Nestlé Nutrition Institute

Addressing Sarcopenia: Optimizing Protein Intake with Aging

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The views expressed herein are those of the presenter and do not necessarily represent Nestlé's views. The material herein is accurate as of the date it was presented, and is for educational purposes only and is not intended as a substitute for medical advice.

Objectives

- Explain changes in skeletal muscle with aging across community and clinical settings
- Describe the benefits of protein for patients with sarcopenia and sarcopenic obesity
- Explain the importance of protein quality and quantity on muscle health and functionality in older adults

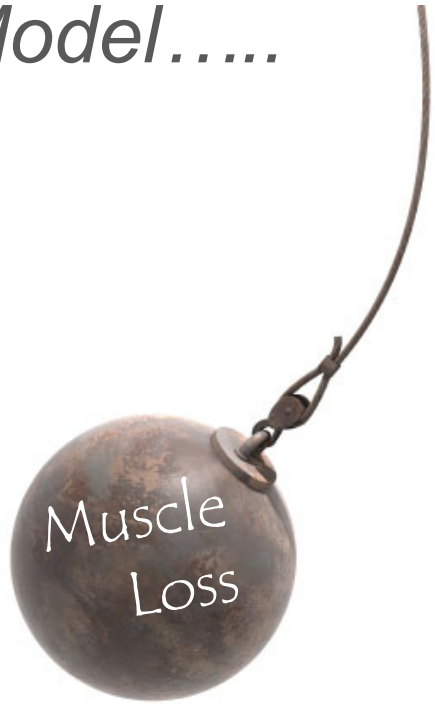
Disclosures

I have received funding, participated on a Scientific Advisory Board or Speaker's Bureau for:

- National Dairy Council
- US Dairy Export Council
- American Egg Board
- National Cattlemens Beef Association
- Abbott Nutrition
- Agropur
- Leprino Foods
- Sabra Wellness
- National Space Biomedical Research Institute

Conceptual Model…..

- Inactivity
- Disease
- Inflammation
- Mitochondrial Dysfunction
- Inadequate Nutrition
- Aging
- Blood Flow



How much protein do we need ?

+ *when, why, how and who….*

Recommended Dietary Allowance (RDA)

→ **0.8 g protein / kg bodyweight / day**

"The minimum daily average dietary intake level ... [*of good quality protein*]...that meets the nutrient requirements of 97 – 98% of healthy individuals"

0.8 g/kg/day:

220 lb - 100 kg	=	80	g protein/day
165 lb - 75 kg	=	60	g protein/day
130 lb - 60 kg	=	48	g protein/day
110 lb - 50 kg	=	40	g protein/day

Position Statements: healthy <u>older</u> adults

PROT-AGE Group

JAMDA

journal homepage: www.jamda.com

Special Article

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

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

1.0 - 1.2 g/kg/day

Contents lists available at ScienceDirect

Clinical Nutrition

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

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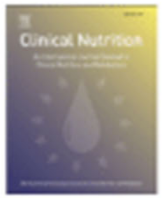


ESPEN Expert Group

ESPEN endorsed recommendation

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

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

Position Statements: highly active older adults

American College of Sports Medicine

Dietitians of Canada

Academy of Nutrition and Dietetics

Protein intake should be increased in highly active people:

1.2 - 1.7 g/kg-/day

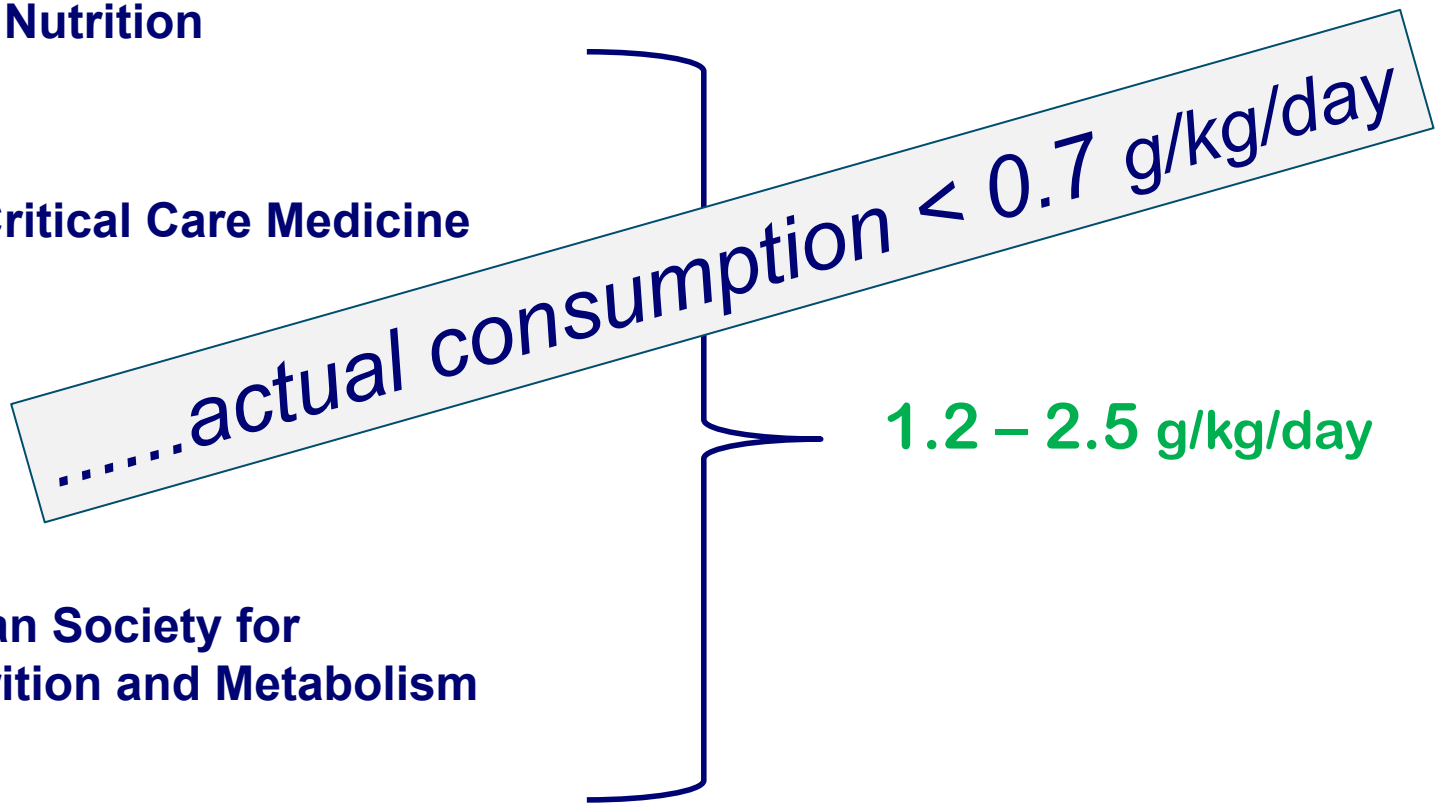
ACSM/ADA/DC Position, *MSSE,* 2009

Position Statements: inpatient / clinical populations

American Society for Parenteral and Enteral Nutrition

Society of Critical Care Medicine

The European Society for Clinical Nutrition and Metabolism



Heyland et. al. Nutrients, 2018

If the RDA defines the minimum protein intake for healthy adults…is there a maximum ?

IOM / FNB: **No Tolerable Upper Intake Level**

AMDR: **Up to 35% of daily energy** ***(~ 220 g protein / day)***

Institute of Medicine

Dietary Reference Intakes

Dangers of too much protein… ?

Institute of Medicine:

“ protein content of diet is not related to progressive decline in kidney function with age "

