ΔΙΑΤΡΟΦΗ ΚΑΙ ΣΑΡΚΟΠΕΝΙΑ

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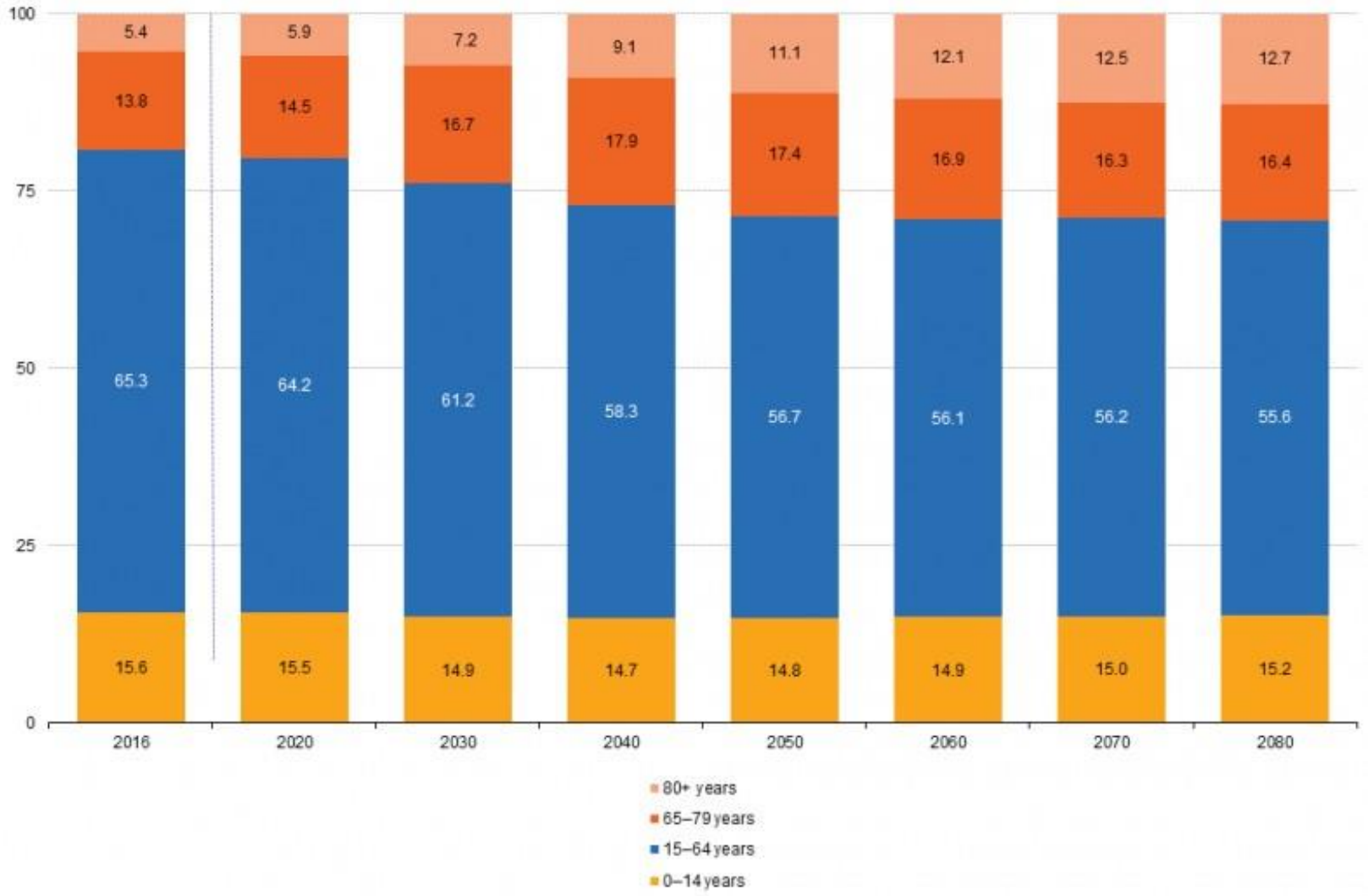
Πληθυσμός Ευρώπης μέχρι το 2080 ανά ηλικία



Note: 2016: estimate, provosional. 2020–80: projections (EUROPOP2015).
Source: Eurostat (online data codes: demo_pjangroup and proj_15ndbims)

Size of this preview: 800 × 591 pixels.

Original file (1,005 × 742 pixels, file size: 34 KB, MIME type: image/png)

