combined with a training stimulus*
  - *20-25 g proten maximize the effect of training on muscle mass*

- Protein source
  - *Animal protein have a high content of EAA and is well absorb from the intestine*
  - *As an example Bovine Milk is an effective post exercise beverage*

20-25 G OF HIGH QUALITY PROTEIN TO MAXIMIZE MYOFIBRILLAR PROTEIN SYNTHESIS* AFTER OVERNIGHT FASTING AND WHEN TRAINING

~ 3 eggs

~ 100 g of Chicken/ Meat/ Turkey/ Fish

~ 0.6 L Milk or Chocolate milk

~ 500 g Yoghurt

~ 200 g Skyr/ Quark (yoghurt-like with high protein content)

~ 200 g Cottage cheese

* 0.25-0.3 g protein/kg