Clinical Nutrition and Longevity

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Messages

- Physiological changes with ageing
- Clinical Nutrition: Malnutrition and ageing
- The future is in the muscle: fighting sarcopenia
- How to refrain ageing

Haaretz 1/12/2010

- The population is reaching 79.5 years for male and 83.4 years for women, an increase of 3 years in the last 10 years….

Can we fight physiological changes of ageing?

ANOREXIA IN AGING

↓ Smell

↓ Taste

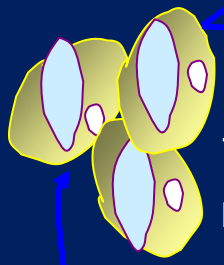
↓ Opioids
↓ NPY
↓ Nitric oxide

Decreased food intake (M>F)

↑ Leptin

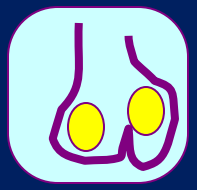
↑ TNF - α

Vagus nerve

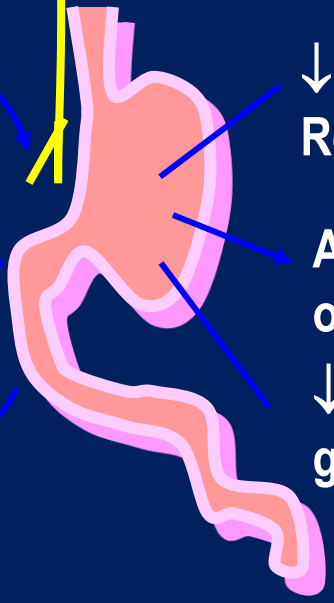


↑ Fat mass

↓ Testosterone



↑Cholecystokinin

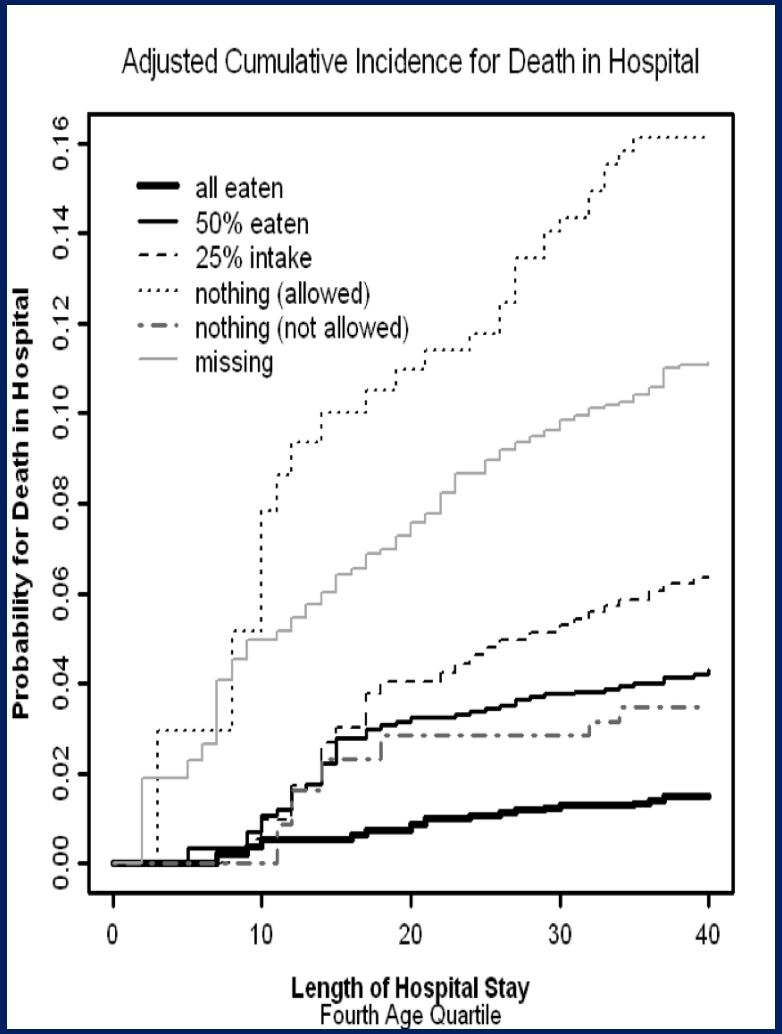


↓ Adaptive Relaxation

Antral stretch occurs earlier

↓ Rate of gastric emptying

Poor eating – higher risk



nutritionDay 2006

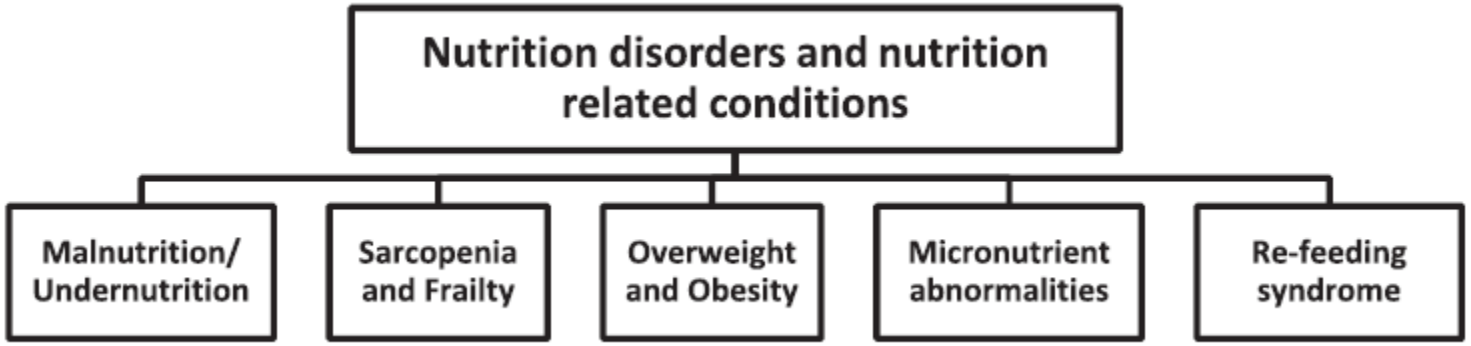
3200 patients
Ages 78 - 103

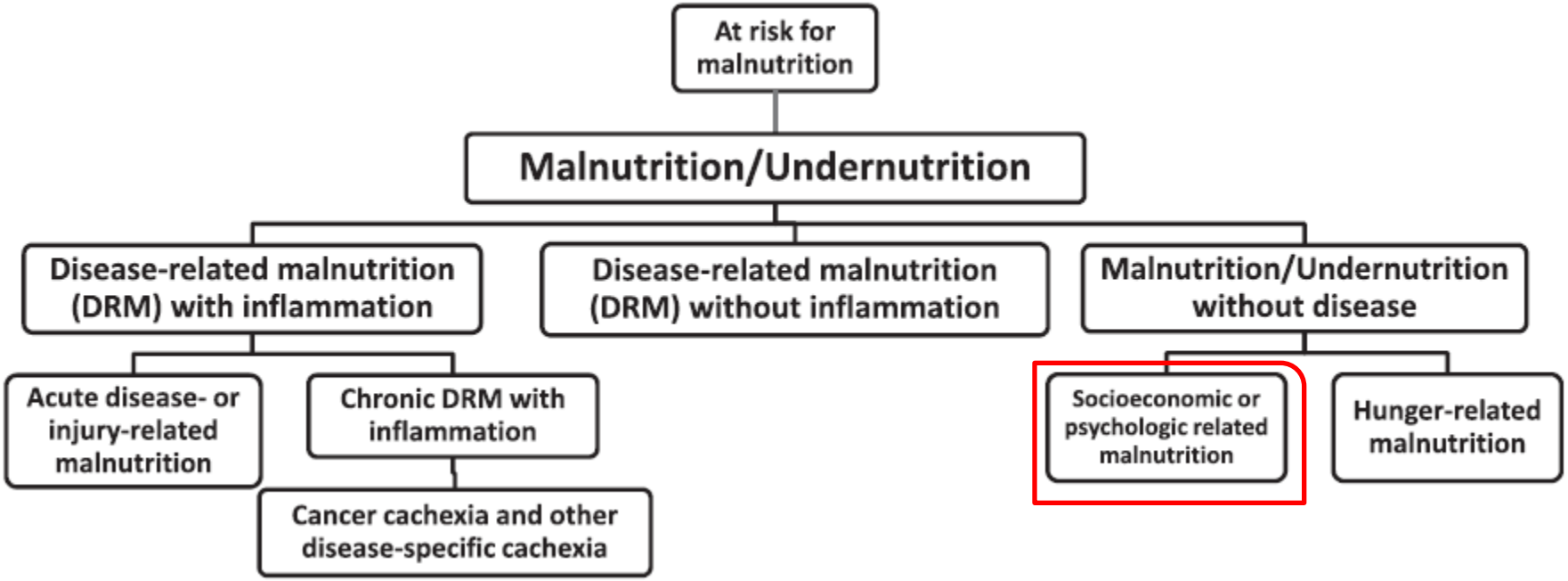
ESPEN Guideline

ESPEN guidelines on definitions and terminology of clinical nutrition

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

ESPEN
THE EUROPEAN SOCIETY FOR CLINICAL NUTRITION AND METABOLISM

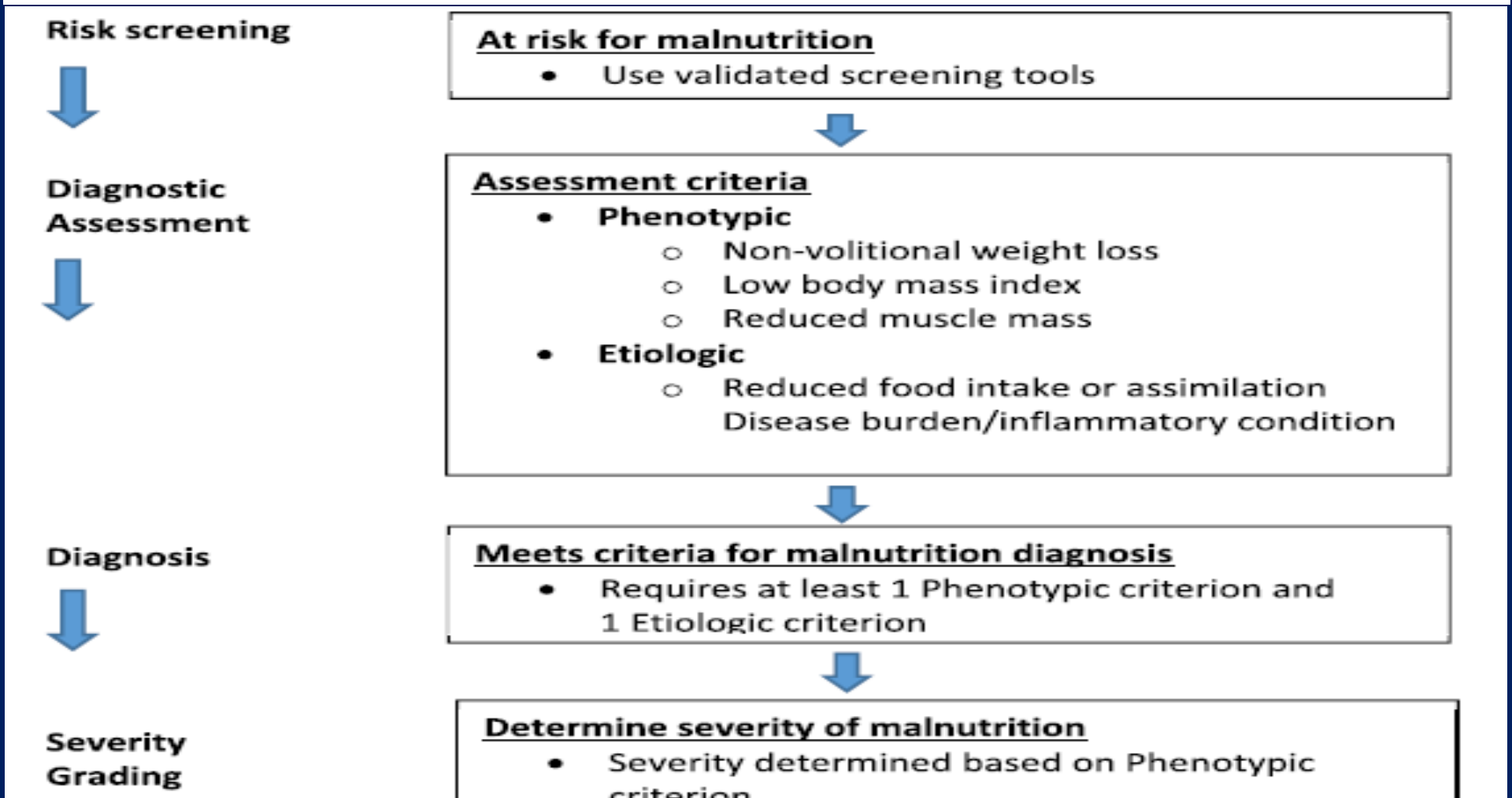




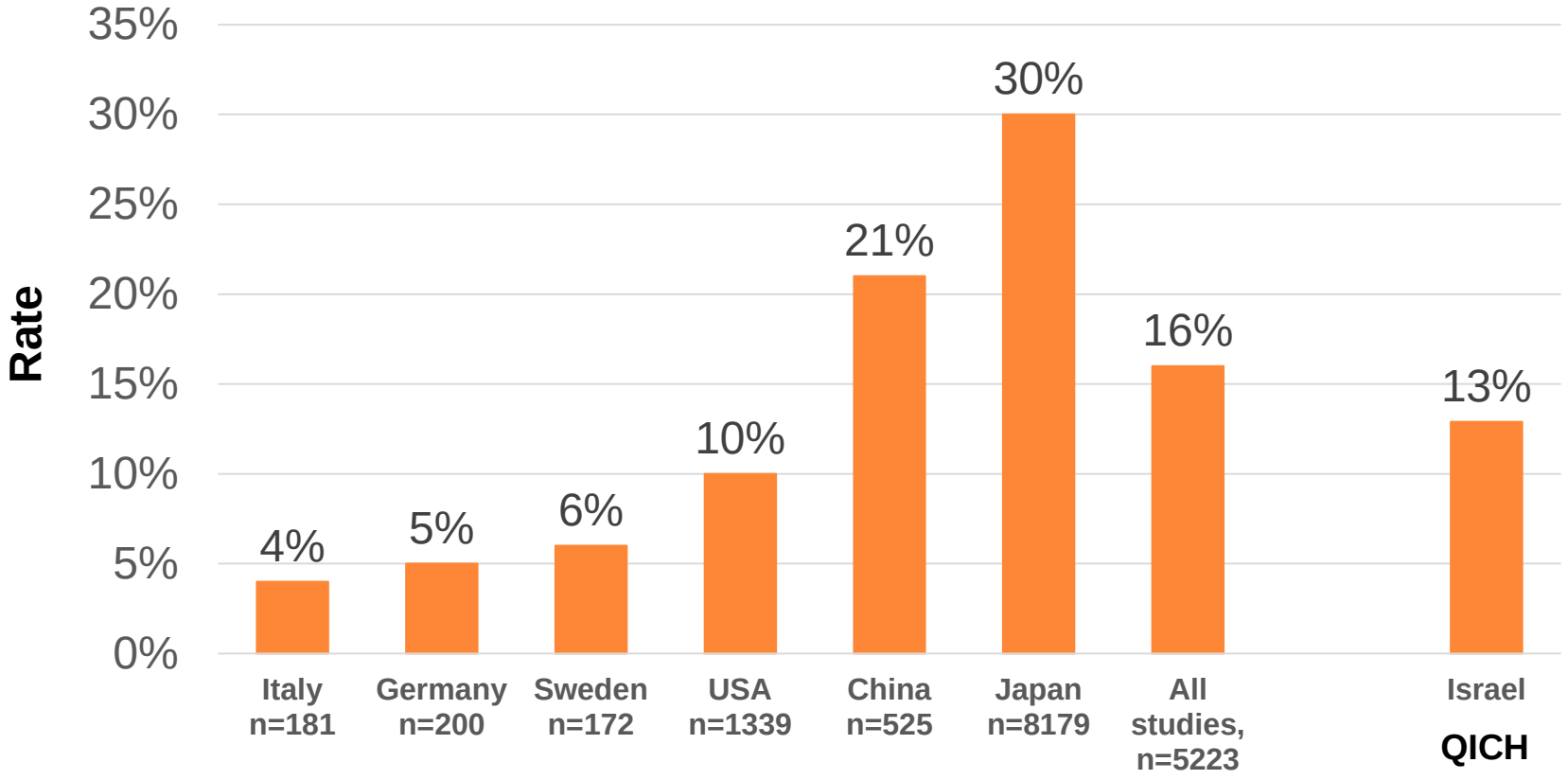
ESPEN Endorsed Recommendation

GLIM criteria for the diagnosis of malnutrition – A consensus report from the global clinical nutrition community☆

T. Cederholm [a, b, *, 1], G.L. Jensen [c, 1], M.I.T.D. Correia [d], M.C. Gonzalez [e], R. Fukushima [f], T. Higashiguchi [g], G. Baptista [h], R. Barazzoni [i], R. Blaauw [j], A. Coats [k, l], A. Crivelli [m], D.C. Evans [n], L. Gramlich [o], V. Fuchs-Tarlovsky [p], H. Keller [q], L. Llido [r], A. Malone [s, t], K.M. Mogensen [u], J.E. Morley [v], M. Muscaritoli [w], I. Nyulasi [x], M. Pirlich [y], V. Pisprasert [z], M.A.E. de van der Schueren [aa, ab], S. Siltharm [ac], P. Singer [ad, ae], K. Tappenden [af], N. Velasco [ag], D. Waitzberg [ah], P. Yamwong [ai], J. Yu [aj], A. Van Gossum [ak, 2], C. Compher [al, 2], GLIM Core Leadership Committee, GLIM Working Group[3]



International comparisons, prevalence of underweight, aged ≥65



Trials included home care residents

Underweight was defined as BMI≤18

Source: Obes Rev. 2015 Nov;16(11):1001-15.

Malnutrition risk in the elderly

ELSEVIER

NUTRITION

Nutrition 21 (2005) 1100–1106

www.elsevier.com/locate/nut

Applied nutritional investigation

Geographical inequalities in nutrient status and risk of malnutrition among English people aged 65 y and older

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Institute of Human Nutrition, School of Medicine, University of Southampton, Southampton General Hospital, Southampton, United Kingdom

Manuscript received December 21, 2004; accepted March 18, 2005.

Abstract

Objective: Geographical inequalities in health continue to be a problem within developed countries. This study investigated whether there were north-south geographical inequalities among older people living in England with respect to risk of protein-energy malnutrition and status of nutrients, particularly those derived from fruit and vegetables.