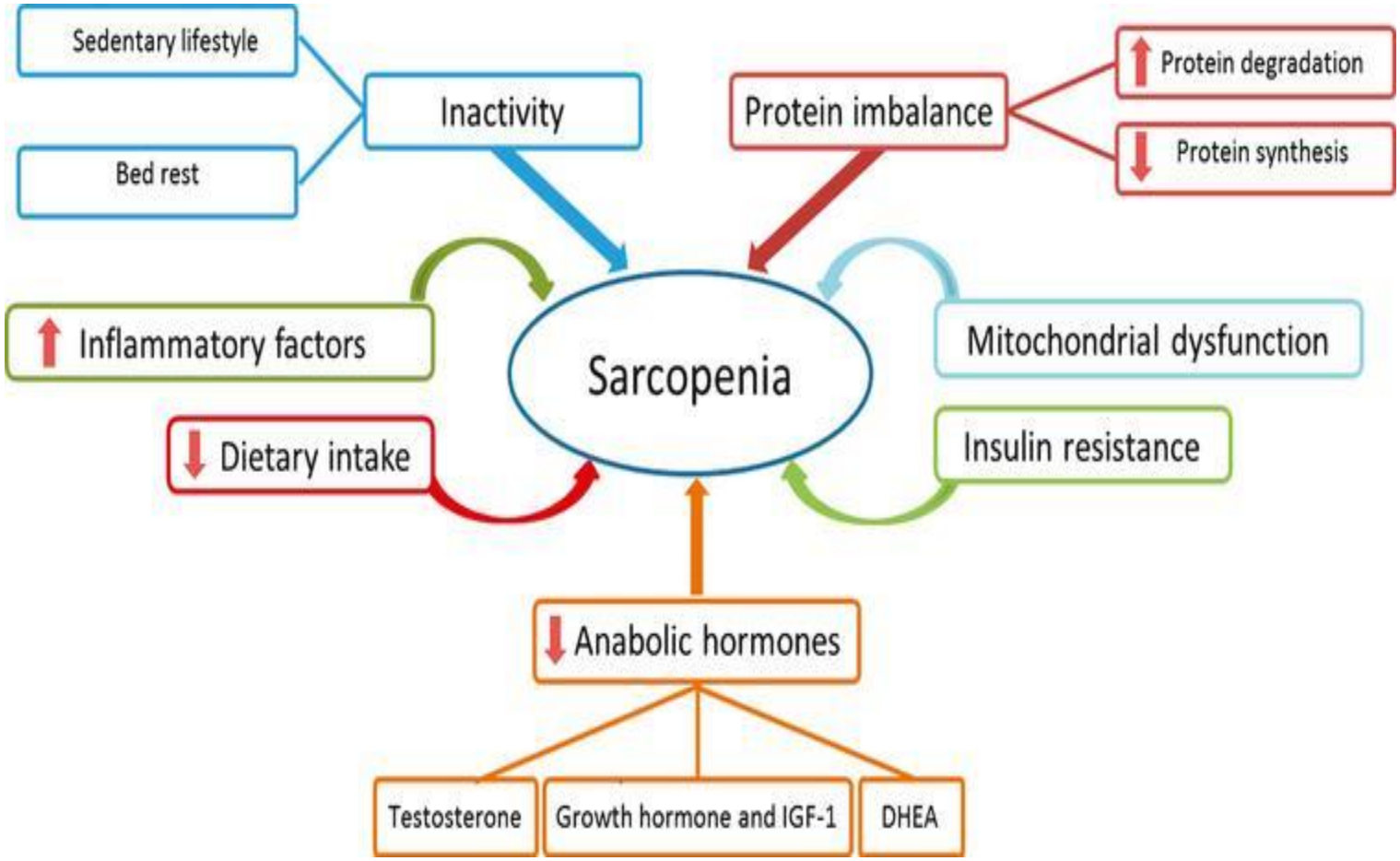
Ολικός πληθυσμός Ευρώπης **742 εκ.**, μέχρι το 2080 το **30%** θα είναι >65 ετών (Eurostat. 2016).

Ευχή ή κατάρα το να ζεις περισσότερο;

Ένα από τα προβλήματα των ανθρώπων που ζουν περισσότερο είναι η **λειτουργική αδυναμία και ανικανότητα**. Η αδυναμία τους αυτή σχετίζεται με μεγαλύτερο κίνδυνο θανάτου και υποβαθμισμένη ποιότητα ζωής, γεγονός που μπορεί να τους οδηγήσει σε κάποιο κέντρο αποκατάστασης.

(Batsis et al., 2015)

Ο Irwin Rosenberg ήταν ο πρώτος που χρησιμοποίησε τον όρο σαρκοπενία (1989) για να χαρακτηρίσει τη συνδεόμενη με το γήρας μείωση της σκελετικής μάζας.



(Farshidfar et al., 2015)

Αλλαγές στο μυϊκό σύστημα

- Ο ρυθμός απώλειας της μυϊκής μάζας αγγίζει το **6%** ανά δεκαετία, μετά την ηλικία των 50 ετών. Το **30%** της μυϊκής μάζας χάνεται περί τα 80 έτη.
- Επίσης κατά τη γήρανση σημειώνεται ραγδαία μείωση των μυϊκών ινών **τύπου ΙΙ**, υπεύθυνων για την δύναμη και εκρηκτικότητα.

(Kyung Mook Choi 2016; McLeod et al., 2016)

Επιδημιολογία

- Μια μελέτη του FNIH (Foundation for the National Institutes of Health), όπου συμμετείχαν πάνω από 4.900 ασθενείς ηλικίας ≥60 ετών, έδειξε ότι η μέση ηλικία των ασθενών με σαρκοπενία ήταν 70,5 έτη για τους άνδρες και 71,6 έτη για τις γυναίκες.
- Τα ποσοστά εμφάνισης της σαρκοπενίας ποικίλλουν σημαντικά εξαιτίας διαφορετικών ορισμών, εργαλείων διάγνωσης και πληθυσμών ασθενών (1-29% άνω των 60 ετών).

(Marty et al., 2017; Bermúdez et al., 2017)

Μέθοδοι-Κριτήρια διάγνωσης

Table 1. Methods for measurement of muscle mass, muscle strength, and physical performance

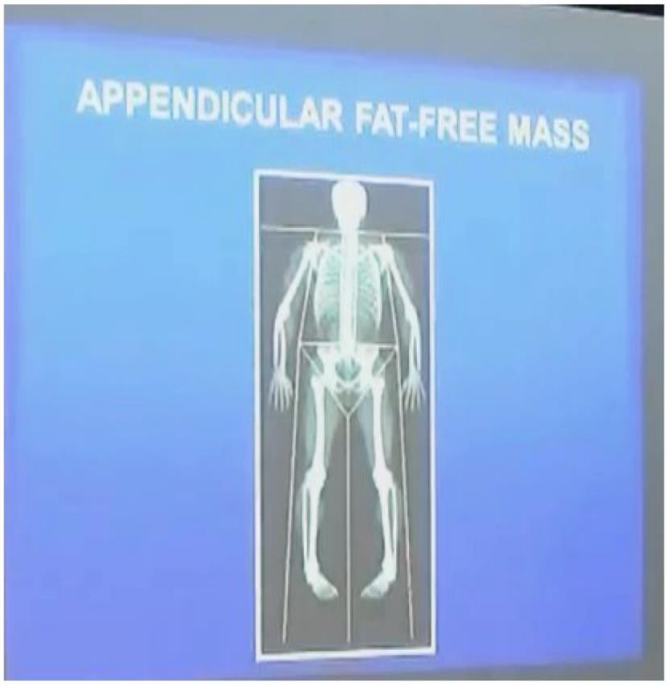
Muscle mass	Muscle strength	Physical performance
Anthropometry	Handgrip strength	Short physical performance battery
Computed tomography	Knee flexion/extension	Usual gait speed
Magnetic resonance imaging		Timed get-up-and-go test
Dual energy X-ray absorptiometry		
Bioimpedance analysis		

(Kyung Mook Choi, 2016)

Time Up and Go test Performance
Short Physical Battery Test
(gait speed, balance, repeated chair stands)
Usual gait speed

Ορισμός

- Το FNIH ορίζει τη σαρκοπενία ως ταυτόχρονη μείωση της μυϊκής μάζας με τη χρήση του πηλίκου ALM (appendicular lean mass) προς το BMI (Body mass Index) με τιμές <0,789 για τους άνδρες και <0,512 για τις γυναίκες και τη μείωση της δύναμης, με τιμές δύναμης χειρολαβής <30 kg για άντρες και <20 kg για γυναίκες (Studenski et al, 2014).