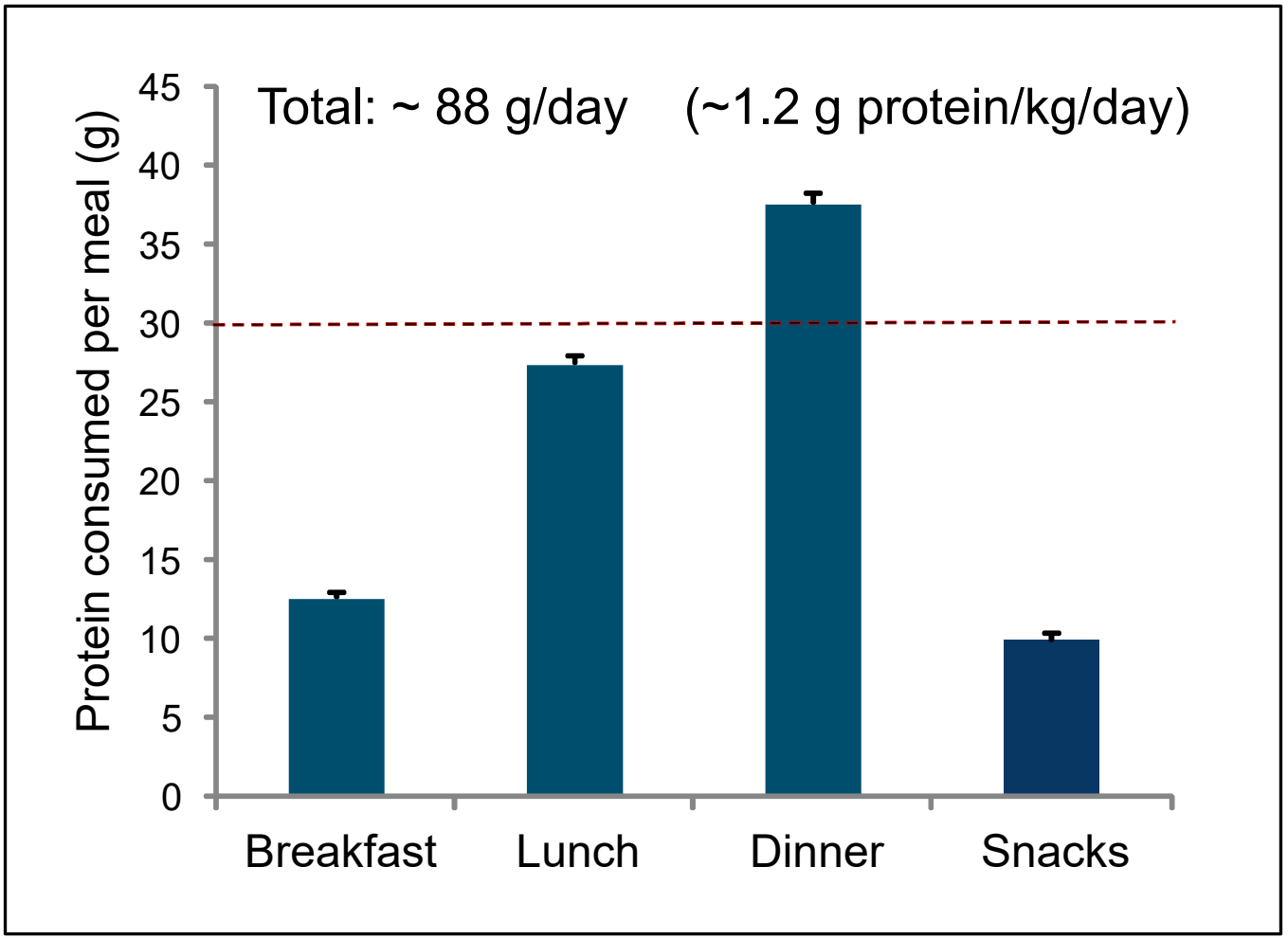
Dietary Reference Intakes

for

Energy
Carbohydrate
Fiber
Fat
Fatty Acids
Cholesterol
Protein
And Amino acids

How Much Protein Do We Eat ?

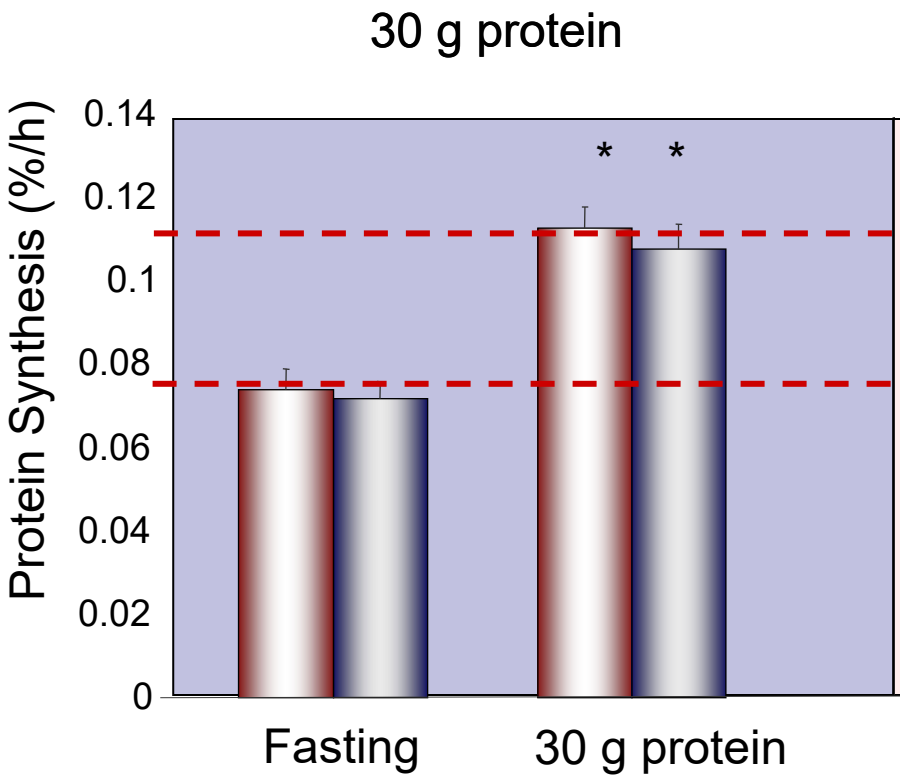
National Health and Nutrition Examination Survey (NHANES)



https://www.cdc.gov/nchs/nhanes/about_nhanes.htm

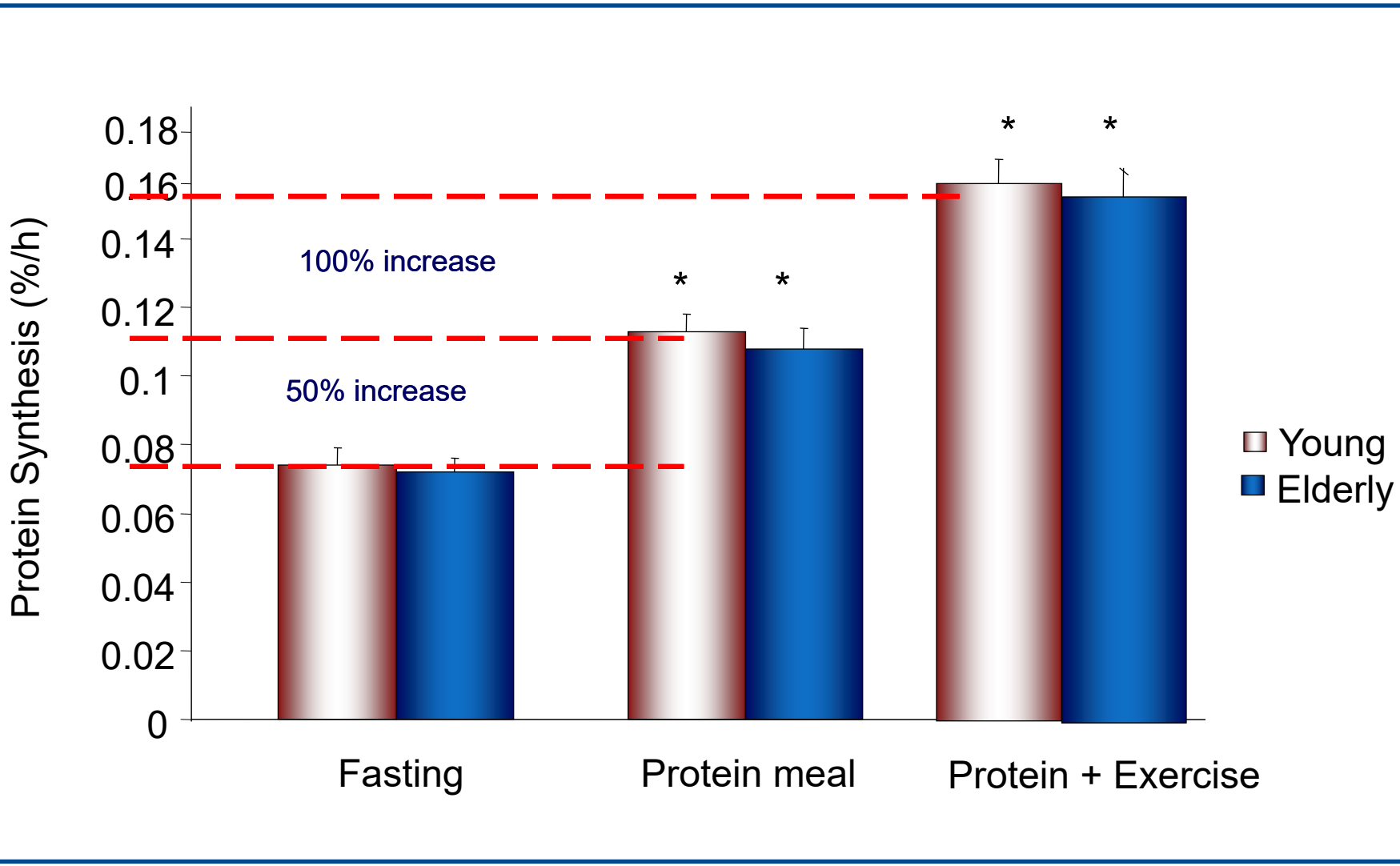
How much protein per meal do we need ?

- a message of moderation -



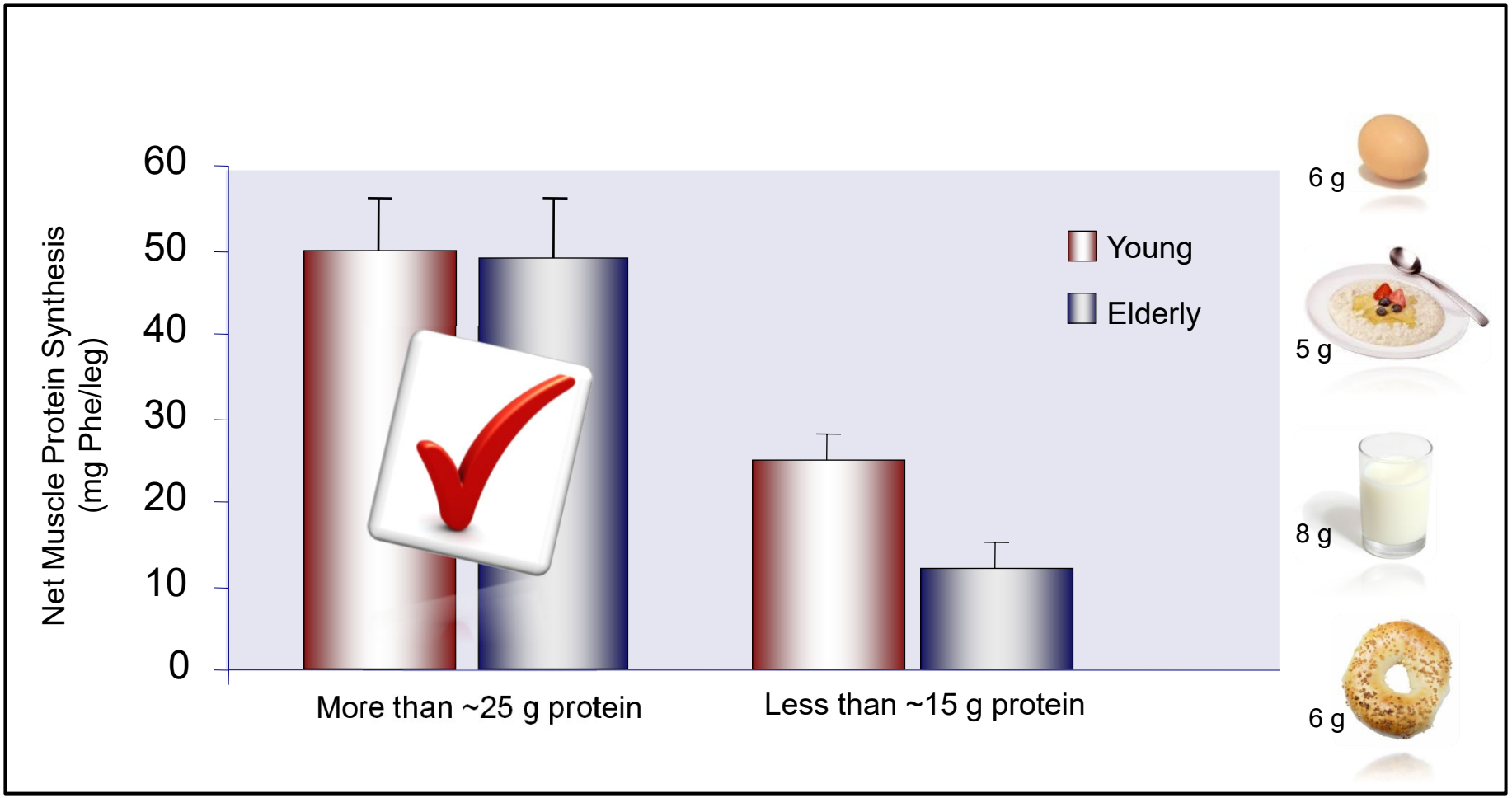
Symons et. al. AJCN, 2007
Symons et. al. JADA, 2009