Methods: A secondary analysis of data collected prospectively by the National Diet and Nutrition Survey of people aged 65 y and older was undertaken to assess geographical prevalence of risk of protein-energy malnutrition (1155 subjects) and nutrient status (881 to 1046 subjects).

Results: A north-south gradient was found in risk of protein-energy malnutrition (19.4%, 12.3%, and 11.2% in the northern, central, and southern regions, respectively; $P = 0.013$, P for trend = 0.002). This was accompanied by a north-south gradient in the status of vitamin C (30, 38, and 46 μmol/L in the respective regions, $P < 0.001$), which was associated with deficiency (<11 μmol/L) in a third of subjects in the northern region, a range of carotenoids ($P = 0.023$ to <0.001), vitamin D ($P < 0.001$), and selenium ($P < 0.001$). These inequalities were accompanied by gradients in indices of health status and socioeconomic status, which could account only partly for the "geographical" inequalities. Circulating vitamin C and carotenoid concentrations were related to the intake of fruit and vegetables.

Conclusions: This study suggests there is a north-south divide in the risk of protein-energy malnutrition and a range of nutrients, which have been implicated in the development of common chronic diseases.

Keywords: Inequalities; Malnutrition; Nutrients; Elderly; Screening; Malnutrition Universal Screening Tool

Introduction

Greater prosperity and improvements in health in the United Kingdom and other developed countries do not appear to have decreased inequalities in income, mortality, and outcome of disease [1,2]. In the United Kingdom there is evidence that several inequalities between people and places have increased [1]. Further, the map of regional standardized mortality in England [3] still reflects its historical past, with lower life expectancy in the poorer industrial and rural northern areas of England than in the richer rural and suburban southern areas of England. However, it is surprising how little attention has been directed toward nutritional inequalities between geographical regions [4], given that nutrition has an important role to play in the development and financial cost of a variety of diseases or conditions, including ischemic heart disease, stroke, hypertension, obesity, and certain types of cancer [5].

A survey of nutritional status of people 65 y and older living in the United Kingdom [6] raised concern about the high frequency of some vitamin and other nutrient deficiencies among older people (10% to 30%), especially those due to inadequate consumption of fruit and vegetables, which have been implicated in the etiology of cardiovascular and malignant conditions [5–7]. In the European Union it has been estimated that low fruit and vegetable consumption contributes to 3.5% of the overall burden of disease [8]. Information about the geographical distribution of nutrient status and intake of fruit and vegetables may help identify and target regions that are at particular risk. An assessment

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0899-9007/05/$ – see front matter
doi:10.1016/j.nut.2005.03.005

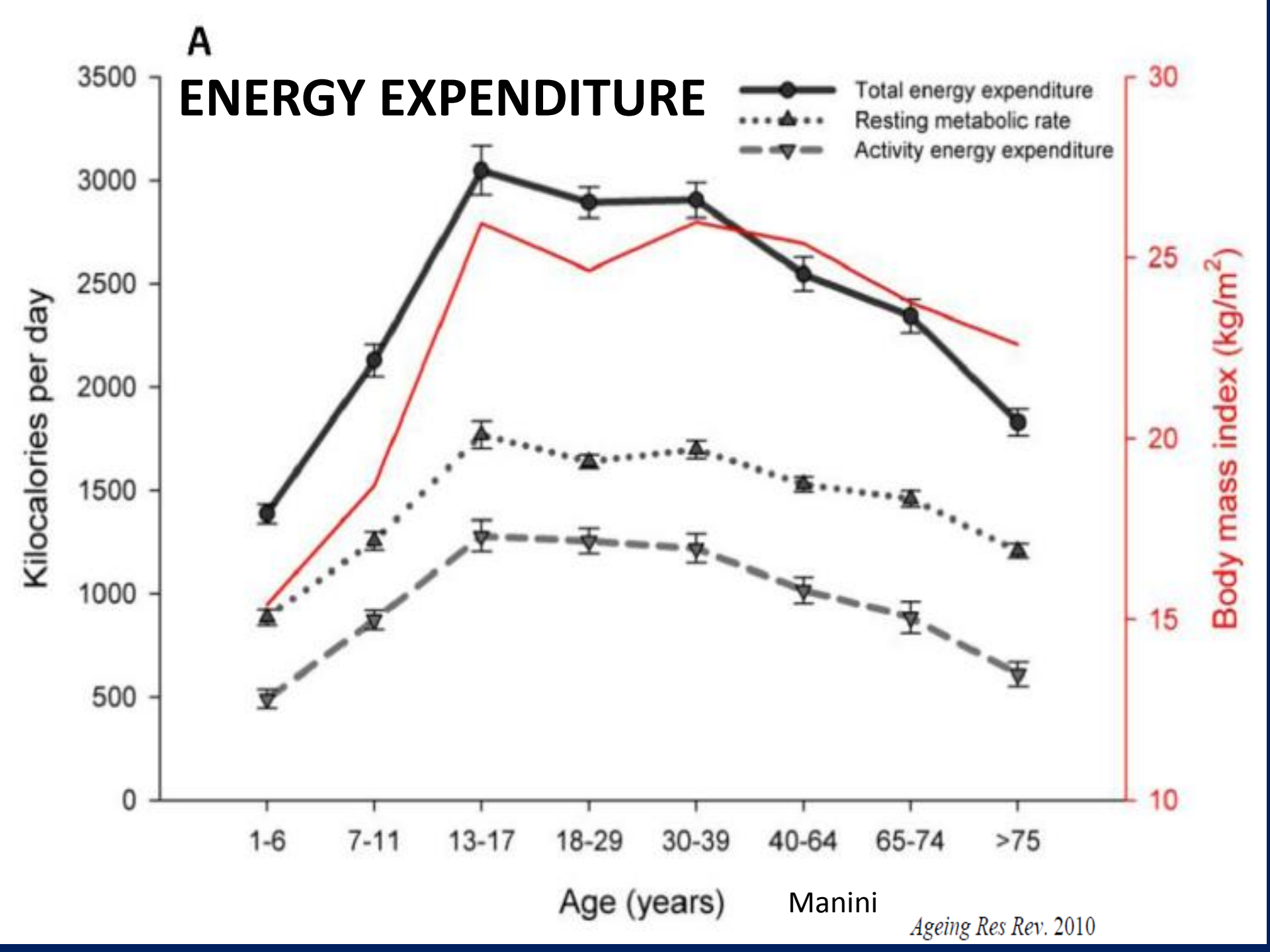
Age	Malnutrition
• 65-74y	11%
• 75-84y	15%
• >85y	18%
Sex	
• Male	12%
• Female	16%
Domicile	
• Free living	13%
• Institution	21%