Age and Ageing 2010; **39:** 412–423

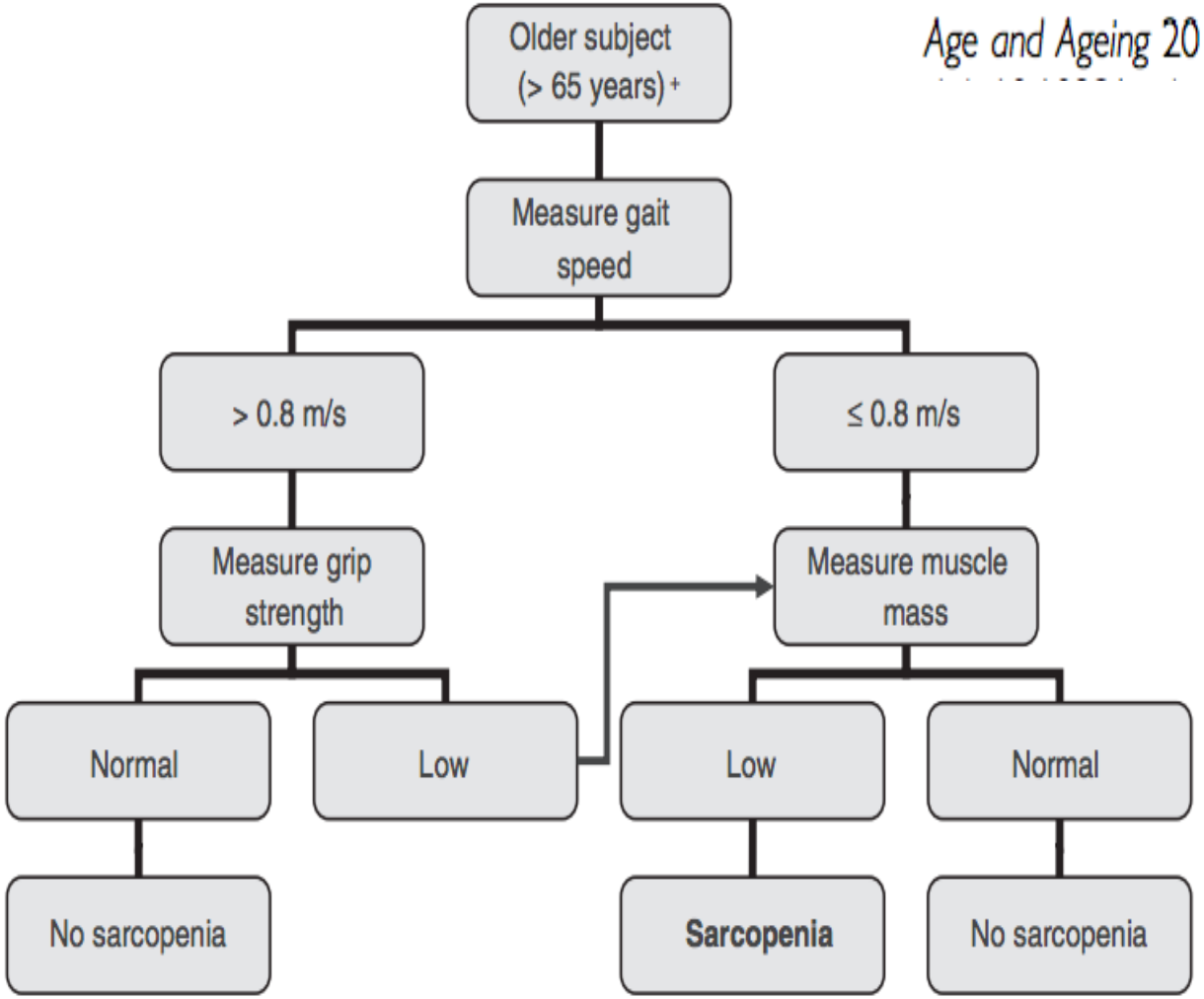


Figure 2. EWGSOP-suggested algorithm for sarcopenia case finding in older individuals.

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Medical Sciences
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doi:10.1093/gerona/glv129
Advance Access publication September 2, 2015

OXFORD

Research Article

The Predictive Value of the EWGSOP Definition of Sarcopenia: Results From the InCHIANTI Study