Synergistic Effect of Protein and Exercise



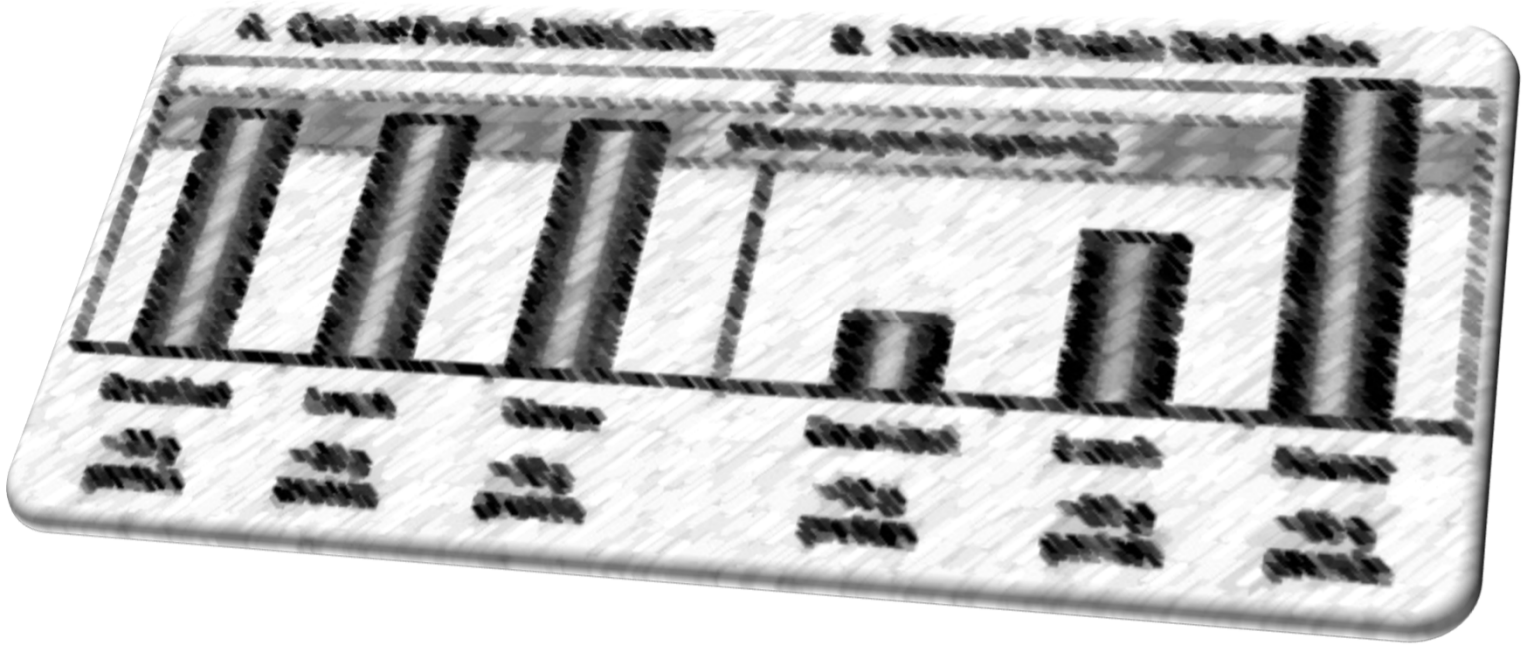
Symons et. al. JNHA, 2011

Reality: Age-related dose-response



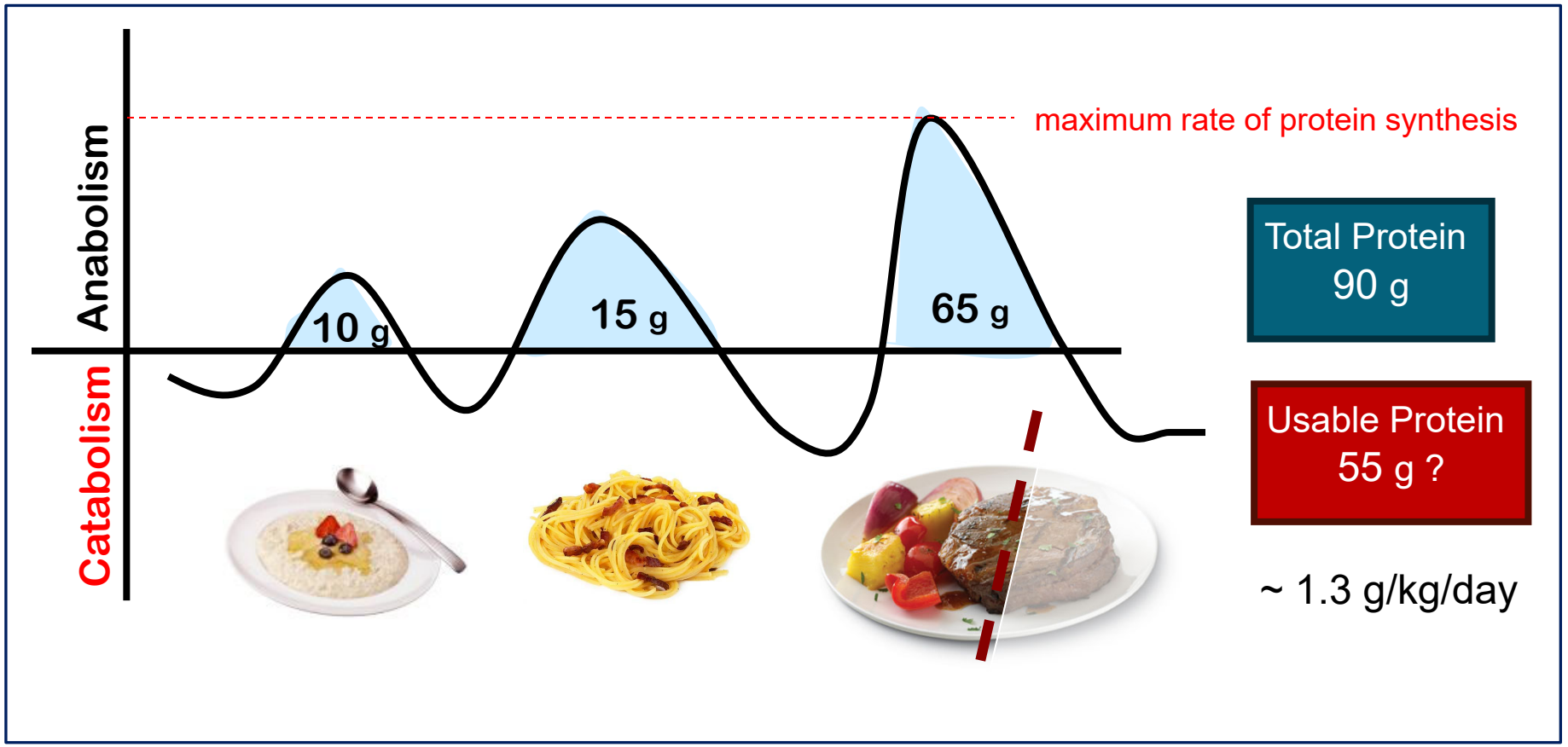
Katsanos et. al. AJCN, 2005

Protein Quantity and Daily Distribution



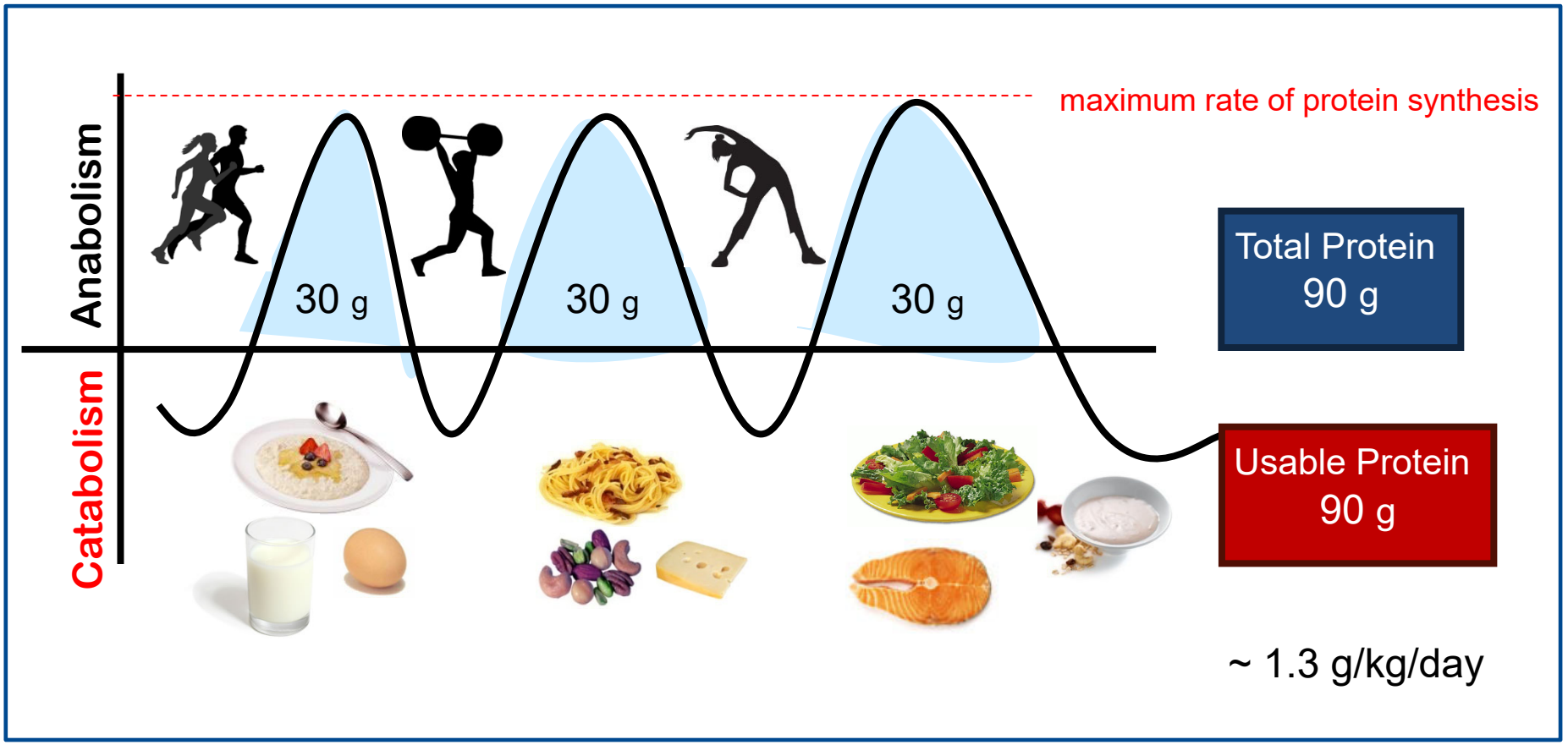
Concept: Typical / skewed protein intake

We can't store excess protein for later anabolism



Paddon-Jones and Rasmussen. Curr Opin Clin Nutr Metab Care, 2009

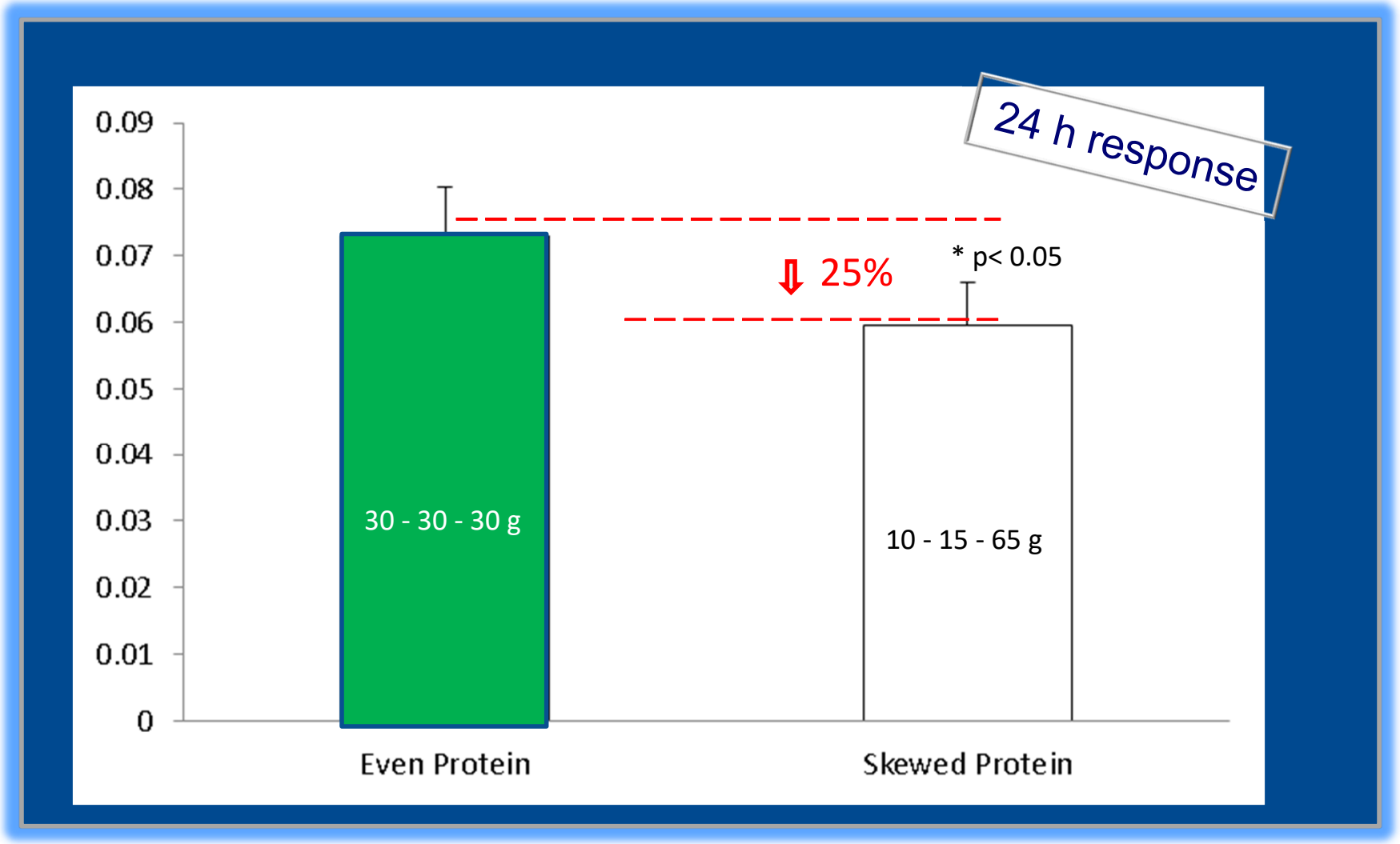
Concept: Moderating protein at each meal ?



→ **greater 24 h protein synthesis response ?**

Paddon-Jones and Rasmussen. Curr Opin Clin Nutr Metab Care, 2009