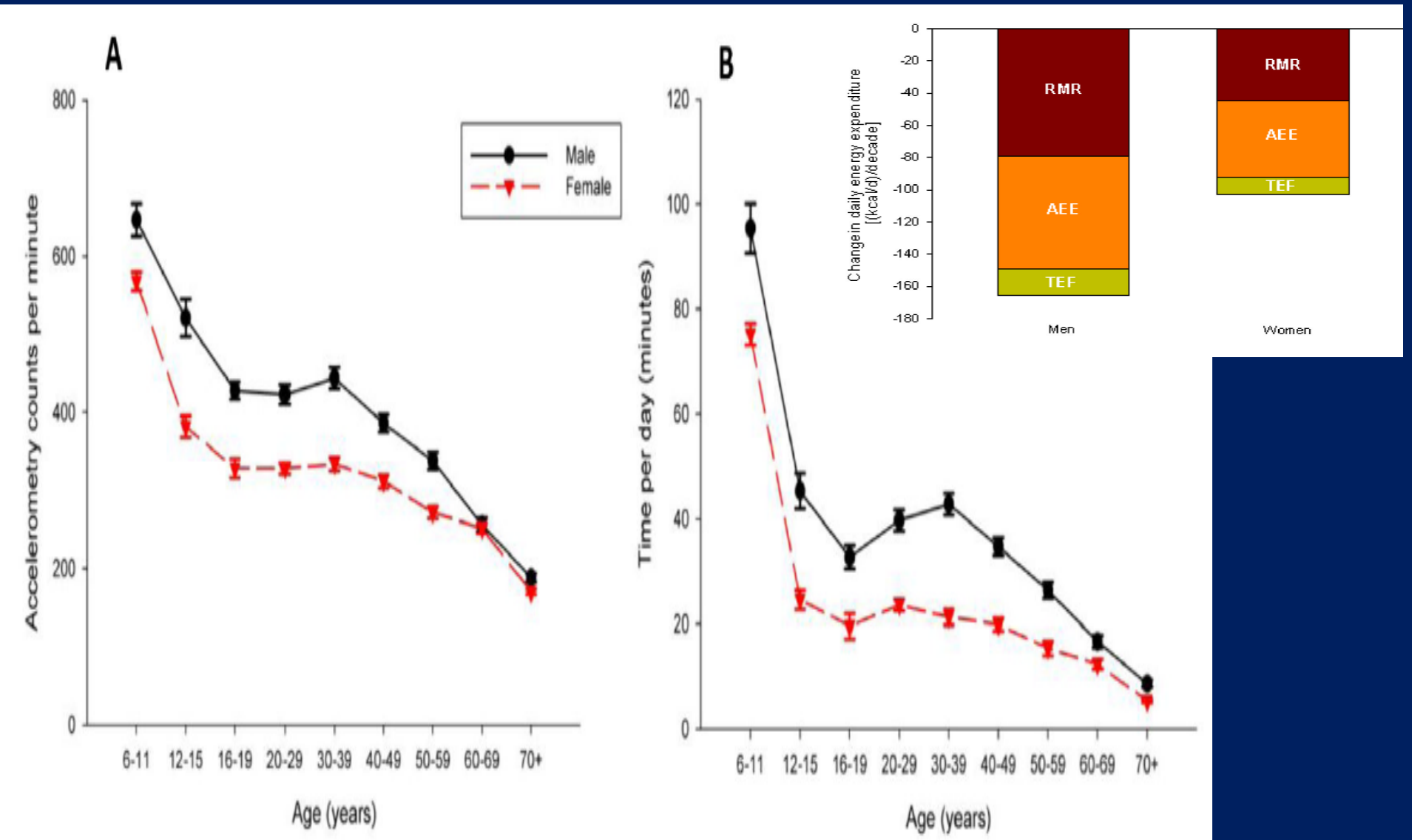
Prevalence of malnutrition in Geriatric hospitals (2015)

21,796 elderly
Using MUST score:
At risk (1)=10%
Malnutrition(2+)=12%

Nutrition Day in Europe: it is an audit

- Mortality increase x 3 in malnourished patients
- Length of hospital stay increase
- Morbidity increase

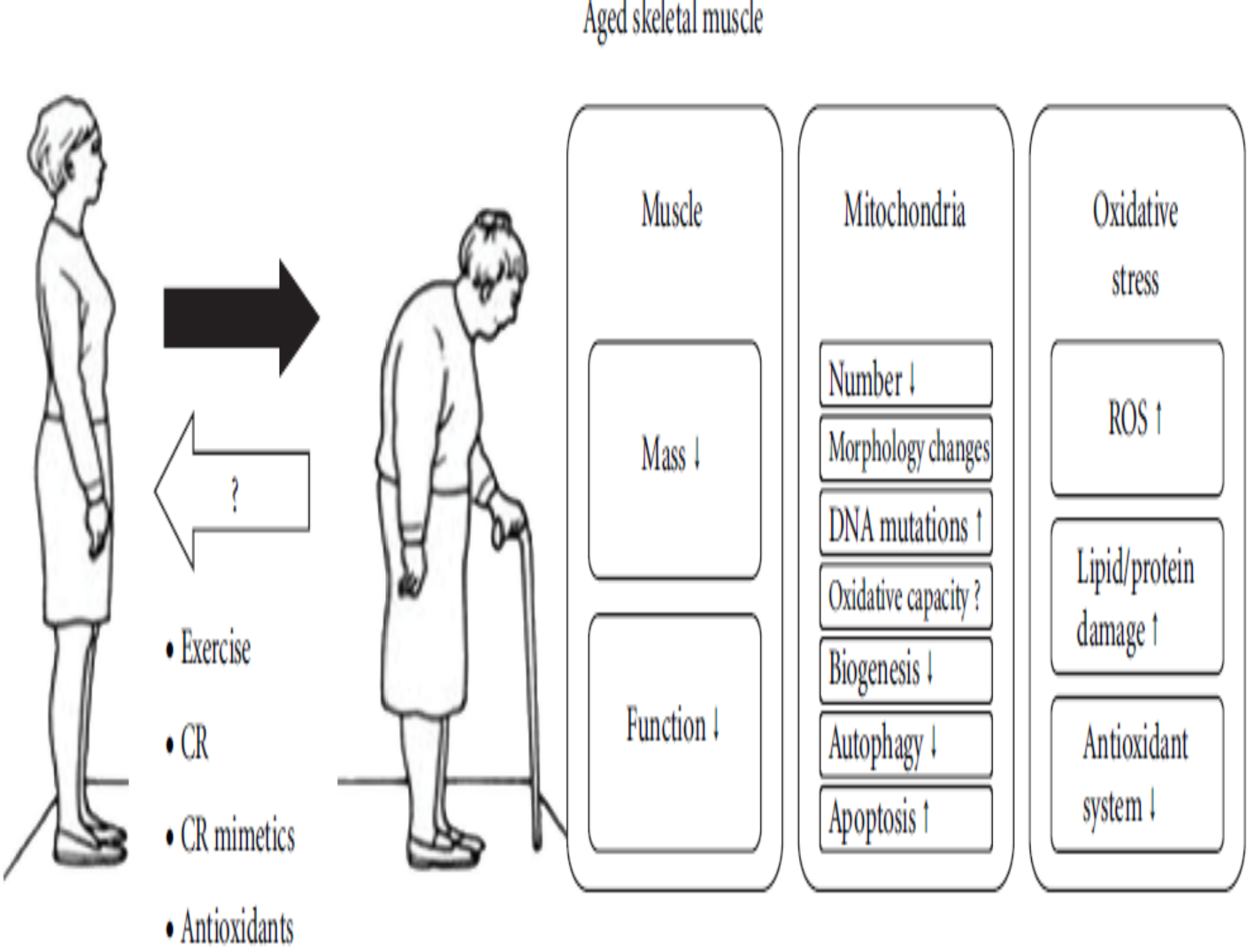

A
ENERGY EXPENDITURE
Total energy expenditure
Resting metabolic rate
Activity energy expenditure
Kilocalories per day
Body mass index (kg/m2)
3500
3000
2500
2000
1500
1000
500
0
30
25
20
15
10
1-6
7-11
13-17
18-29
30-39
40-64
65-74
>75
Age (years)
Manini
Ageing Res Rev. 2010



VOLUTIONAL PHYSICAL ACTIVITY

Figure 6.

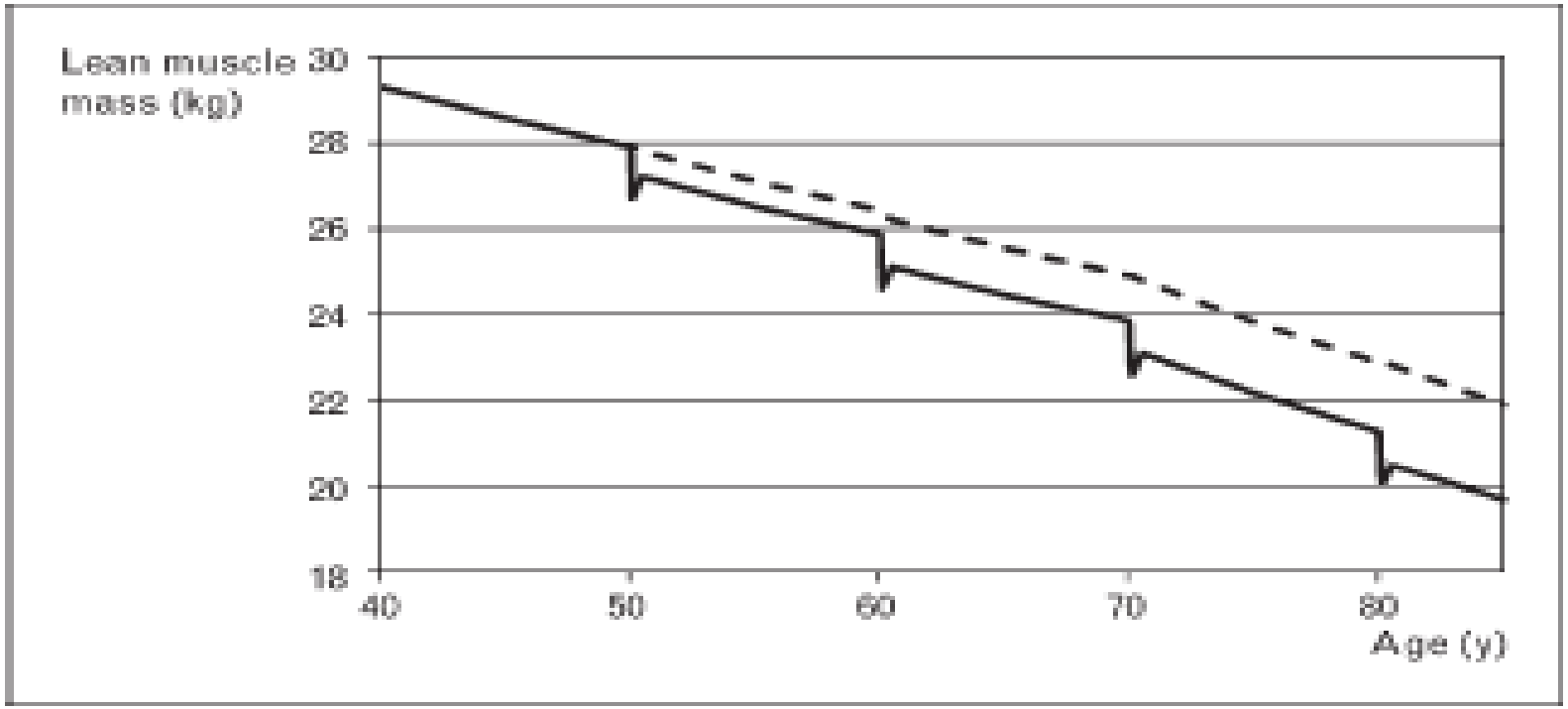
Figure 6a & b. Volitional physical activity levels across the lifespan in a nationally representative sample of Americans (National Health and Nutrition Examination Surve *Ageing Res Rev.* 2010


Aged skeletal muscle
?
• Exercise
• CR
• CR mimetics
• Antioxidants
Muscle
Mass ↓
Function ↓
Mitochondria
Number ↓
Morphology changes
DNA mutations ↑
Oxidative capacity ?
Biogenesis ↓
Autophagy ↓
Apoptosis ↑
Oxidative stress
ROS ↑
Lipid/protein damage ↑
Antioxidant system ↓

Protecting muscle mass and function in older adults during bed rest

Kirk L. English and Douglas Paddon-Jones

Figure 1 Proposed model of age-related muscle loss punctuated by episodes of acute illness or injury and characterized by accelerated muscle loss and incomplete recovery



(– –), Traditional sarcopenia model; (—), Catabolic crisis model.

Consequences of undernutrition

- DEATH
- NOSOCOMIAL INFECTIONS
- SARCOPENIA
- HIP FRACTURES
- PRESSURE ULCER DEVELOPMENT
- DEPRESSED MOOD-QoL

Schols et al. Am J Respir Crit Care Med 1998;157:1791-7

Anker et al. Lancet 2003;361:1077-83

Ensrud et al. Arch Intern Med 1997;157:857-63

Original article

The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome

Tamar Koren-Hakim [a,b], Avraham Weiss [a,c], Avital Hershkovitz [c,d], Irena Otzrateni [a], Boris Grosman [a], Sigal Frishman [b], Moshe Salai [c,e], Yichayaou Beloosesky [a,c,*]

Demographic, clinical, functional characteristics and patient outcome by MNA groups.

Variable	Well-nourished ($n = 95$)	At risk of malnutrition ($n = 95$)	Malnourished ($n = 25$)	*P* Value
Age (years)	82.99 ± 5.64 (73–96)	83.76 ± 6.65 (66–104)	84.52 ± 5.48 (73–93)	NS
Gender (*n*)				
Male	22 (23.2%)	34 (35.8%)	5 (20.0%)	NS
Female	73 (76.8%)	61 (64.2%)	20 (80.0%)	
CCI	1.26 ± 1.30	2.15 ± 1.85	2.16 ± 1.40	<0.001
CIRS-G	8.17 ± 3.81	9.77 ± 3.78	10.92 ± 4.10	0.001
BMI	28.15 ± 4.04	25.46 ± 5.15	22.71 ± 3.70	<0.001
Functional groups (*n*)				
Independent	59 (62.1%)	15 (15.8%)	6 (24.0%)	
Partially dependent	32 (33.7%)	44 (46.3%)	8 (32.0%)	<0.001
Fully dependent	4 (4.2%)	36 (37.9%)	11 (44.0%)	
Cognitive groups (*n*)				
Cognitively normal	80 (84.2%)	35 (36.8%)	10 (40.0%)	<0.001
Impaired mental status	15 (15.8%)	60 (63.2%)	15 (60.0%)	
Main complications	46 (48.4%)	46 (48.4%)	13 (52.0%)	NS
6 months readmission	36 (37.9%)	51 (53.7%)	13 (52.0%)	0.024
Mortality (*n*)				
Up-to 36 months	21 (22.1%)[ab]	48 (50.5%)	10 (40.0%)	0.001[a] 0.01[b]