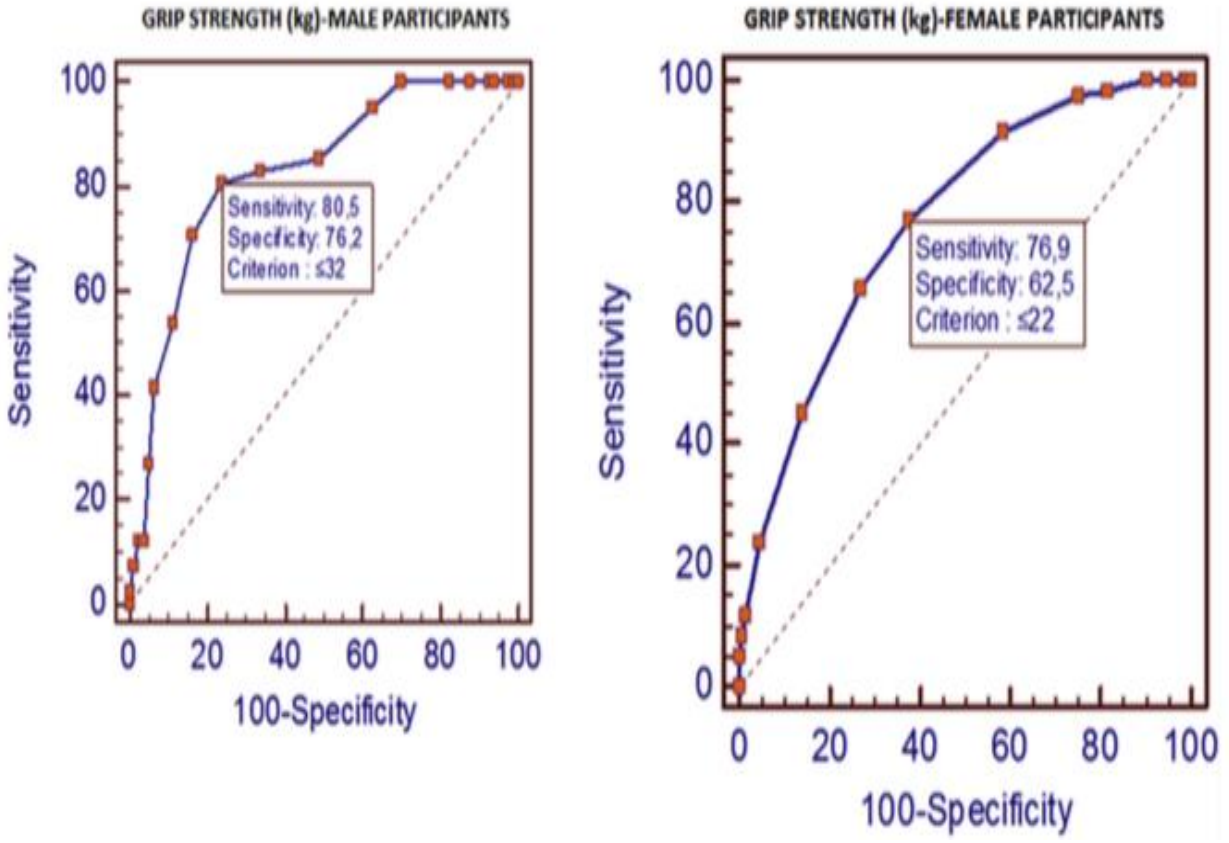
Lara Bianchi,[1] Luigi Ferrucci,[2] Antonio Cherubini,[3] Marcello Maggio,[4] Stefania Bandinelli,[5] Elisabetta Savino,[1] Gloria Brombo,[1] Giovanni Zuliani,[1] Jack M. Guralnik,[6] Francesco Landi,[7] and Stefano Volpato[1,8]

In summary, in our sample of Italian community-dwelling older adults, the EWGSOP phenotype is a good predictor of incident disability, hospitalization, and death. Assessment of only muscle weakness, in addition to low muscle mass, provided similar predictive value as compared with the original algorithm, suggesting that walking speed assessment might not be essential for sarcopenia definition.

Table 5
Thresholds for low hand grip strength in different studies.

	Turkey M/F	USA[a] [18] (Cardiovascular Health Study) M/F	Italy[b] (InCHIANTI) [5] M/F	Japan[c] (Obu) [19] M/F
n	123/283	2240/3077	469/561	1848/1962
Age (years)	77.5 ± 6.2/76.2 ± 6.8	Range: 65–101	Range: 20–102 [77.1 (*SD* 5.5)]	71.2 ± 4.9
HGS (kg)	32/22	29–32*/17–21**	30/20	28.8/18.2

M: male, F: female.
HGS: hand grip strength.



(Bahat et al., 2016)

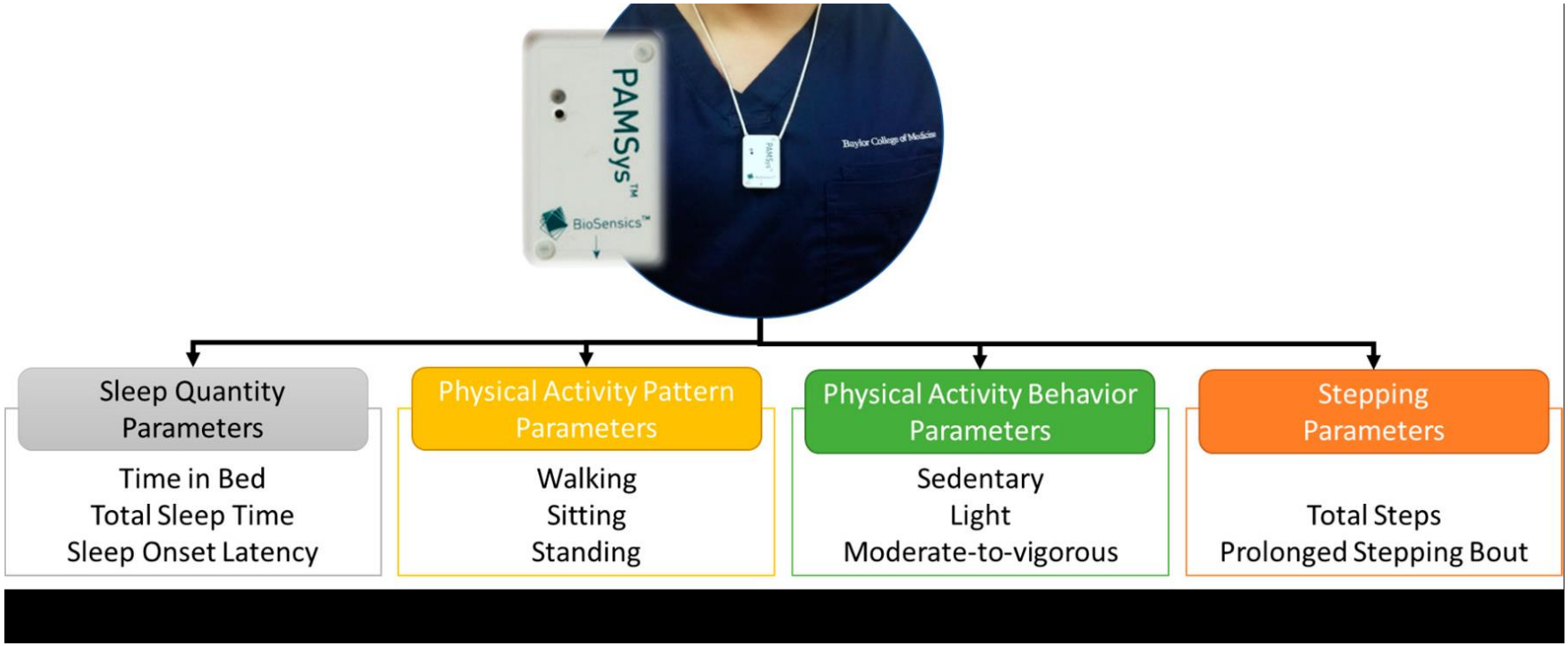
Fig. 1. Figure of ROC analysis results of grip strength for predicting usual gait speed (UGS) < 0.8 m/s indicating the grip strength value of ideal highest sensitivity and specificity in (a) males and (b) females.