Protein distribution impacts muscle protein synthesis



Mamerow et.al. J Nutr, 2014

Sarcopenia

age
and
ageing

REPORT

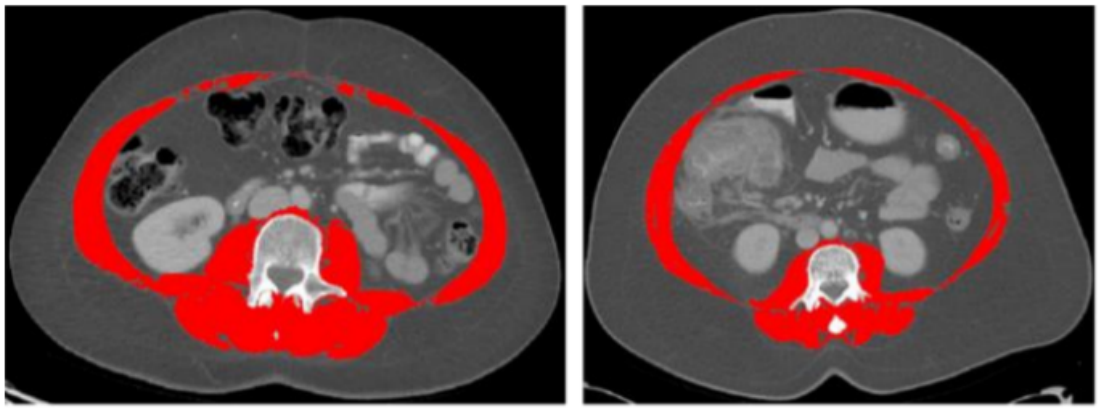
Sarcopenia: European consensus on definition and diagnosis

Report of the European Working Group on Sarcopenia in Older People

ALFONSO J. CRUZ-JENTOFT[1], JEAN PIERRE BAEYENS[2], JÜRGEN M. BAUER[3], YVES BOIRIE[4], TOMMY CEDERHOLM[5], FRANCESCO LANDI[6], FINBARR C. MARTIN[7], JEAN-PIERRE MICHEL[8], YVES ROLLAND[9], STÉPHANE M. SCHNEIDER[10], EVA TOPINKOVÁ[11], MAURITS VANDEWOUDE[12], MAURO ZAMBONI[13]

Sarcopenia is a 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.