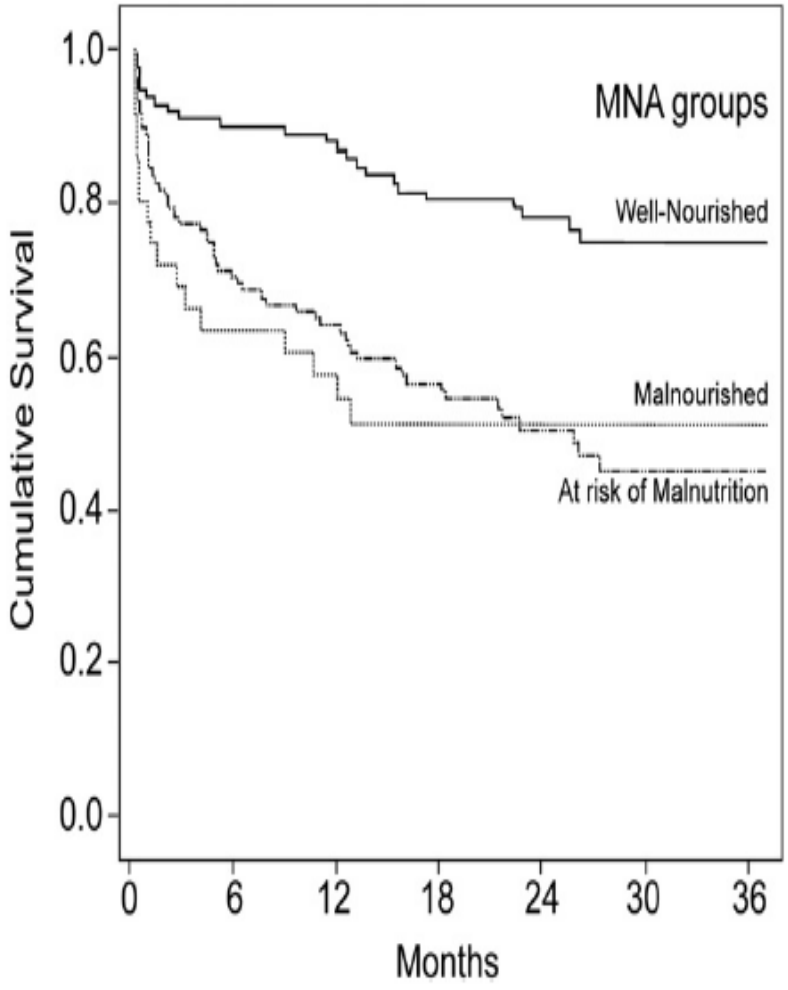
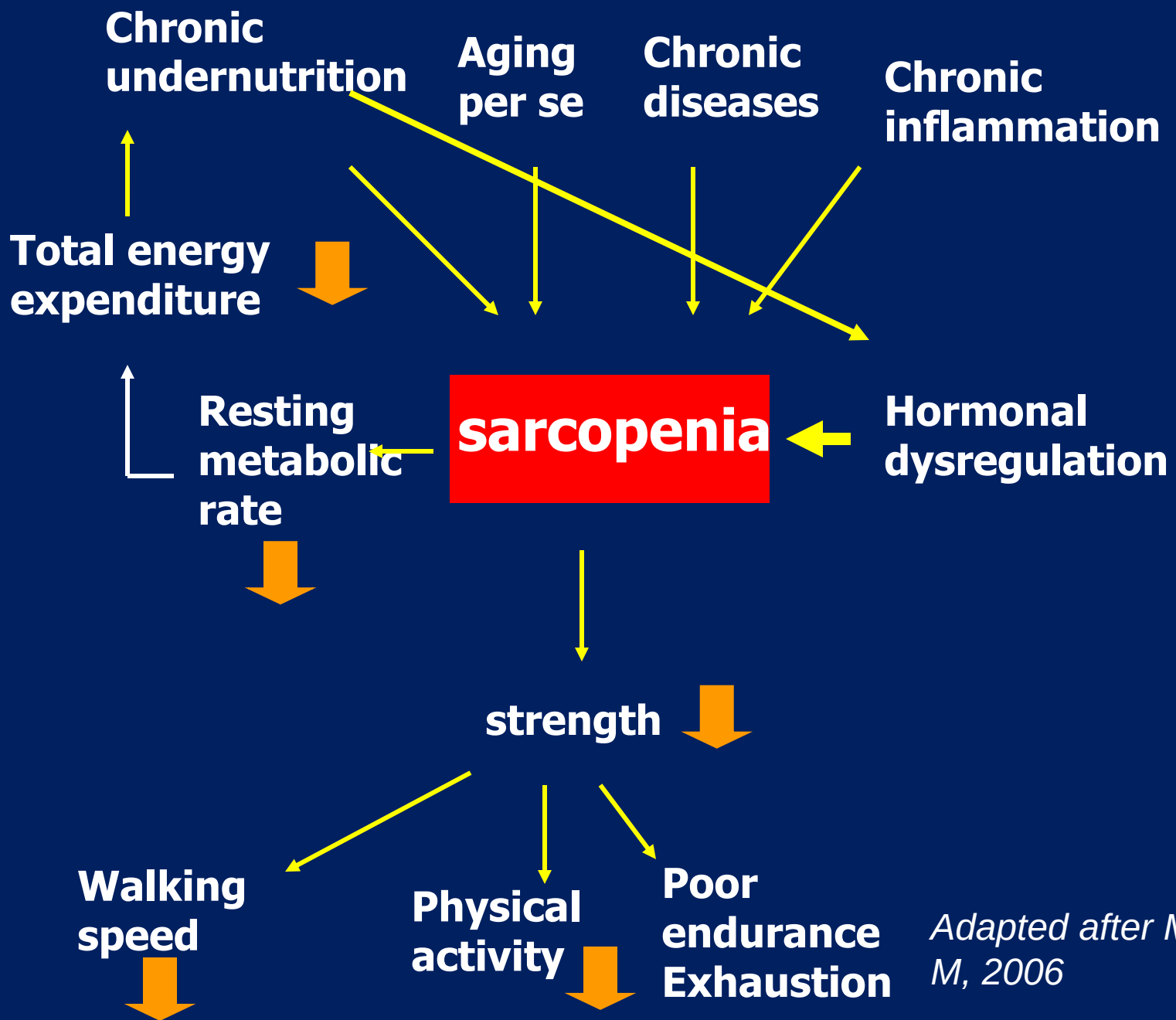


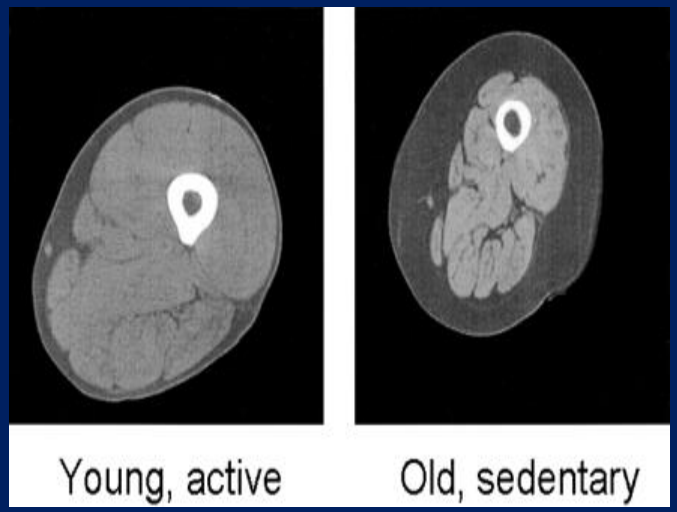
Fig. 1. Long-term mortality of the 3 nutritional groups.



Adapted after Maggio M, 2006

Definition of Sarcopenia

- Age-associated loss of skeletal muscle mass and muscle functions (Muscle strength and performance)
- Less-than-expected in an individual of a specified age and gender *(Baumgartner RN, Waters DL, 2006)*



Roubenoff R, J Gerontol Med Sci 2003; 58: 1012 - 1017

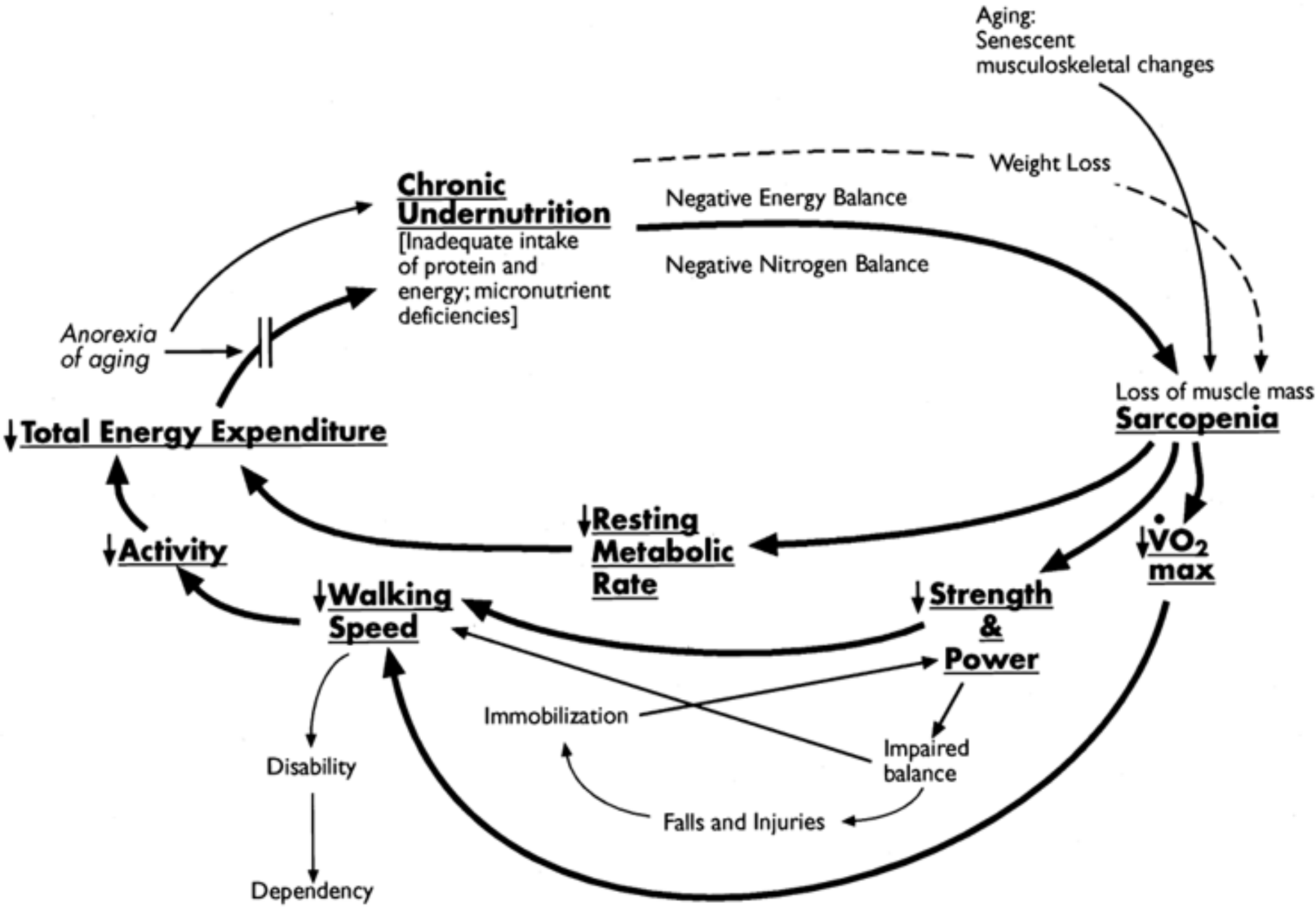
CURRENT OPINION

Sarcopenia: the new definitions

Tommy Cederholm[a,b] *and John E. Morley*[c]

Table 1. SARC-F screen for sarcopenia

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0
		Some = 1
		A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0
		Some = 1
		A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0
		Some = 1
		A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0
		Some = 1
		A lot or unable = 2
Falls	How many times have you fallen in the last year?	None = 0
		1–3 falls = 1
		4 or more falls = 2


Aging:
Senescent
musculoskeletal changes
Weight Loss
Chronic
Undernutrition
[Inadequate intake
of protein and
energy; micronutrient
deficiencies]
Negative Energy Balance
Negative Nitrogen Balance
Anorexia
of aging
Loss of muscle mass
Sarcopenia
↓Total Energy Expenditure
↓Activity
↓Resting
Metabolic
Rate
↓$\dot{V}O_2$
max
↓Walking
Speed
↓Strength
&
Power
Immobilization
Impaired
balance
Disability
Falls and Injuries
Dependency

frailty

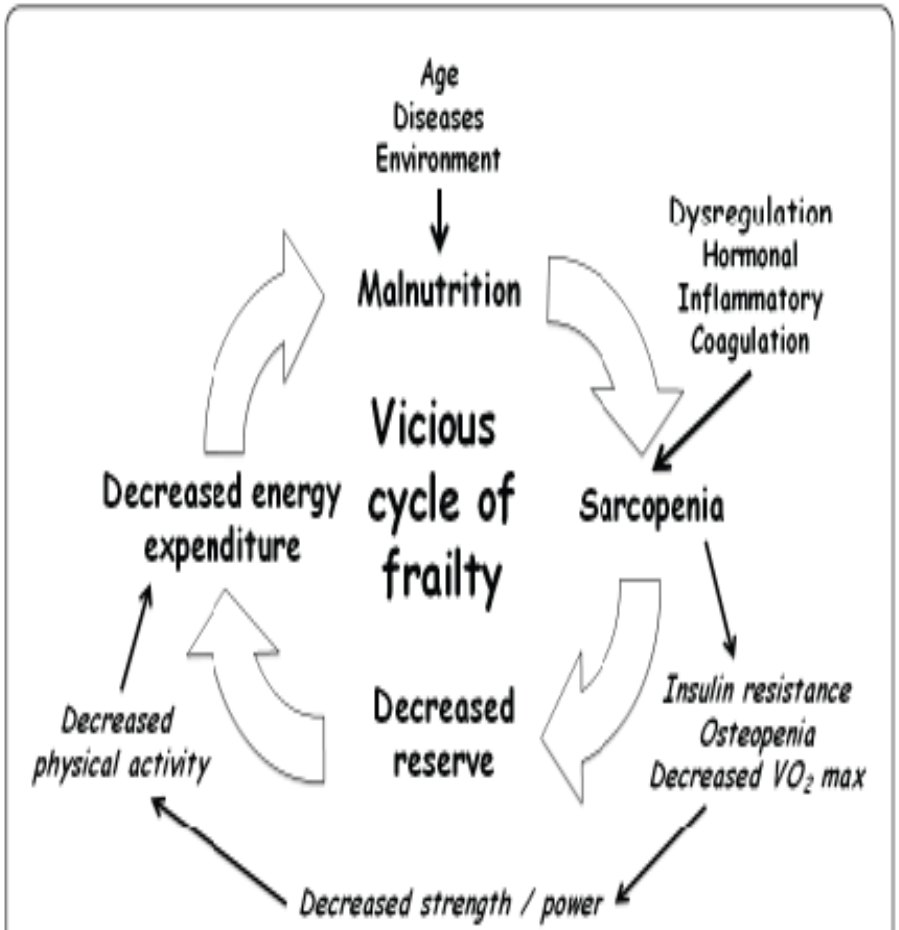


Figure 1. Overview of the vicious cycle of frailty. VO_2 max, maximal oxygen consumption. Adapted from [2].