Table 3. Recommendation for the diagnostic criteria and cut-points for sarcopenia.

Population	Physical function (gait speed)		Muscle strength (handgrip strength)		Muscle mass (DXA ALM/height^2)
Asian	Men: ≤0.8 m/s	Or	Men: <26 kg	And	Men: ≤7.00 kg/m^2
	Women: ≤0.8 m/s		Women: <18 kg		Women: ≤5.40 kg/m^2
Caucasian	Men: ≤0.8 m/s	Or	Men: <30 kg	And	Men: ≤7.23 kg/m^2
	Women: ≤0.8 m/s		Women: <20 kg		Women: ≤5.67 kg/m^2

ALM: Appendicular lean mass; DXA: Dual energy x-ray absorptiometry.

Lee D, Shook R, Drenowatz C, Blair S (2016). *Future Sci. OA* 2(3), FSO127



This study demonstrates that a pendant sensor can identify pre-frailty via daily home monitoring.

(Razjouyan et al., 2018)

Επίδραση της σαρκοπενίας

Η σαρκοπενία έχει αρνητική επίδραση στην ποιότητα ζωής των ασθενών και συχνά οδηγεί σε:

- Μείωση στις καθημερινές δραστηριότητες και τη λειτουργικότητα
- Αργή επούλωση πληγών
- Μειωμένη ανάρρωση από χειρουργεία και τραυματισμούς
- Αυξημένο κίνδυνο ασθενειών και λοιμώξεων
- Αυξημένες μέρες νοσηλείας
- Αυξημένη θνησιμότητα

(Demling et al., 2009; Wolfe, 2006; Pitchard et al., 2004)

Bone 105 (2017) 276–286

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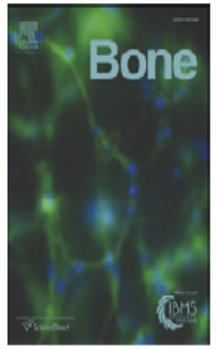
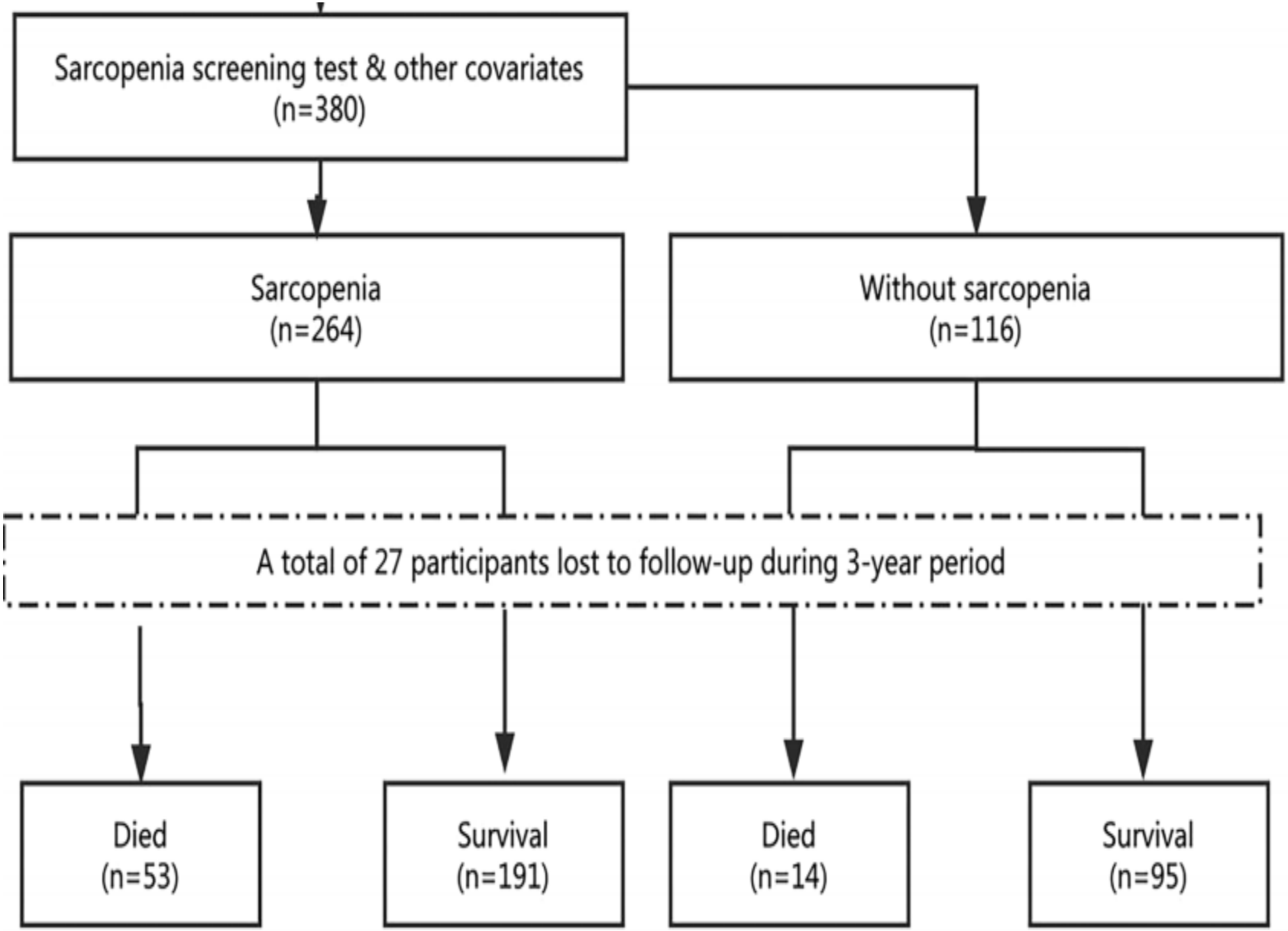