Sarcopenia can exist at any BMI



49F BMI 29.1 SMI 47.4cm^2/m^2
Normal Muscle Mass

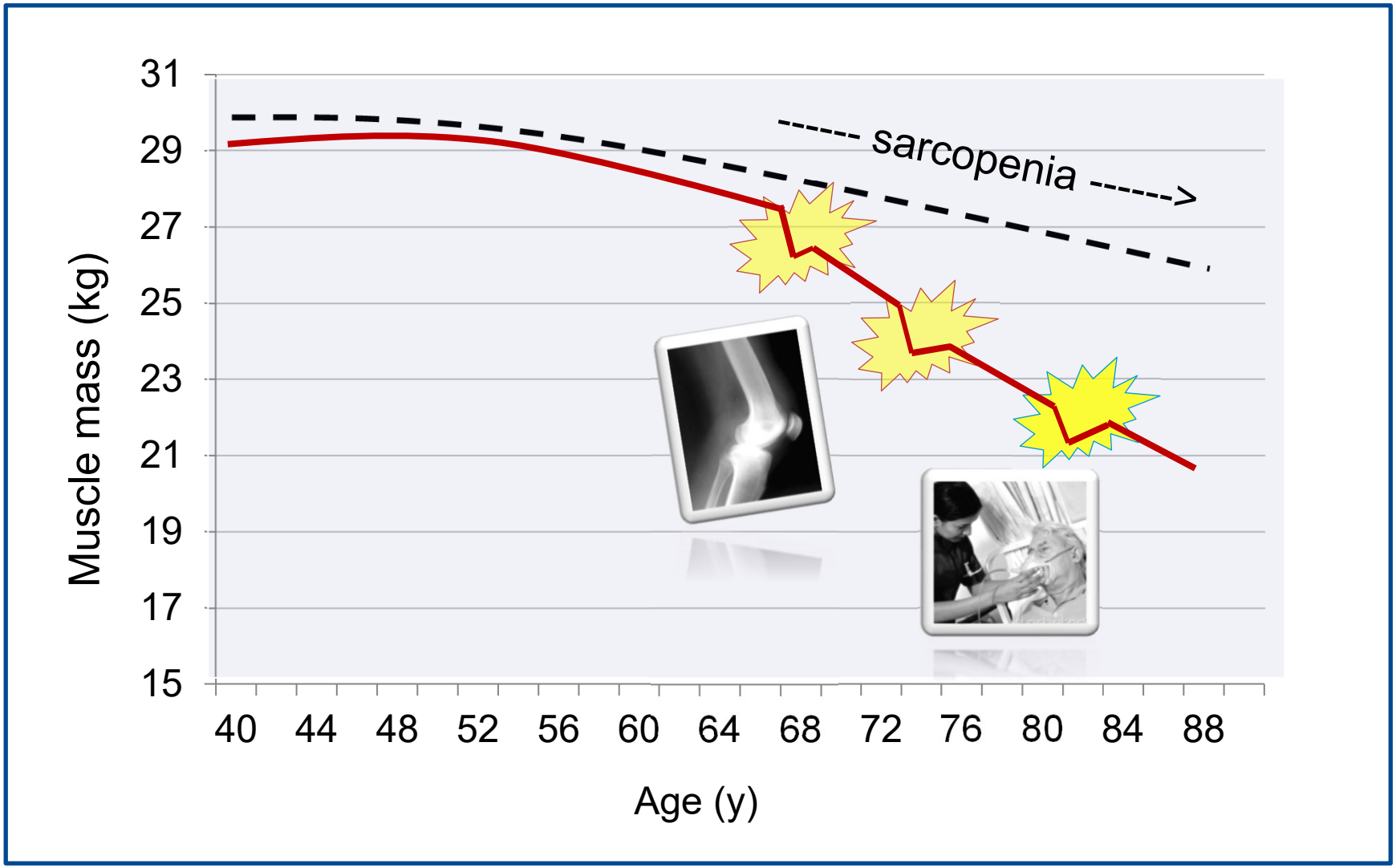
42F BMI 29.2 SMI 37.0cm^2/m^2
Sarcopenia

Wu et al. Ann Clin Oncol 2019

- Sarcopenic obesity is characterized by low lean mass and excess fat mass
- Associated with declines in functionality and increased cardiometabolic risk

Johnson Stoklossa et. al. Curr Dev Nutr 2018

Catabolic Crisis Model

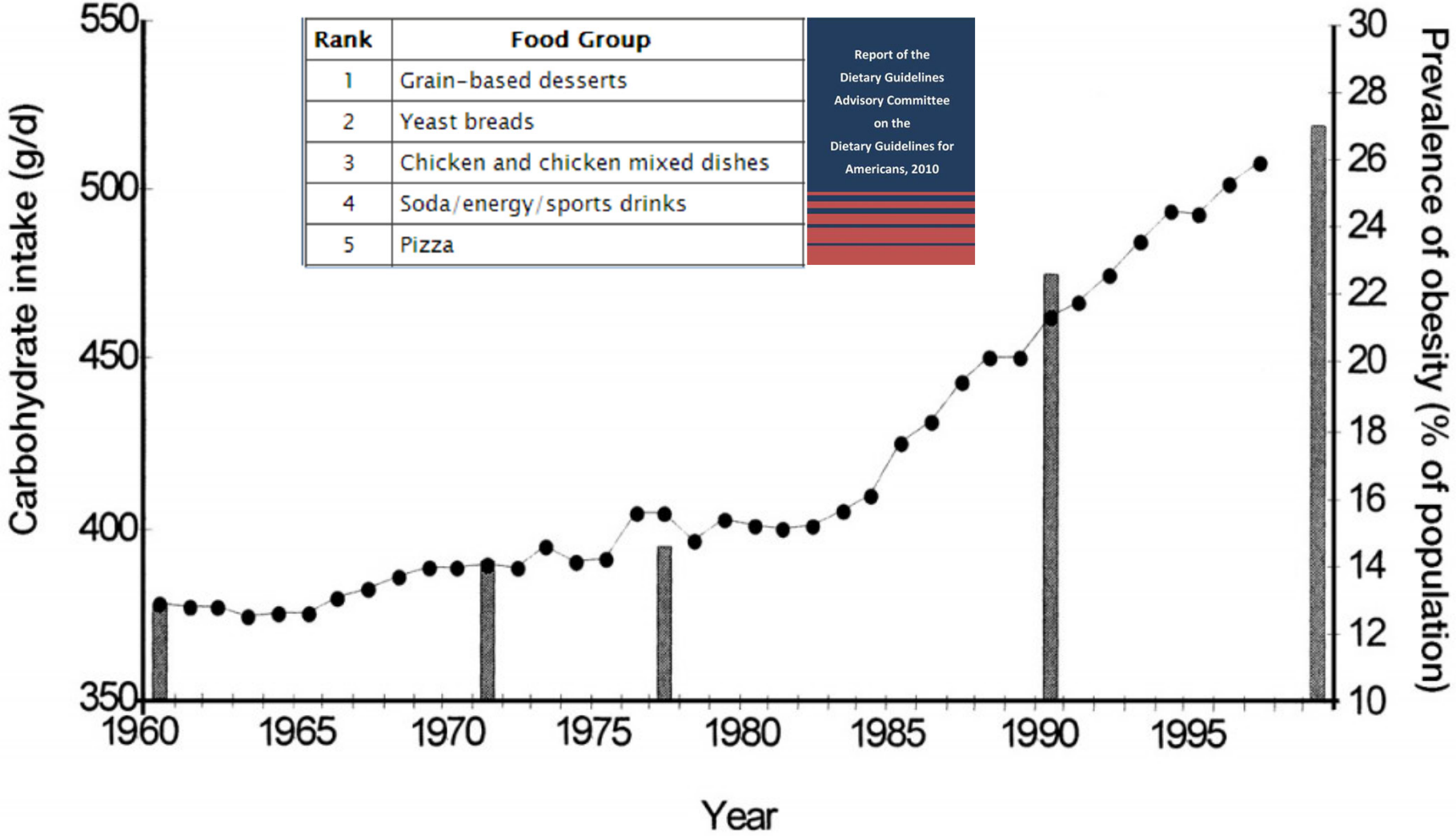


English and Paddon-Jones. Curr Opin Clin Nutr Metab Care, 2010

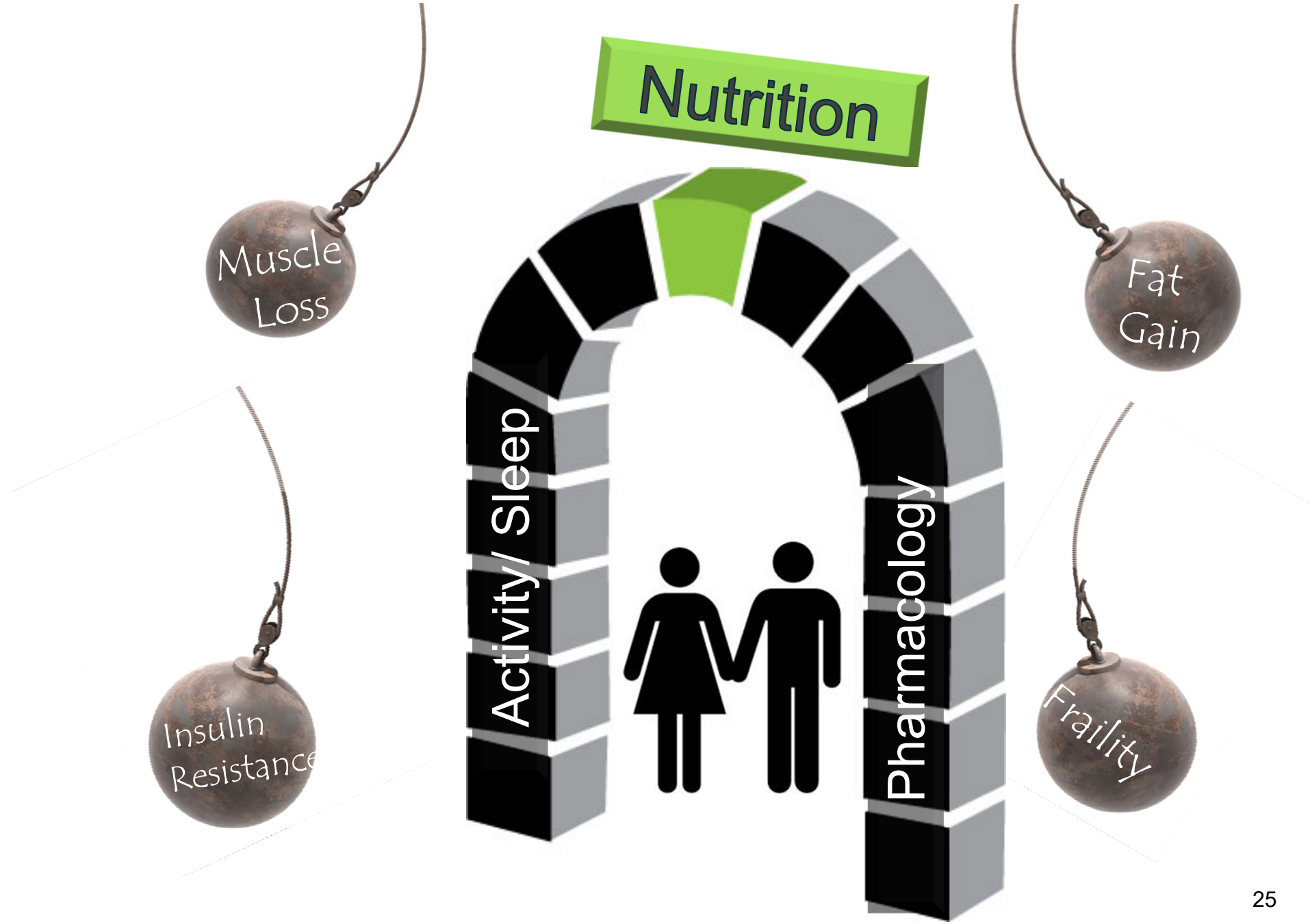
What is driving changes in muscle and fat… ?