Table 1. Proposed clinical definition of the phenotype of frailty

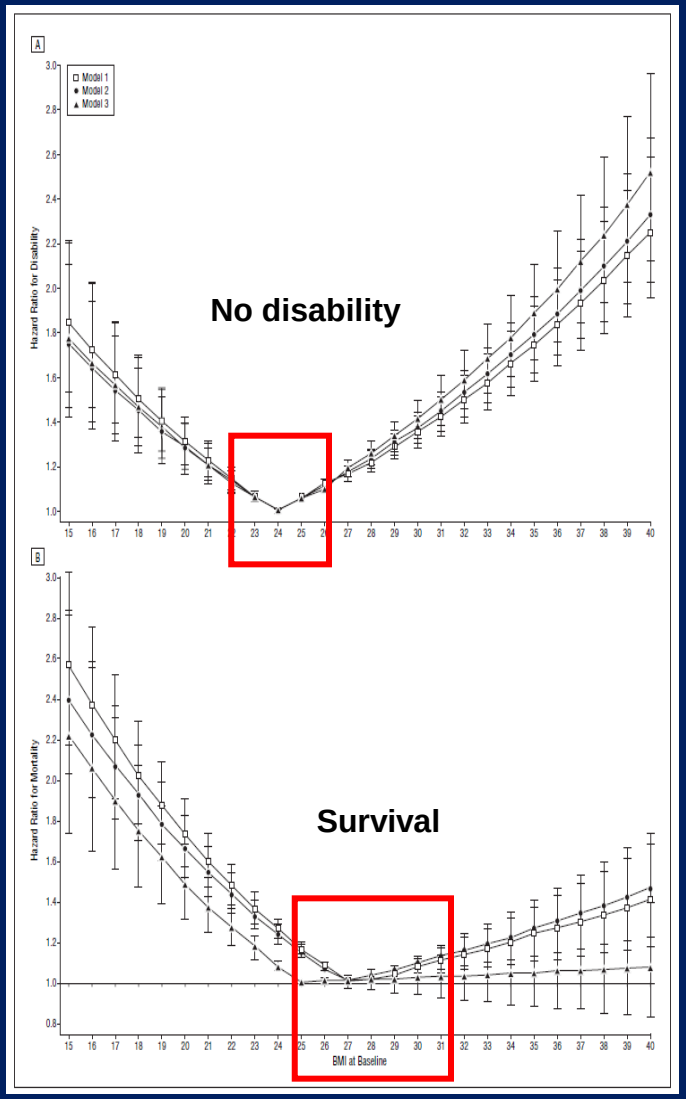
Criteria
1. Decreased grip strength
2. Self-reported exhaustion
3. Unintentional weight loss of more than 4.5 kg over the past year
4. Slow walking speed
5. Low physical activity
Definition
Positive for frail phenotype: ≥3 criteria present
Intermediate/pre-frail: one or two criteria present
Nonfrail: no criteria present

Adapted from Fried and colleagues [2].

Body mass index - function and survival in old age

- ~13.000 >65 y
- 7 y follow-up
- Optimal function at BMI ~25
- Best survival at BMI ~25-30

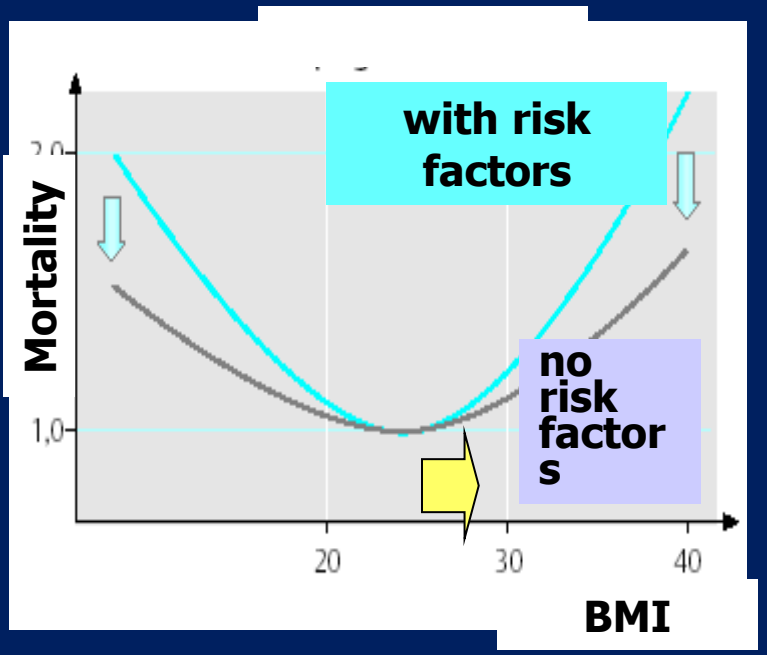
Al Snih S et al. Arch Intern Med 2007;167:774-80



Anthropometry

$$\text{BMI} = \frac{\text{Weight}}{\text{Height}^2}$$

- For the elderly association between BMI and body fat less close
- For the elderly higher survival for people with higher BMI
- Treshhold for malnutrition in the elderly
  22 kg / m²



Flodin L et al. Clin Nutr 2000;19:121-5.

Sarcopenic obesity: A Critical appraisal of the current evidence

C.M.M. Prado [a], J.C.K. Wells [b], S.R. Smith [c], B.C.M. Stephan [d], M. Siervo [e,*]

Clinical Nutrition 31 (2012) 583–601

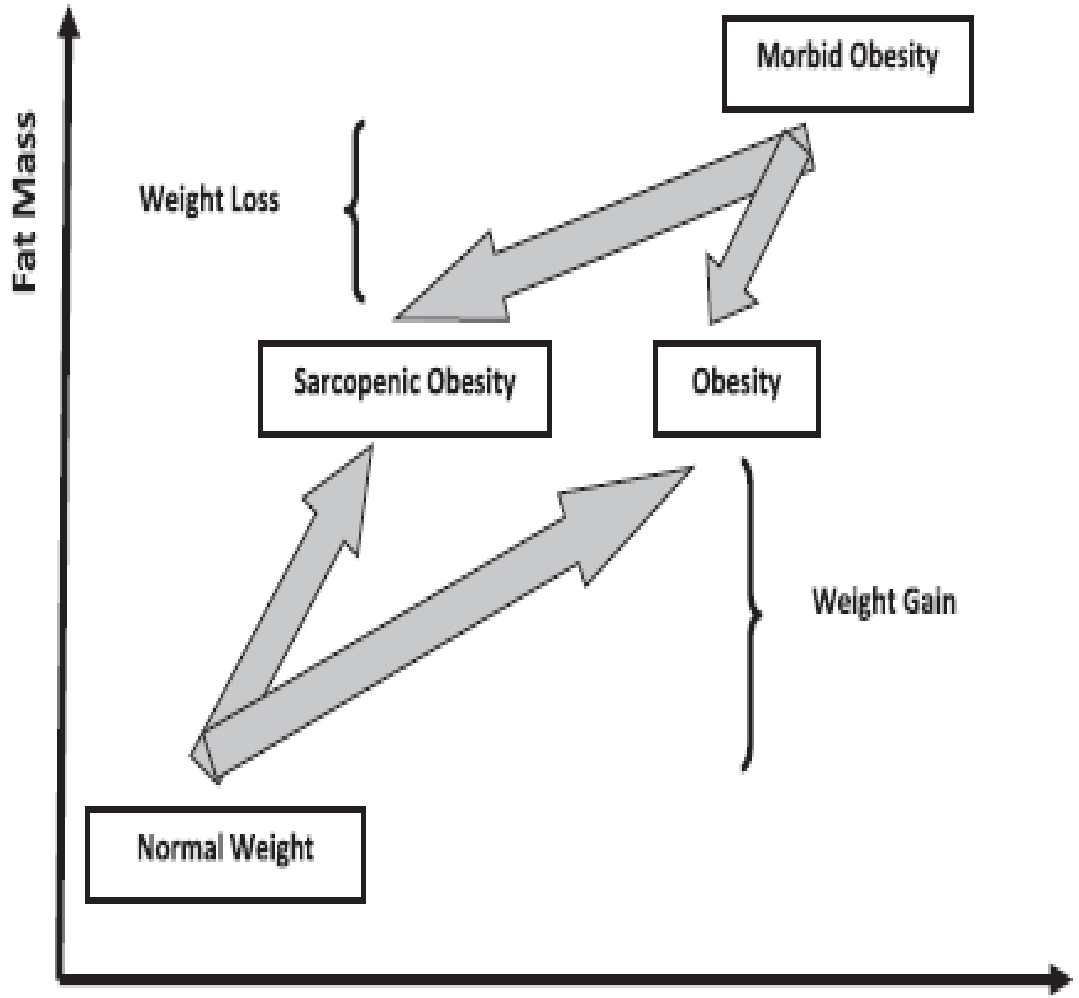
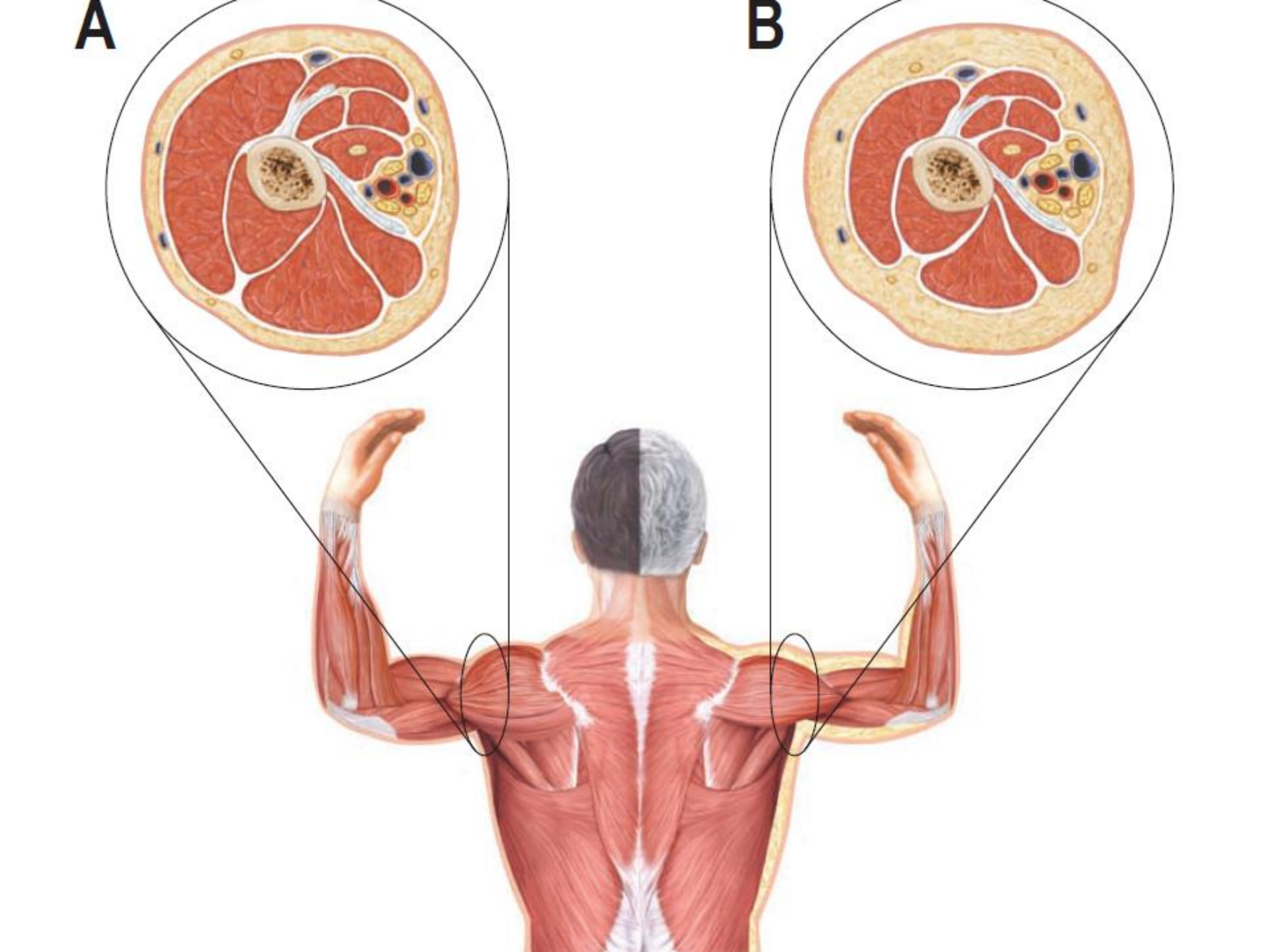