Review Article

A review of sarcopenia: Enhancing awareness of an increasingly prevalent disease

Eric Marty, Yi Liu, Andre Samuel, Omer Or, Joseph Lane *

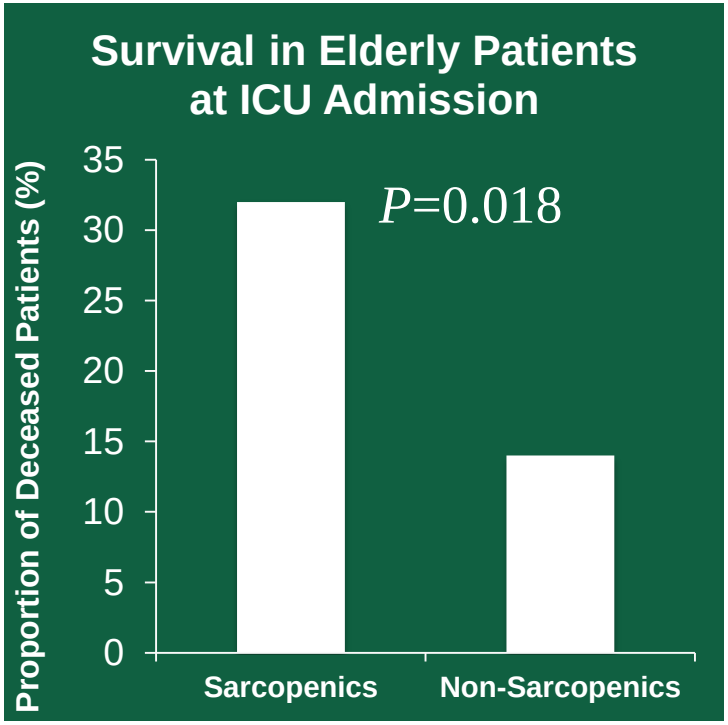
Department of Orthopedic Surgery, Hospital for Special Surgery, New York, NY 10021, United States


Sarcopenia screening test & other covariates
(n=380)
Sarcopenia
(n=264)
Without sarcopenia
(n=116)
A total of 27 participants lost to follow-up during 3-year period
Died
(n=53)
Survival
(n=191)
Died
(n=14)
Survival
(n=95)

Characteristic	No sarcopenia (n = 116)	Sarcopenia (n = 264)	p
Age (years)	79.7 ± 7.2	81.3 ± 6.9	0.535
Women	35 (30.2)	65 (24.6)	0.258
Current smokers	17 (14.7)	32 (12.1)	0.497
Current alcohol drinkers	19 (16.4)	27 (10.2)	0.090
Comorbidities			
Hypertension	70 (60.3)	155 (58.7)	0.766
Ischemic heart disease	44 (37.9)	79 (29.9)	0.124
COPD	25 (21.6)	94 (35.6)	0.007
Diabetes	35 (30.5)	69 (26.1)	0.416
Stroke	2 (1.7)	23 (8.7)	0.011
CKD	15 (12.9)	38 (14.4)	0.705
Acute infection	40 (34.5)	75 (28.4)	0.235
Osteoarthritis	25 (21.6)	78 (29.5)	0.106
Tumor of any type	8 (6.9)	34 (12.9)	0.087
GI disease	20 (17.2)	53 (20.1)	0.518
Liver disease	12 (10.3)	19 (7.2)	0.302

Characteristic	No sarcopenia (n = 116)	Sarcopenia (n = 264)	p
Falls in the previous year	9 (7.8)	37 (14.0)	0.085
Urinary incontinence	12 (10.3)	36 (13.6)	0.374
Chronic pain	35 (30.2)	84 (31.8)	0.750
Malnutrition	8 (6.9)	32 (12.1)	<0.001
Polypharmacy*	35 (43.2)	93 (48.4)	0.429
Cognitive impairment*	17 (21.0)	79 (41.1)	0.001
Depression*	18 (22.2)	50 (26.0)	0.505
BMI (kg/m^2)			
Women	23.9 ± 3.6	22.1 ± 4.4	0.048
Men	23.7 ± 3.6	21.7 ± 3.6	<0.001
CC (cm)			
Women	34.4 ± 3.4	30.1 ± 4.0	<0.001
Men	35.5 ± 2.8	31.6 ± 3.5	<0.001
Gait speed (m/s)			
Women	0.8 ± 0.3	0.7 ± 0.2	0.027
Men	0.9 ± 0.5	0.7 ± 0.3	0.002
Handgrip strength (kg)			
Women	21.0 ± 3.8	10.2 ± 5.2	<0.001
Men	30.4 ± 6.4	18.8 ± 6.9	<0.001
Hemoglobin (g/L)	125.1 ± 21.1	121.3 ± 22.8	0.126
Prealbumin (mg/L)	202.0 ± 53.1	192.2 ± 65.7	0.291
1-year mortality	9 (8.3)	28 (11.5)	0.362
2-year mortality	10 (9.2)	43 (17.6)	0.040
3-year mortality	14 (12.8)	53 (21.7)	0.049

Skeletal Muscle is Related to Mortality in Critical Illness



- Presence of sarcopenia associated with decreased ventilator-free days (*P*=0.004) and ICU-free days (0.002)
- BMI, fat and serum albumin were not associated with ventilator- and ICU-free days

(Moisey et al., 2013)

Relationship between Sarcopenia and Frailty

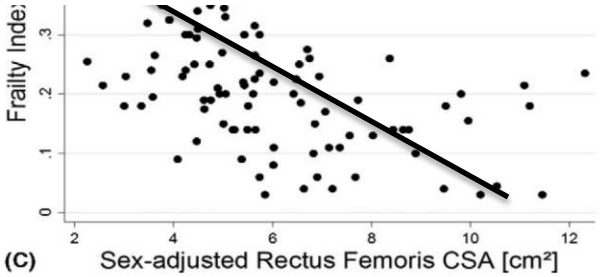


FIGURE 3. Frailty and sarcopenia are associated variables that equally well predict adverse discharge disposition. A, Relationship between sarcopenia and adverse discharge disposition defined as discharge to skilled-nursing facility or in-hospital mortality. B, Relationship between frailty and adverse discharge disposition. C, Scatterplot of frailty index versus cross-sectional area of rectus femoris muscle as measured by ultrasound. A significant correlation was found between the frailty index and sex-adjusted cross-sectional area of rectus femoris muscle (Spearman $r = -0.52$, $P < 0.001$).