Rank	Food Group
1	Grain-based desserts
2	Yeast breads
3	Chicken and chicken mixed dishes
4	Soda/energy/sports drinks
5	Pizza

Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010



Gross LS, Li L, et. al. Am J Clin Nutr, 2004


Nutrition
Activity/ Sleep
Pharmacology
Muscle Loss
Fat Gain
Insulin Resistance
Frailty

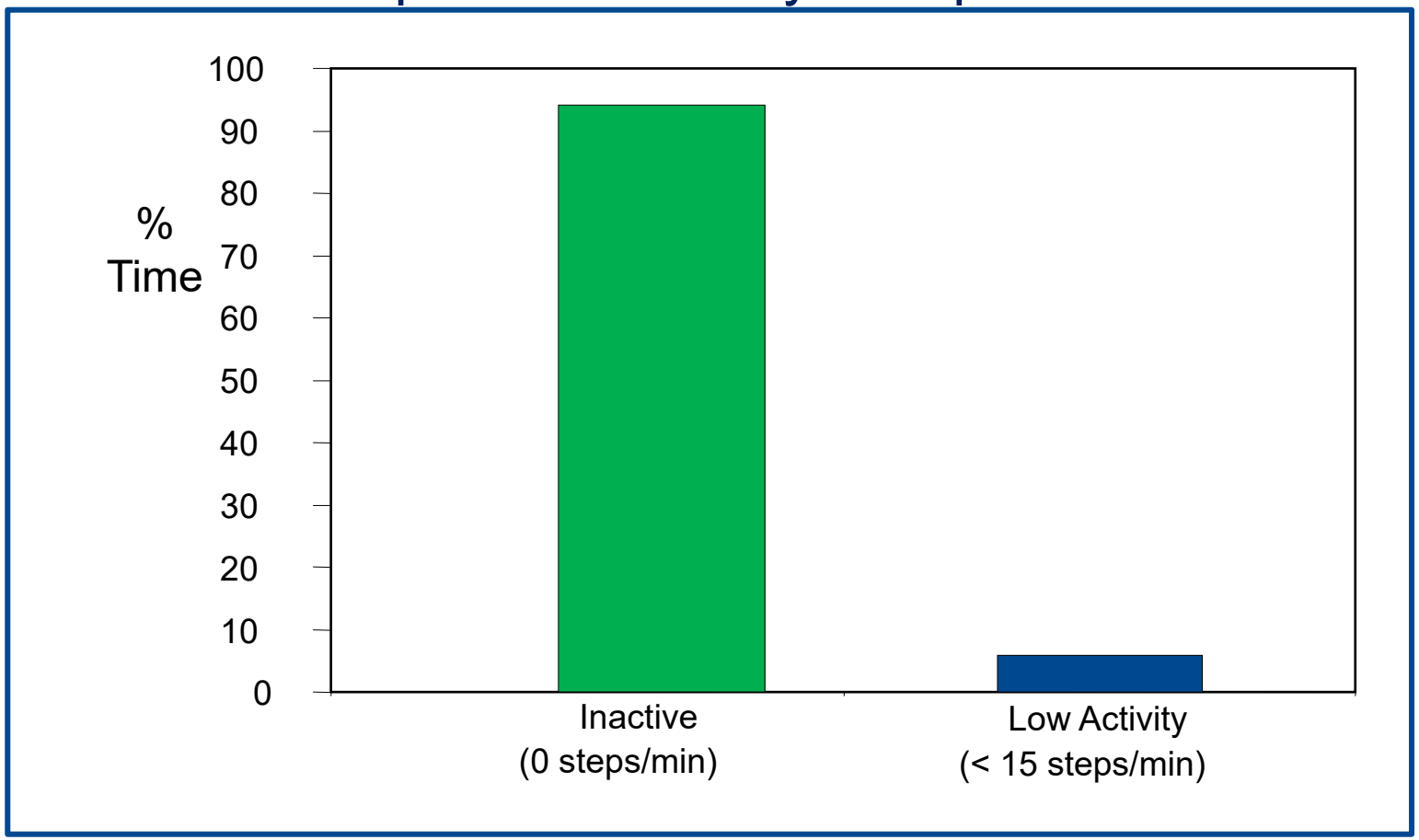
Research models to assess nutrition interventions:

Bed Rest Studies

Mimics the physical inactivity of hospitalization, while separating the catabolic, disease-related effects from the intrinsic effects of skeletal muscle disuse.

Bed rest / disuse in clinical settings

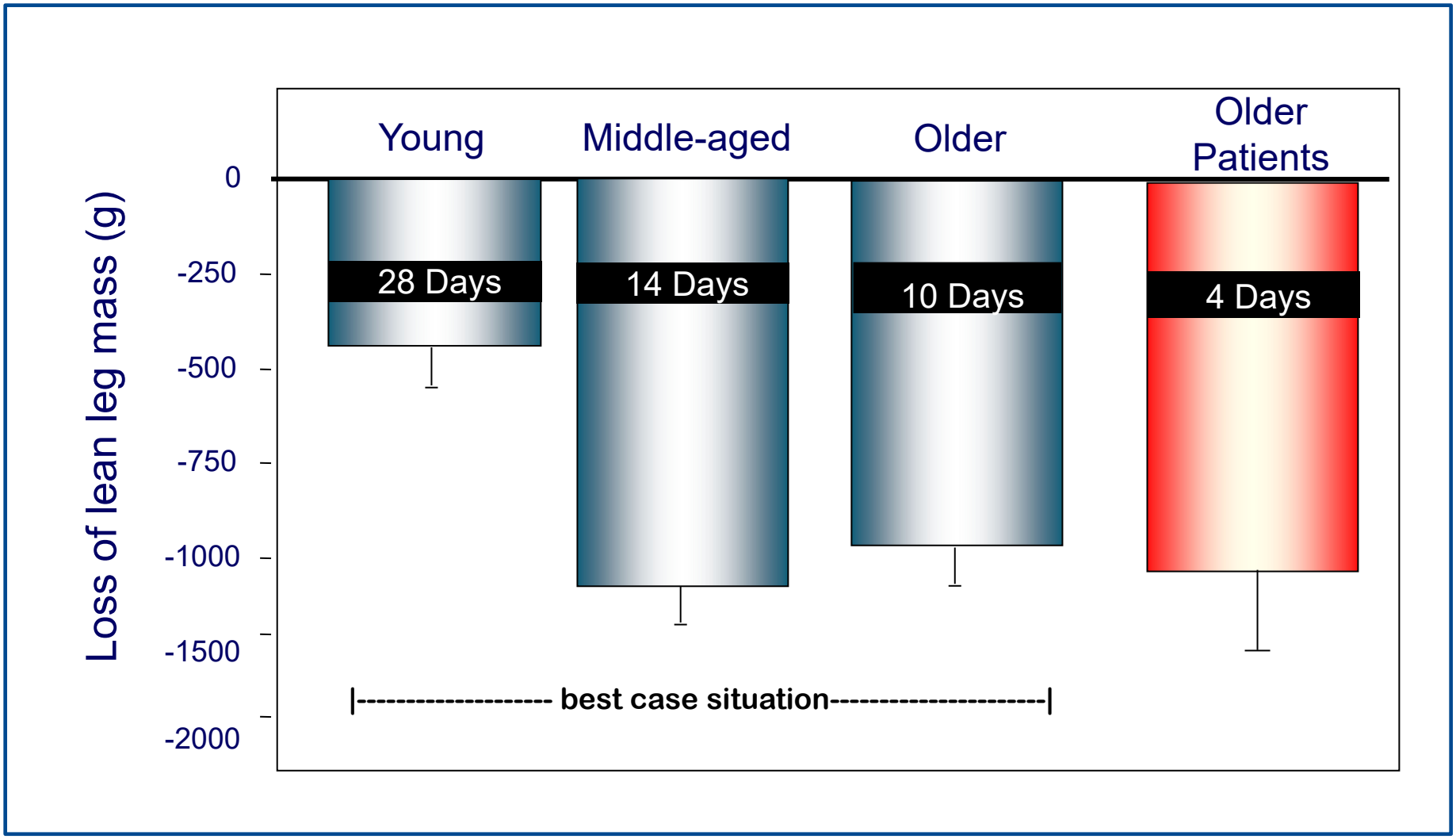
Older inpatients: ~4 days hospitalization