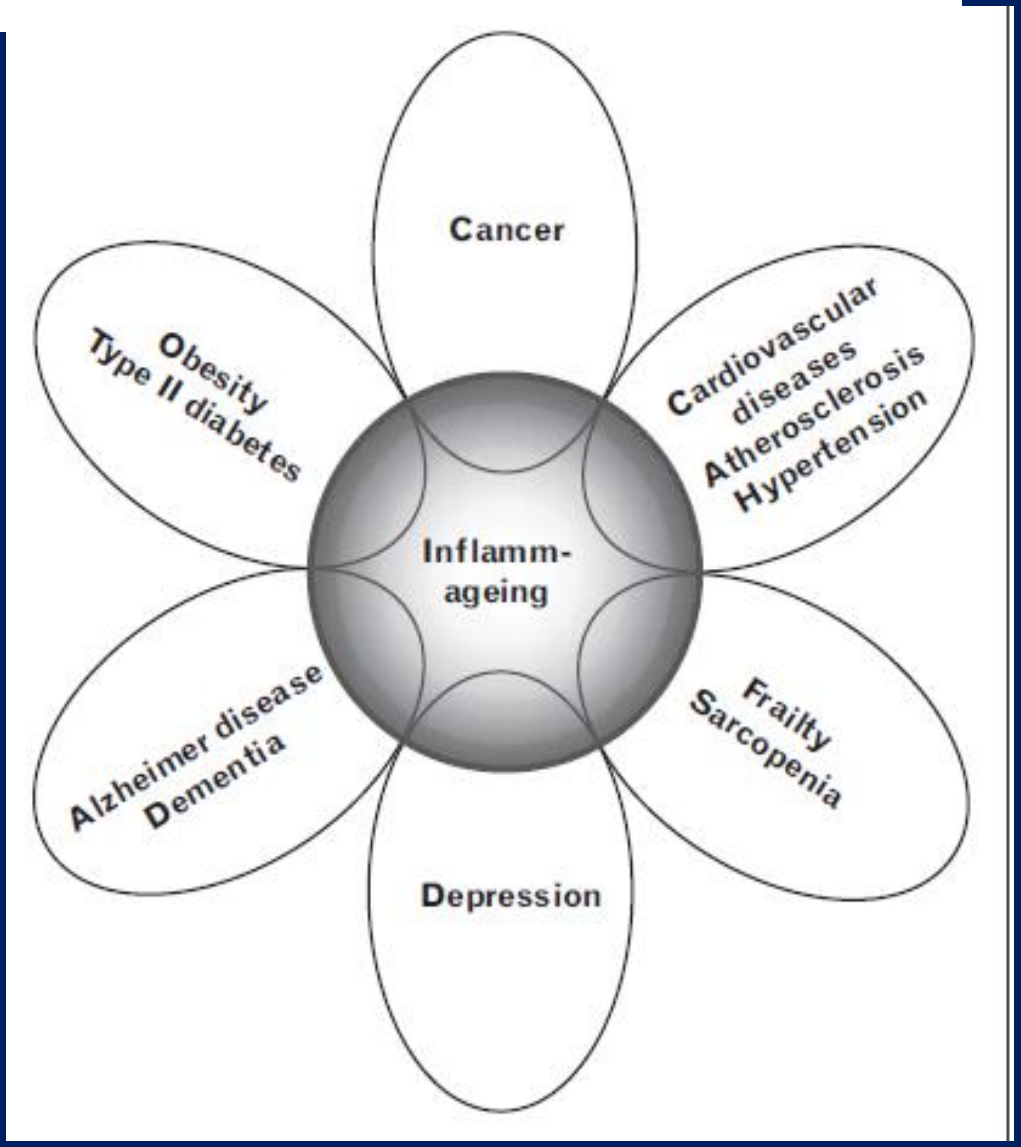
Table 3
Profile of sarcopenic obesity.

Feature	
Definition	• Deficiency of skeletal muscle relative to fat tissue; evolving definitions should include measure of muscle performance too
Prevalence	• 4%–12% in individuals aged >60 years, depending on the defining cutoffs used [72]
Health consequences	• Mobility limitations [70] • Reduced quality of life [75] • Risk of mortality [76]
Clinical management	• Weight loss with focus on losing fat but not muscle • Increased dietary protein intake • Resistance training for building muscle and endurance exercise [75]

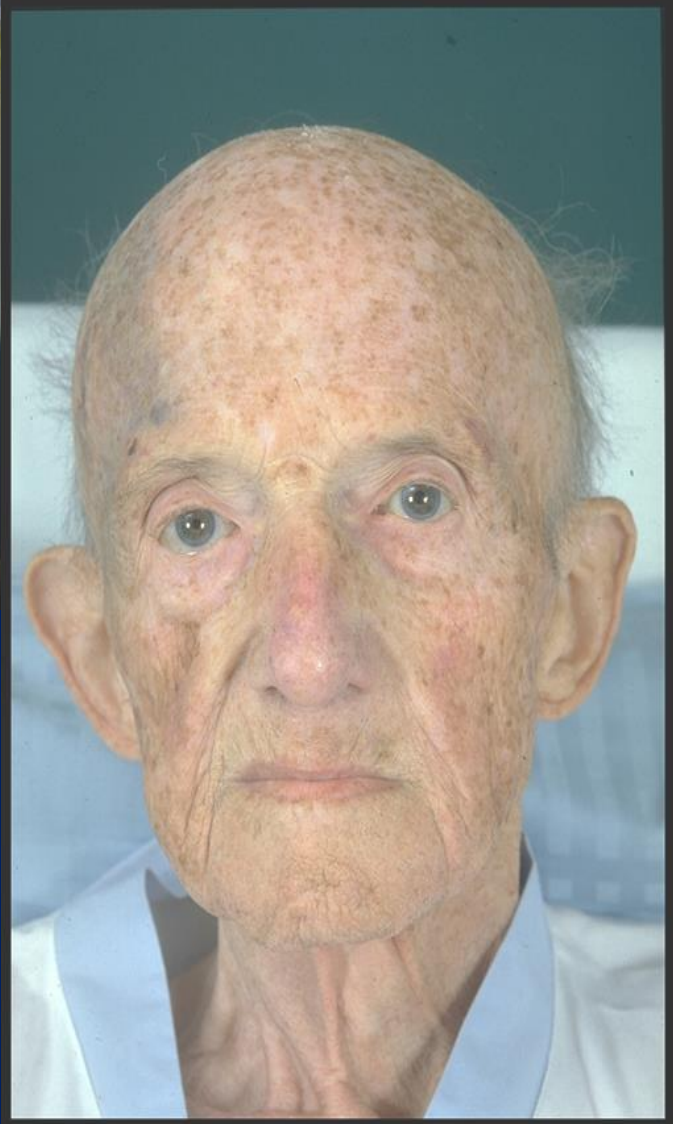

A
B

Inflamm-ageing

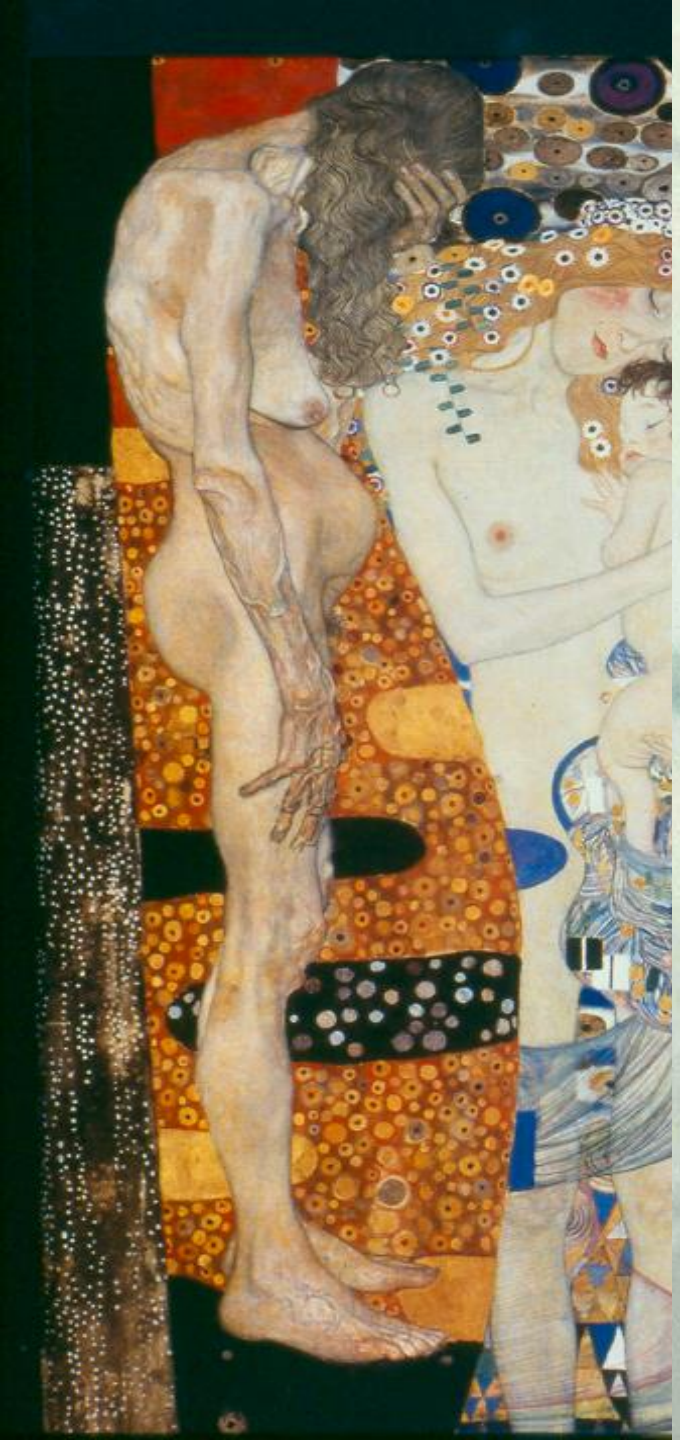
Elisa Cevenini[a,b,*], *Daniela Monti*[c,*], *and Claudio Franceschi*[a,b]

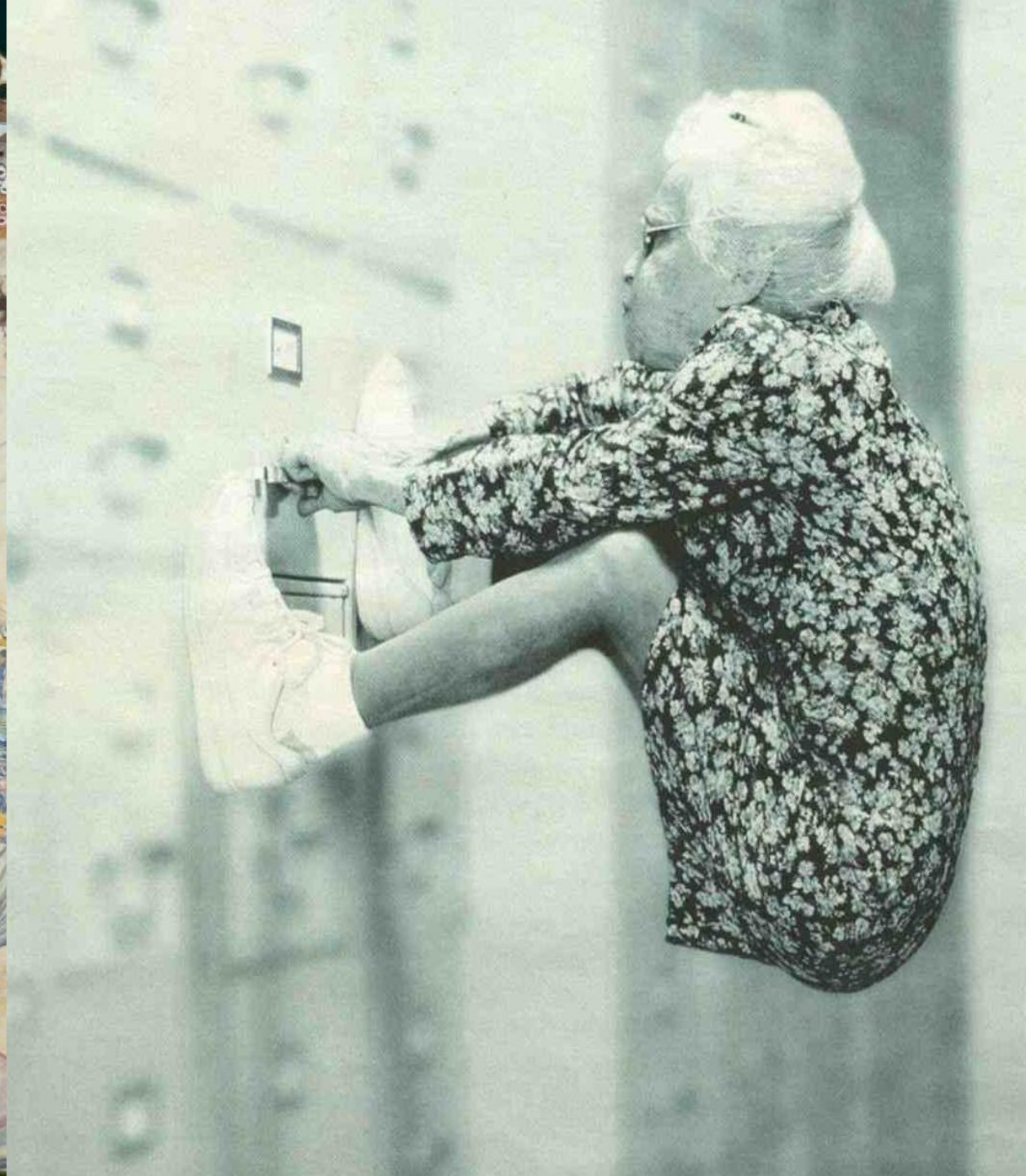


Ageing



Intensity,
chronicity…





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]