(Mueller et al., 2016)

Σύνδεση της σαρκοπενίας με οστεοπόρωση

- Η σχέση μεταξύ οστεοπόρωσης και σαρκοπενίας είναι λογική στο πλαίσιο της υπομονάδας οστού-μυός. Και οι δύο ιστοί προέρχονται από ένα κοινό μεσεγχυματικό προγονικό-βλαστικό κύτταρο. Τα μυϊκά κύτταρα εκκρίνουν κυτοκίνες που ρυθμίζουν τα οστά, ενώ τα οστικά κύτταρα εκκρίνουν τον IGF-1, ο οποίος έχει πιθανές μυο-διεγερτικές ιδιότητες.
- Γενικά υπάρχουν πολλές μελέτες που να αποδεικνύουν τη σχέση αυτή.

(Marty et al., 2017)

Σαρκοπενία στο μέλλον…

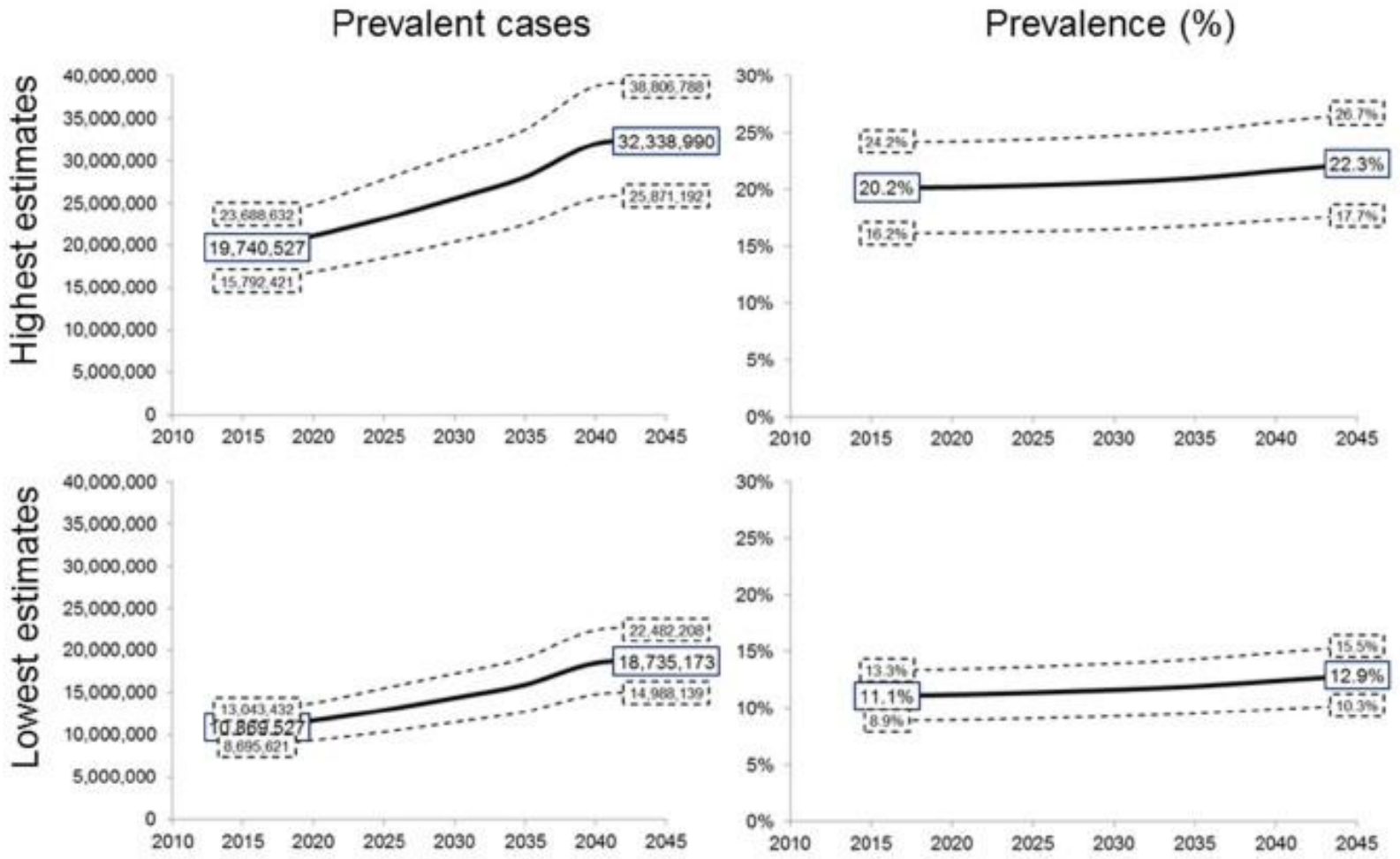


Fig. 3 Projected prevalence of sarcopenia in Europe from 2016 to 2045 according to the highest and the lowest definition variants (*dotted boxes* and *lines* represent the ±20% sensitivity analyses)

(Ethgen et al., 2017)

Διαιτητική αντιμετώπιση

- Ρόλος της πρωτεΐνης και άλλων θρεπτικών συστατικών

ESPEN endorsed recommendation

Clinical Nutrition, 2014

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]