Fisher et. al. J Am Geriatr Soc, 2011

Inactivity and Muscle Loss

- Bed Rest Studies -

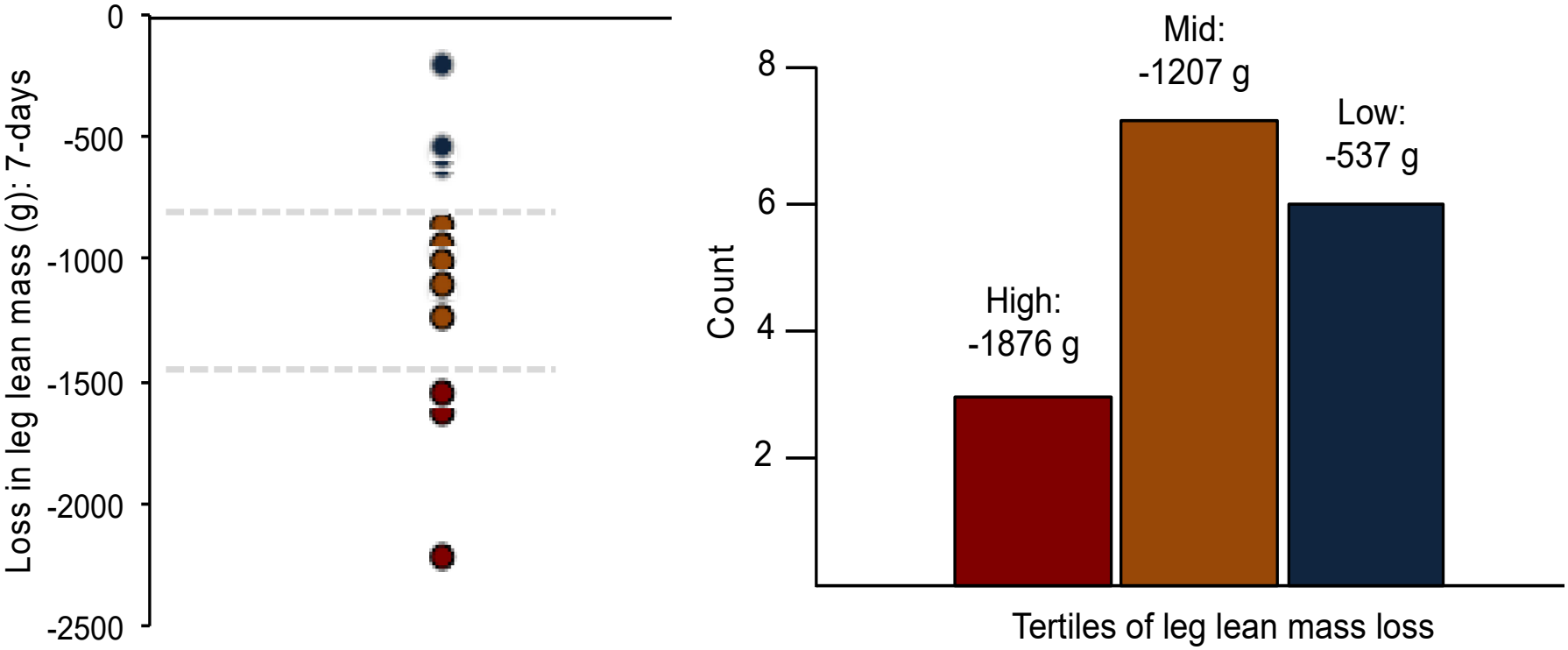


Paddon-Jones et. al. J Clin Endocrinol Metab, 2004 English et. al. AJCN, 2016
Kortebein et. al. JAMA, 2007 Paddon-Jones, Pilot Data

Disuse inactivity: age and sex-specificity

English et. al. AJCN, 2016
+ new prelim data

Disuse atrophy: *"responders & non-responders"*



English et. al. AJCN, 2016

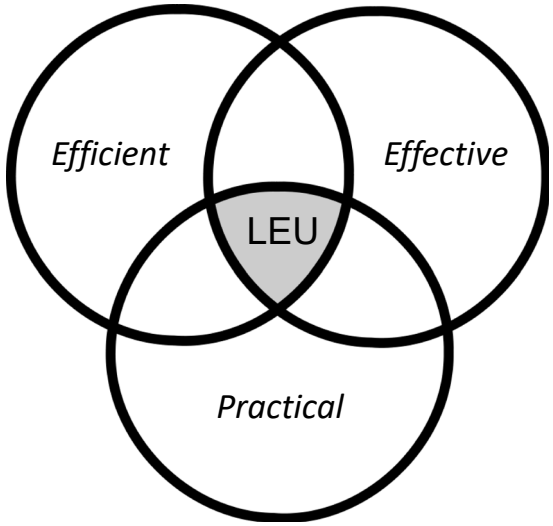
N=16 healthy middle-age males; 14 days bed rest

Dietary Interventions: *obstacles and opportunities*

→ Pragmatic approach: efficiency and protein quality

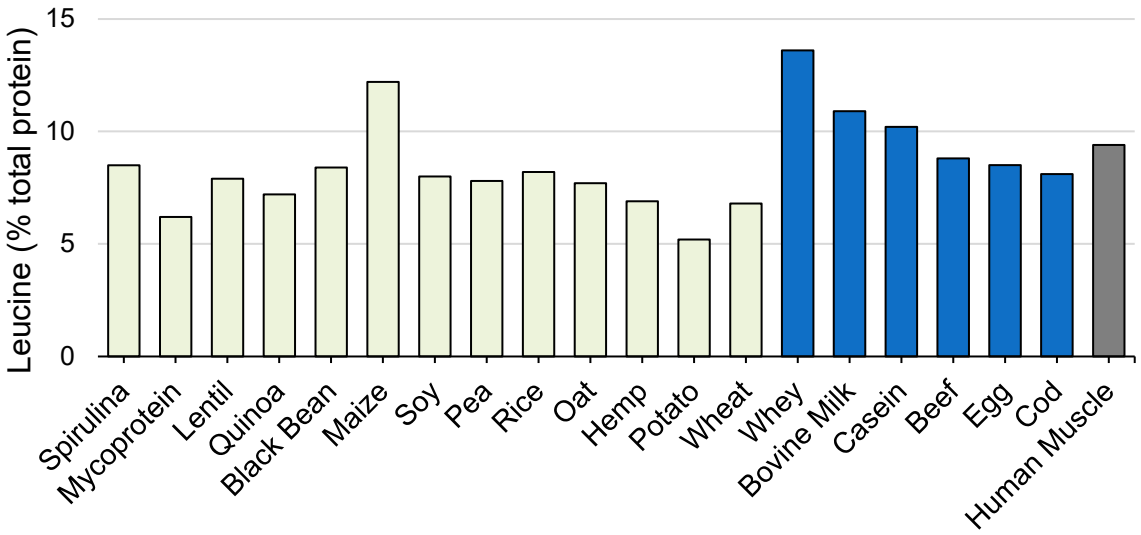
Leucine:

- branch chain amino acid (BCAA)
- common in most high quality proteins
- key regulatory role in protein synthesis
- overstated benefits ?



Protein Quality

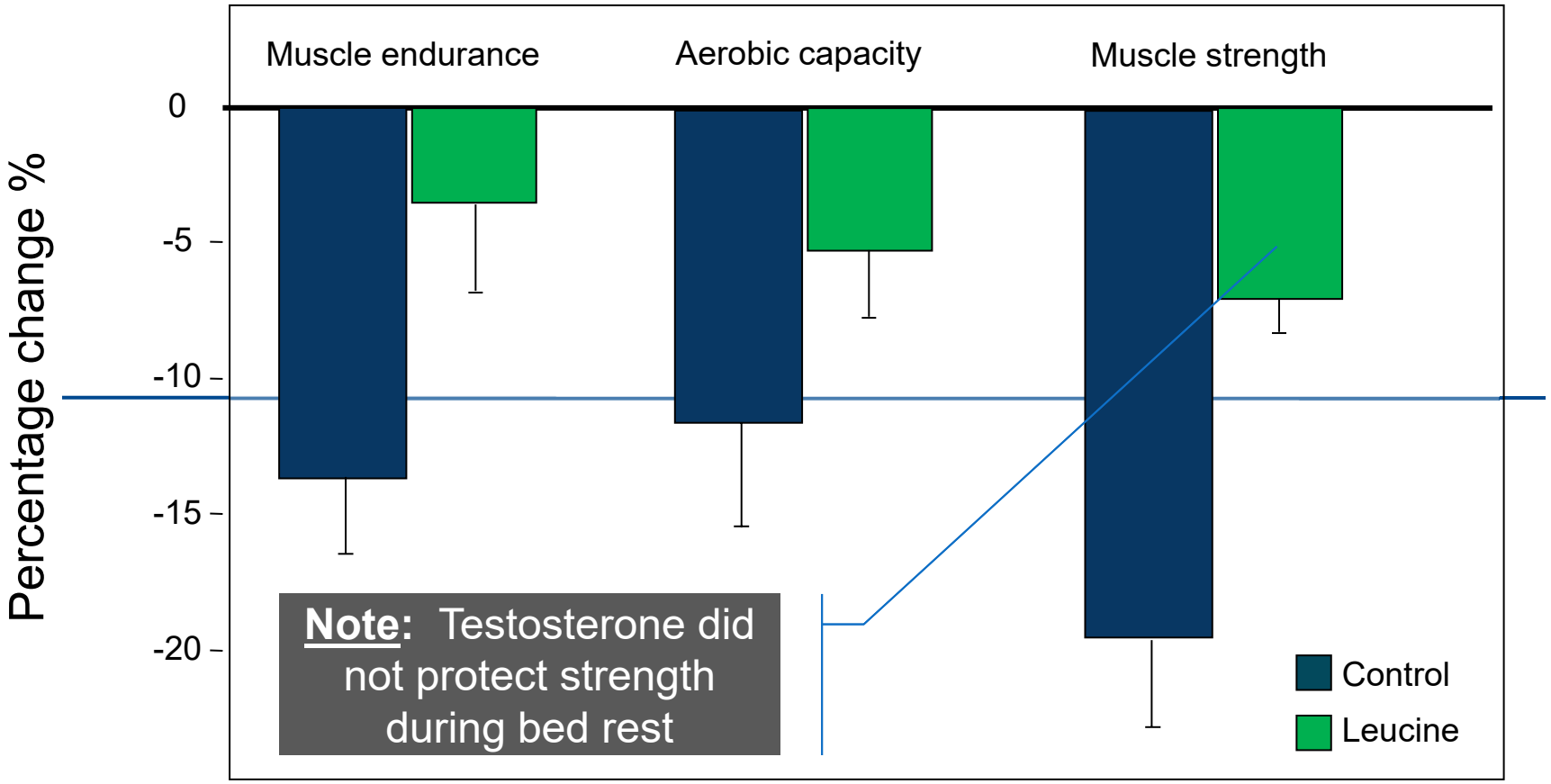
- Defined in terms of essential amino acid content and digestibility (bioavailability)
  - Protein Digestibility Corrected Amino Acid Score (PDCAAS)
- Leucine varies among protein sources (highest concentration in whey)