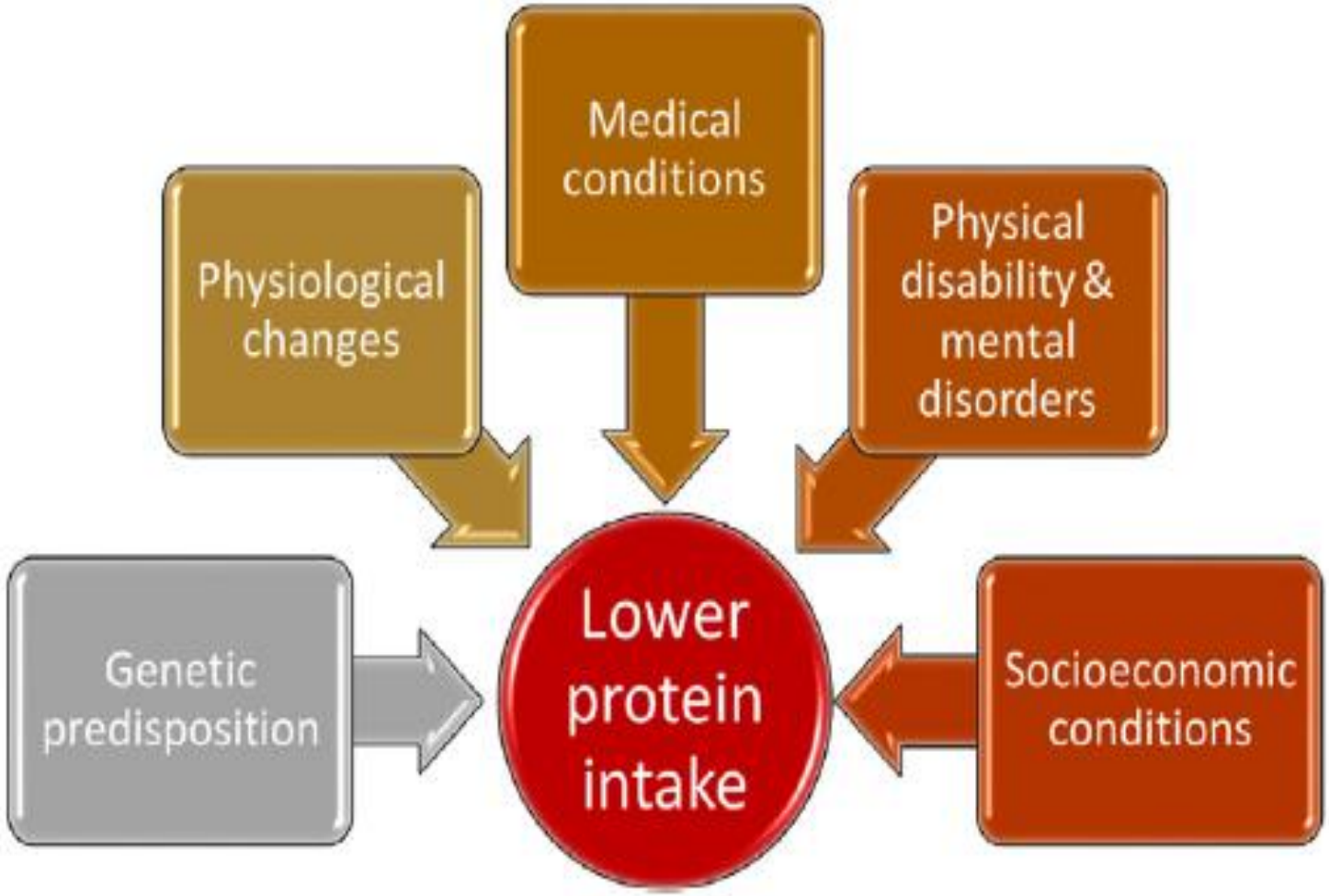


Fig. 1. Protein status: factors leading to lower protein intake in older persons.

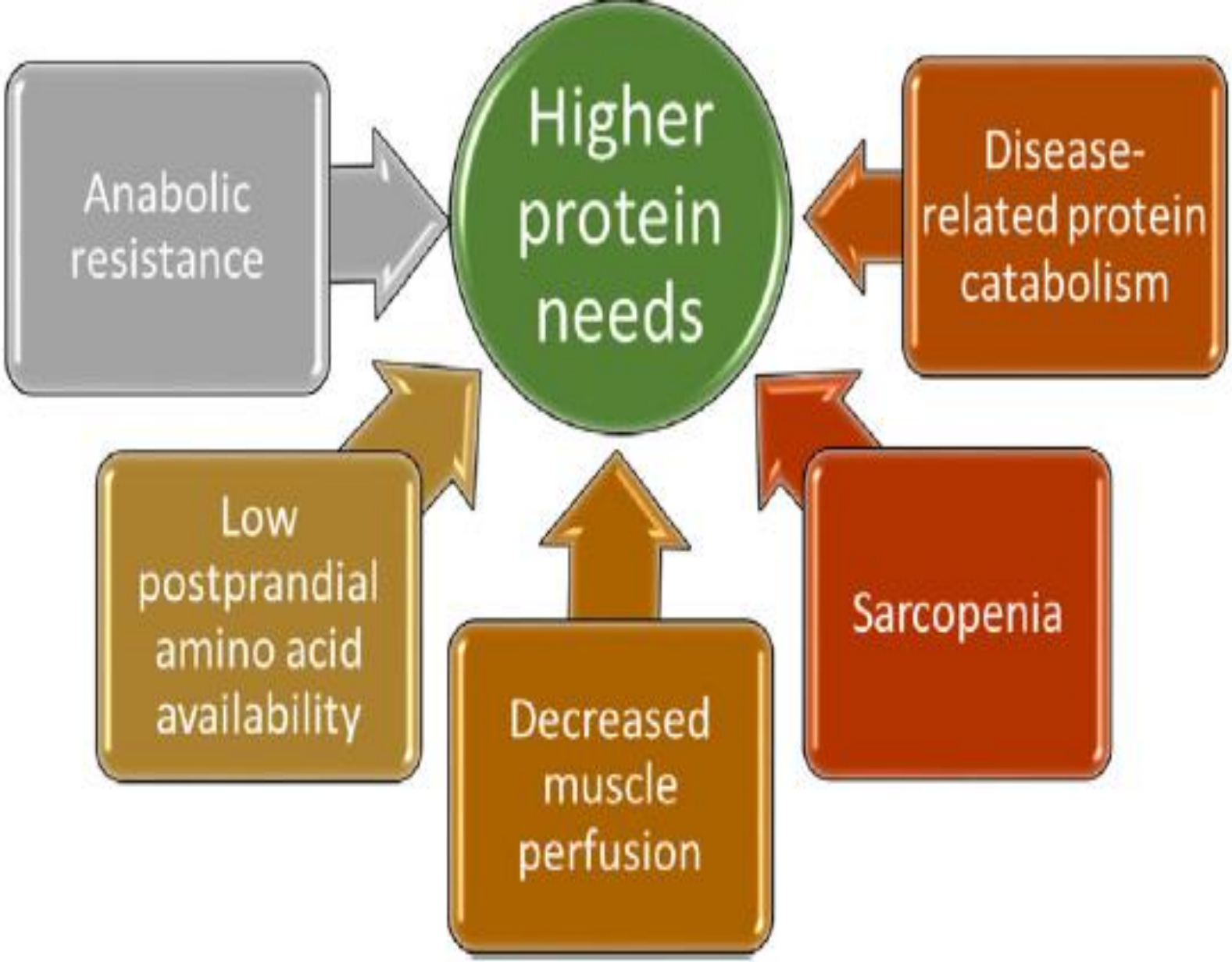
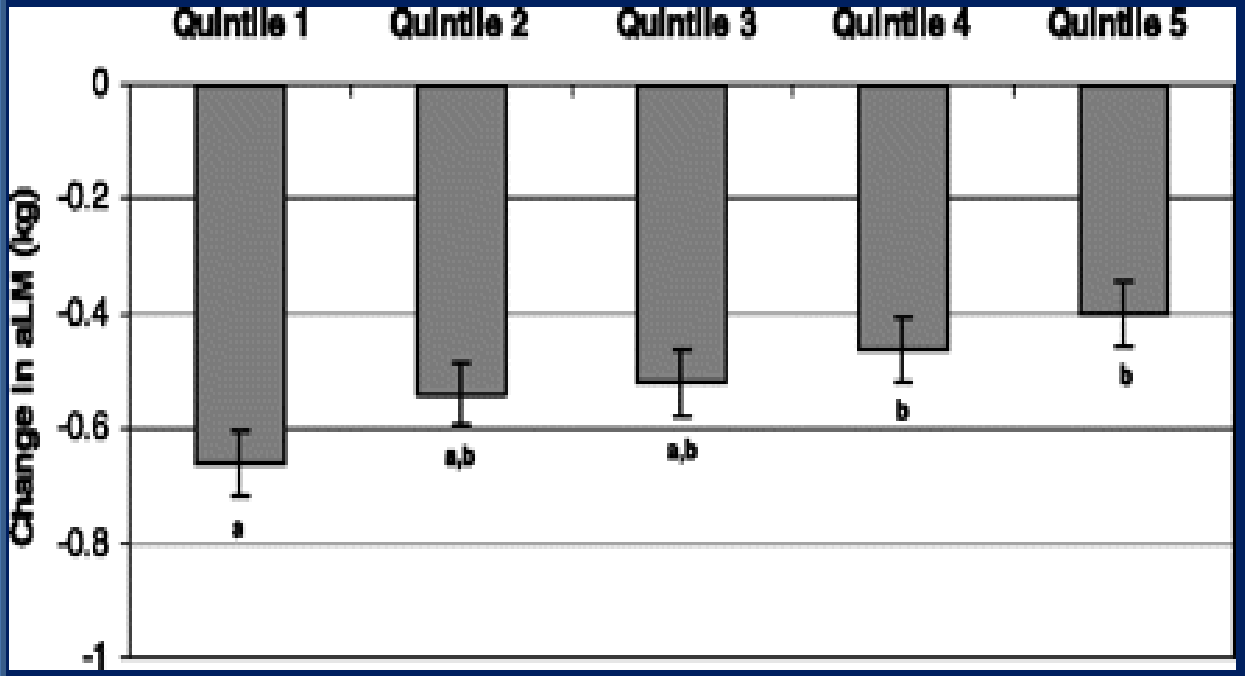


Fig. 2. Protein status: factors leading to higher protein needs in older persons.

Protein intake and change of appendicular muscle mass

- **lower rates of protein synthesis**
- **less able to recover LBM loss** resulting from physical inactivity and/or illness/injury
- **RDA for protein (0.8 g protein/kg/day) seems to be insufficient**



Protein intake of 1.0 to 1.3 g/kg per day

Houston DK et al, Am J Clin Nutr 2008;87:150-155

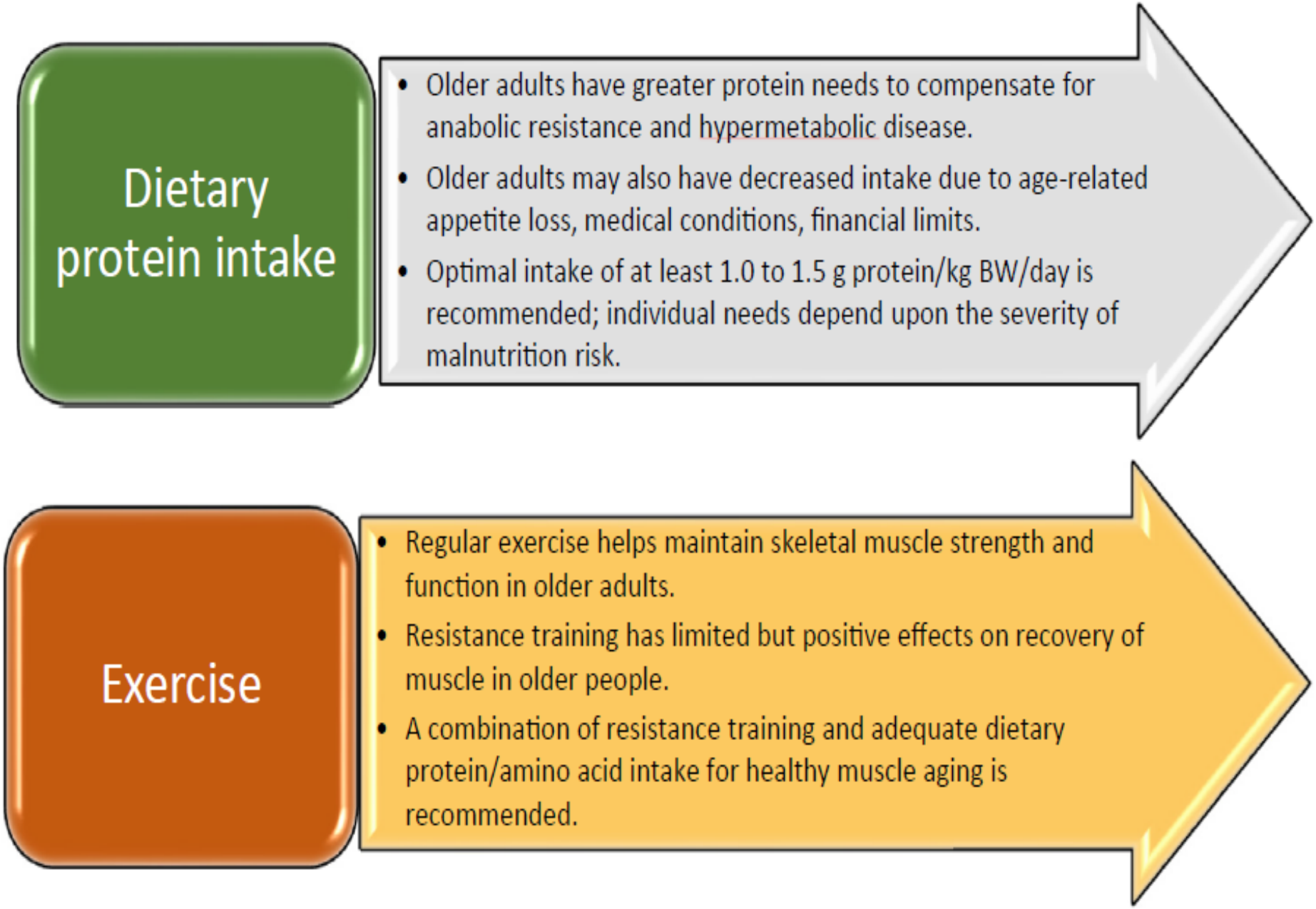
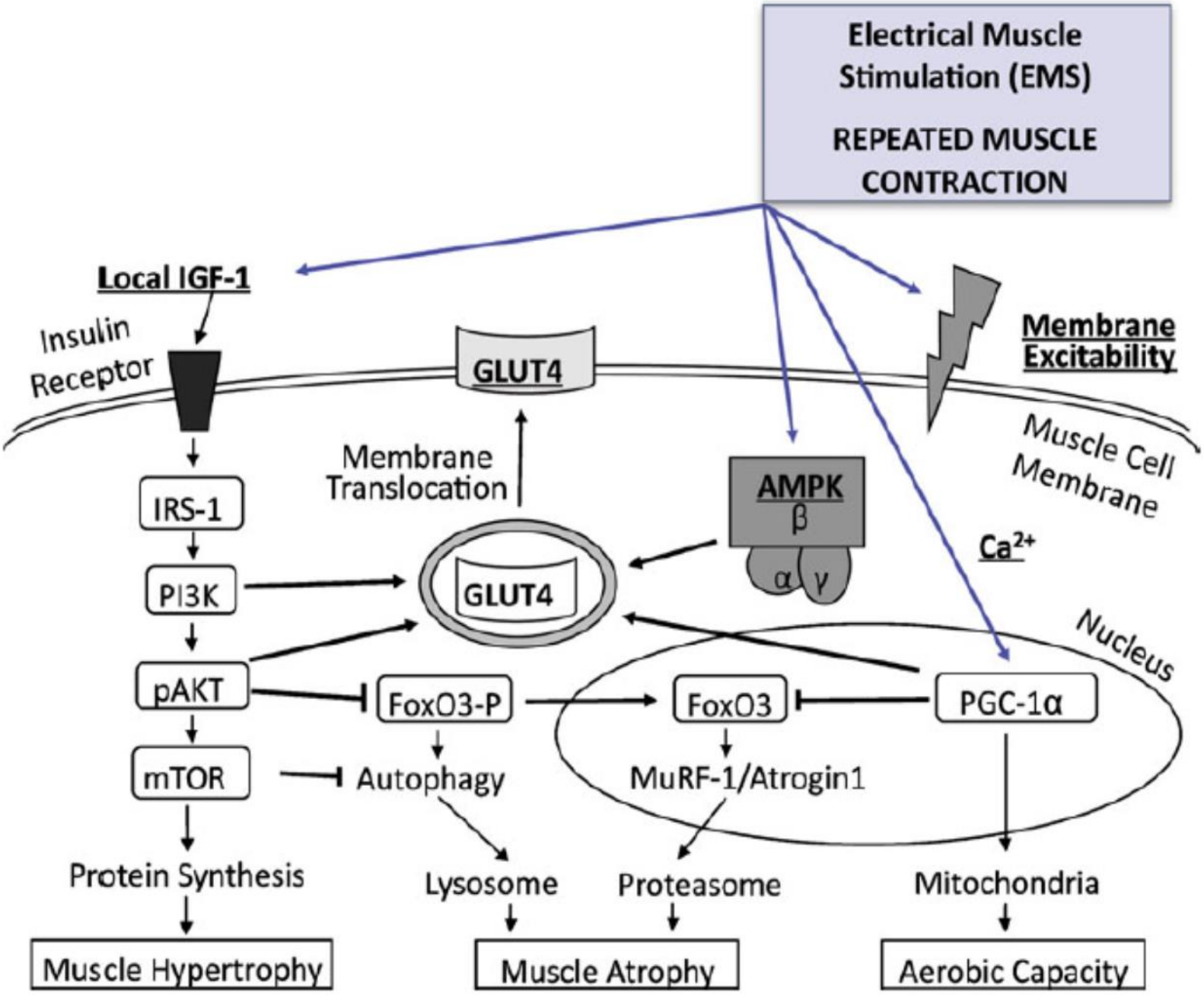


Fig. 3. Recommendations for maintaining healthy muscle with aging.


Electrical Muscle Stimulation (EMS)
REPEATED MUSCLE CONTRACTION
Local IGF-1
Insulin Receptor
GLUT4
Membrane Excitability
Muscle Cell Membrane
Membrane Translocation
IRS-1
AMPK
β
α
γ
Ca2+
PI3K
GLUT4
Nucleus
pAKT
FoxO3-P
FoxO3
PGC-1α
mTOR
Autophagy
MuRF-1/Atrogin1
Protein Synthesis
Lysosome
Proteasome
Mitochondria
Muscle Hypertrophy
Muscle Atrophy
Aerobic Capacity

Effects of Protein Supplementation in Older Adults Undergoing Resistance Training: A Systematic Review and Meta-Analysis

Débora Finger · Fernanda Reistenbach Goltz · Daniel Umpierre · Elisabeth Meyer · Luis Henrique Telles Rosa · Cláudia Dornelles Schneider

Sports Med (2015) 45:245–255

Key Points

Protein supplementation in older people is associated with increases in fat-free mass when compared with control groups undergoing resistance training only.

Protein supplementation in older people is not associated with increases in muscle mass and muscle strength in comparison with the control groups undergoing resistance training only.

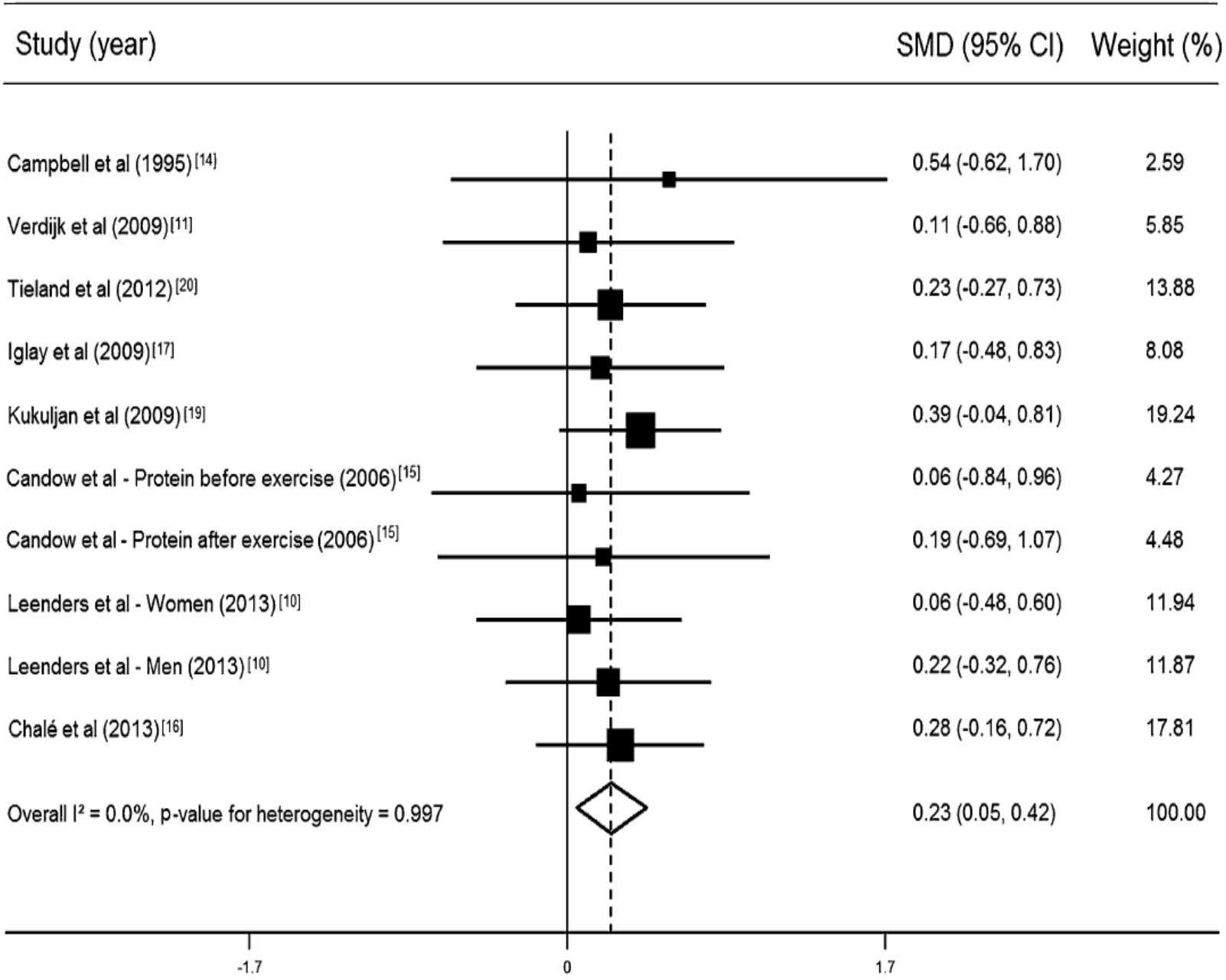

Study (year)
SMD (95% CI)
Weight (%)
Campbell et al (1995)[14]
0.54 (-0.62, 1.70)
2.59
Verdijk et al (2009)[11]
0.11 (-0.66, 0.88)
5.85
Tieland et al (2012)[20]
0.23 (-0.27, 0.73)
13.88
Iglay et al (2009)[17]
0.17 (-0.48, 0.83)
8.08
Kukuljan et al (2009)[19]
0.39 (-0.04, 0.81)
19.24
Candow et al - Protein before exercise (2006)[15]
0.06 (-0.84, 0.96)
4.27
Candow et al - Protein after exercise (2006)[15]
0.19 (-0.69, 1.07)
4.48
Leenders et al - Women (2013)[10]
0.06 (-0.48, 0.60)
11.94
Leenders et al - Men (2013)[10]
0.22 (-0.32, 0.76)
11.87
Chalé et al (2013)[16]
0.28 (-0.16, 0.72)
17.81
Overall I² = 0.0%, p-value for heterogeneity = 0.997
0.23 (0.05, 0.42)
100.00
-1.7
0
1.7

Table 2. Resistance Training Recommendations for Healthy Older Adults

Exercises	Frequency	Volume	Intensity	Precautions
Include at least 8 exercises designed to stimulate all major muscle groups. Use free weights or exercise machines. Chest • front press Back • pulldown • row Shoulders • overhead press Arms • extension • flexion (curl)	Exercise 3 nonconsecutive days/wk to achieve muscle hypertrophy. *Although some benefits will accrue with 2 days/wk, 3 days/wk is preferable.* Allow at least 24 hours rest between training sessions to allow muscle groups to recover.	At least 2–3 sets for each exercise at each training session. Include an additional warm-up set for each exercise, using about 50% of the target weight (load) to be used for subsequent sets.	8–12 repetitions per set using a weight that causes fatigue at the end of each set or that would be described as "somewhat hard" to "very hard" (6–8 on a 10-point scale). Weight (load) should be increased when 10–12 repetitions can be achieved in all sets of an exercise.	To minimize transient increases in blood pressure, patient education should stress the need to avoid the Valsalva maneuver when force is exerted. Breathing patterns should emphasize • exhalation during exertion (pushing with presses and extensions, pulling with pulldowns, rows, flexion, and curls) • inhalation during relaxation (returning to the starting position)

Sarcopenic Obesity: Strategies for Management

Increased protein intake and resistance training can counter muscle loss in older adults.

Conclusions

Table 1

Practical guidance for optimal dietary protein intake and exercise for older adults above 65 years.

Recommendations
For healthy older adults, we recommend a diet that includes at least 1.0–1.2 g protein/kg body weight/day.
For certain older adults who have acute or chronic illnesses, 1.2–1.5 g protein/kg body weight/day may be indicated, with even higher intake for individuals with severe illness or injury.
We recommend daily physical activity for all older adults, as long as activity is possible. We also suggest resistance training, when possible, as part of an overall fitness regimen.

ESPEN guideline on clinical nutrition and hydration in geriatrics

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

I.1 How much energy and nutrients should be offered/delivered to older persons?

Recommendation 1

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

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

Conclusions

- Protein and exercise….

But of course good life, good friends and good (mediterranean) diet…