PDCAAS of common protein foods	
Source	**PDCAAS**
Milk	1.00
Whey	1.00
Egg	1.00
Soy protein isolate	1.00
Casein	1.00
Beef	0.92
Soy	0.91
Pea	0.67
Oat	0.57
Whole wheat	0.45

van Vliet et. al. J Nutr 2015

Leucine (4 g/meal): *partially protects muscle function*

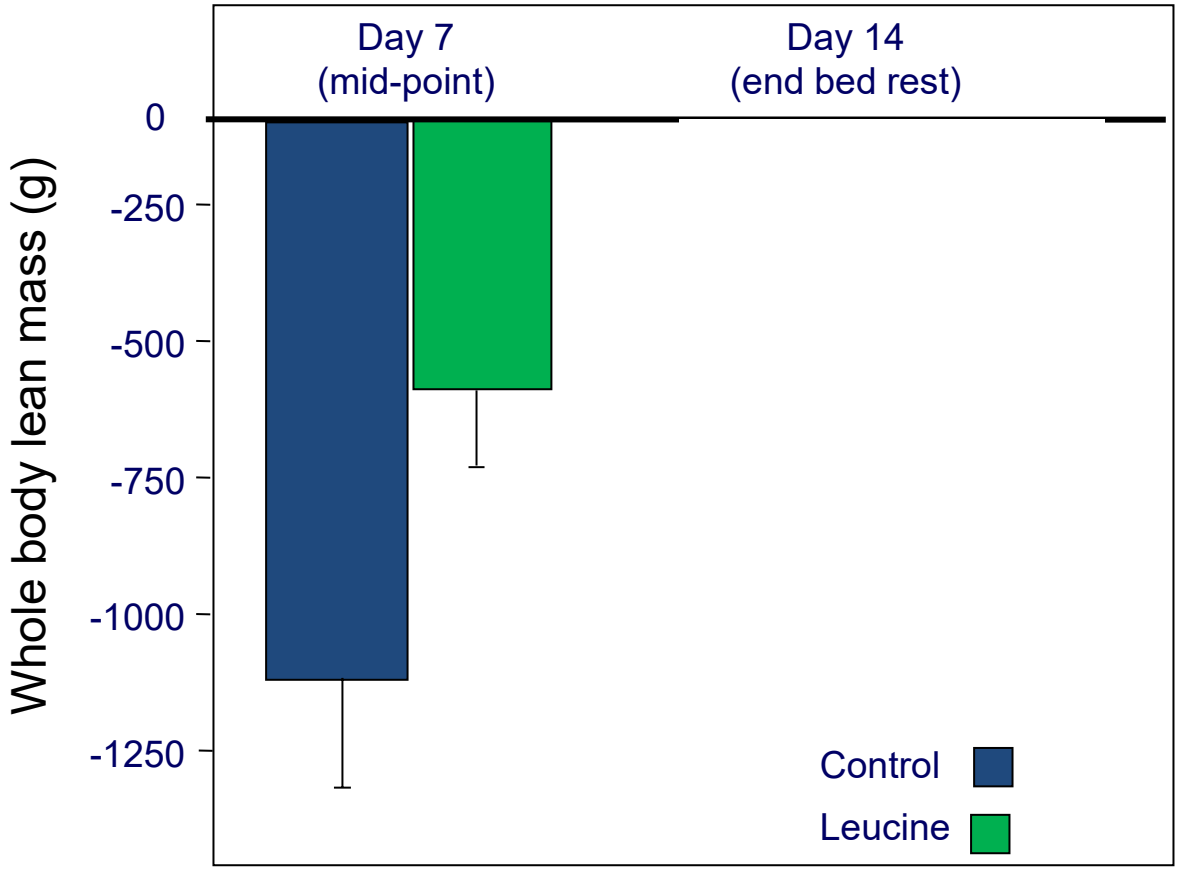


Healthy middle-age adults; 14 days bed rest

English et. al. AJCN, 2016

Zachwieja et. al. JCEM,1999

Leucine: *partially / temporarily protects muscle mass*

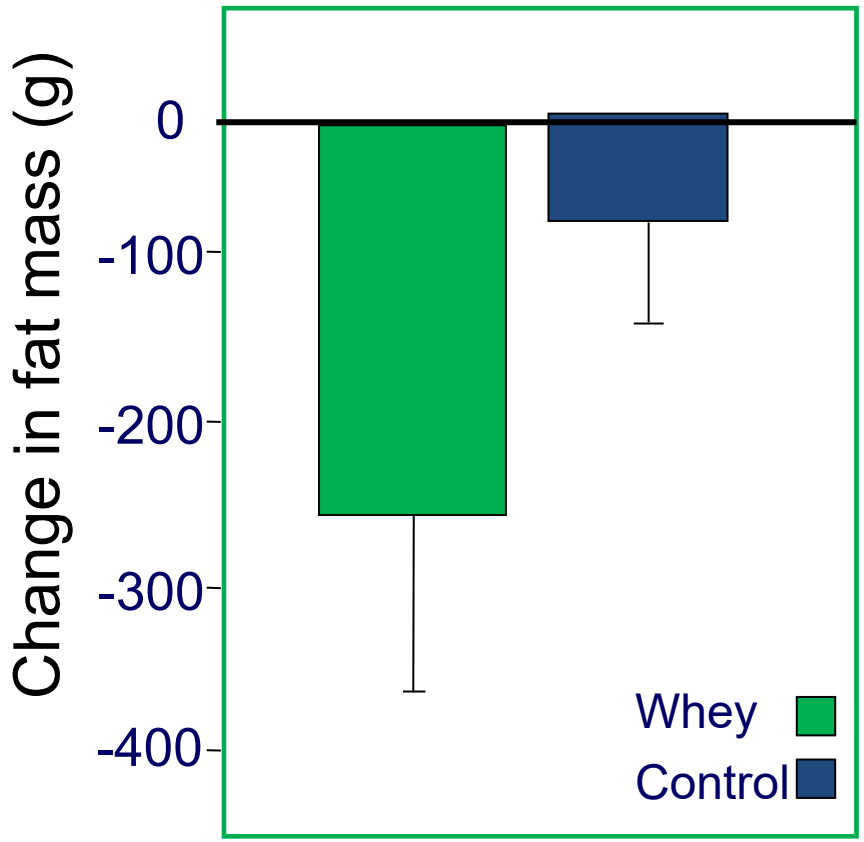


Healthy middle-age adults; 14 days bed rest

English et. al. AJCN 2016

Anabolic efficiency:

→ Improving dietary protein quality (whey) *enhances fat loss ?*



Design

- ❑ 7 days bed rest
- ❑ N = 20
- ❑ healthy older adults

Diets

- ❑ 0.9 g protein/kg/day
- ❑ whey protein augmentation
- ❑ mildly (10%) hypocaloric

Loss of lean leg mass

WHEY: - 680 ± 131 g
MIXED: - 1035 ± 138 g (*p=0.08)*

Arentson-Lantz et. al. J Gerontol A Biol Sci Med Sci, 2019

Protein Intake and Functionality

- Observational studies show higher protein intake is associated with better physical function (e.g. strength, functional status), while results from clinical trials are mixed

TABLE 3 Studies assessing the relation between dietary protein intake and physical function[1]

Study (ref)	Subjects, *n*	Age, y	Design	Dietary assessment	Physical function measurement	Protein intake	Outcomes
Gregorio et al. (76)	387 F	60–90	CS	4-d food record	PPT, SPPB	In g · kg^{-1} · d^{-1}; LP: <0.8; HP: ≥0.8	Upper and lower extremity function was impaired in those who consumed an LP diet
McLean et al. (84)	759 M, 986 F	29–85	L (6 y)	FFQ	IHHD	In g/d; Q1: 63; Q2: 74; Q3: 82; Q4: 94	Higher total and animal protein intakes preserved grip strength in adults ≥60 y
Sahni et al. (82)	1160 M, 1496 F	29–86	CS	FFQ	IHHD	In g/d; Q1: M 64.2, F 56.9; Q2: M 70.2, F 63.1; Q3: M 78.9, F 73.4; Q4: M 101.6, F 93.6	Higher plant (but not total and animal) protein intake was associated with greater quadriceps strength
Isanejad et al. (79)	554 F	65–72	L (3 y)	3-d food record	IHHD, SPPB	In % of energy (g · kg^{-1} · d^{-1}); T1: 16.4 (≤0.8); T2: 17.4 (0.8–1.2); T3: 18.6 (≥1.2)	Higher protein intake is positively associated with muscle strength and physical function

[1] CS, cross-sectional; HP, high protein; IHHD, isometric hand-held dynamometer; L, longitudinal; LP, low protein; PPT, physical performance test; Q, quartile; ref, reference; SPPB, short physical performance battery; T, tertile.

Traylor et. al. Adv Nutr 2018

Recommendations: *Prevention* and Treatment

For healthy older adults: day-to-day

Establish a dietary framework that includes a **moderate** amount of **high quality** protein at **each meal**.

Modify as necessary to accommodate individual needs:

- *energy requirements*
- *physical activity*
- *health status*
- *body composition goals*
- *dentition, satiety*

Recommendations: Prevention and *Treatment*

During periods of catabolic crisis:

- **0.8 g protein/kg/day is insufficient**
- **Blunt addition of protein/energy is inefficient**
- **Aggressive support with high quality protein (*whey/leucine*) and activity may help preserve muscle health**

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- Heather Leidy
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- Don Layman

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- National Cattlemens Beef Association
- National Dairy Council
- UTMB Claude D. Pepper Older Americans Independence Center

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CeRPAN
Center for Recovery, Physical Activity, and Nutrition

Questions?

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