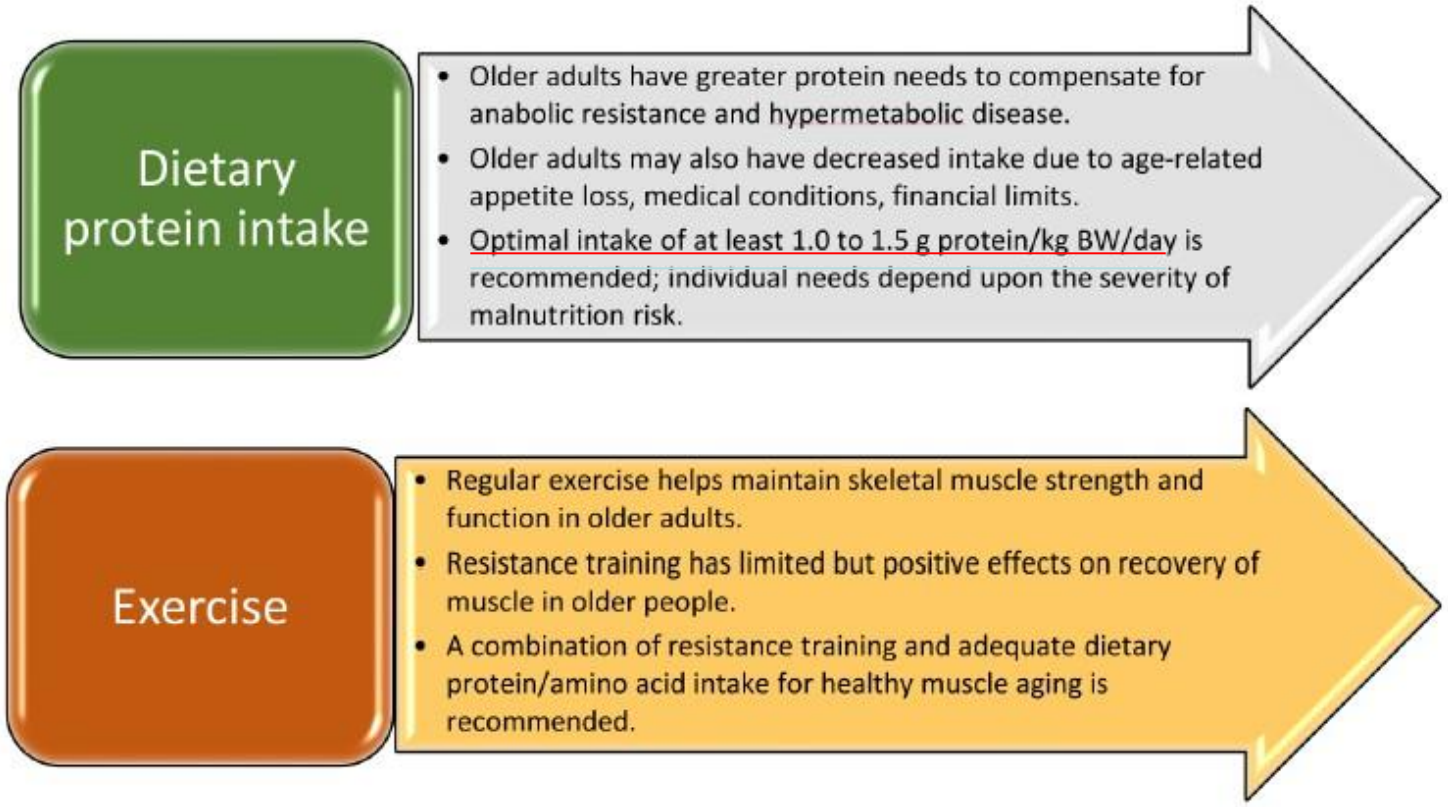


Figure 3.
Recommendations for maintaining healthy muscle with aging

- 25-30g πρωτεΐνης ανά γεύμα

Protein Intake and Muscle Function in Older Adults

Rachel R. Deer[1] and Elena Volpi[1,] Curr Opin Clin Nutr Metab Care, 2015

1 γυναίκα στις 5 & 1 άνδρας στους 10 καταναλώνουν <0,66g πρωτ./Kg ΣΒ

. These studies are supported by recent consensus reports that concluded that the current protein recommendation for older adults is too low and that older adults should consume 1.0–1.2 g/kg BW/day (25–28) for optimal health.

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

Clinical Nutrition 37 (2018) 551–557

Sjors Verlaan [a, b, *], Andrea B. Maier [c, d], Jürgen M. Bauer [e], Ivan Bautmans [f], Kirsten Brandt [g], Lorenzo M. Donini [h], Marcello Maggio [i], Marion E.T. McMurdo [j], Tony Mets [f], Chris Seal [g], Sander L.J. Wijers [a], Cornel Sieber [k], Yves Boirie [l, m], Tommy Cederholm [n]

Methods and design: Post-hoc analysis was performed in the PROVIDE study that was a randomized controlled, double blind trial among 380 sarcopenic older adults. This study showed that those who received a vitamin D and leucine-enriched whey protein medical nutrition drink for 13 weeks gained more appendicular muscle mass (aMM), and improved lower-extremity function as assessed by the chair stand test compared with controls. To define low and high groups, a baseline serum concentration of 50 nmol/L 25(OH)D and baseline dietary protein intake of 1.0 g/kg/d were used as cut offs.

Results: At baseline, participants with lower 25(OH)D concentrations showed lower muscle mass, strength and function compared with participants with a high 25(OH)D, while the group with lower protein intake (g/kg/day) had more muscle mass at baseline compared with the participants with higher protein intake. Participants with higher baseline 25(OH)D concentrations and dietary protein intake had, independent of other determinants, greater gain in appendicular muscle mass, skeletal muscle index (aMM/h^2), and relative appendicular muscle mass (aMM/body weight × 100%) in response to the nutritional intervention. There was no effect modification of baseline 25(OH)D status or protein intake on change in chair-stand test.

Conclusions: Sufficient baseline levels of 25(OH)D and protein intake may be required to increase muscle mass as a result of intervention with a vitamin D and protein supplement in sarcopenic older adults. This suggests that current cut-offs in the recommendations for vitamin D and protein intake could be considered the "minimum" for adults with sarcopenia to respond adequately to nutrition strategies aimed at attenuating muscle loss.

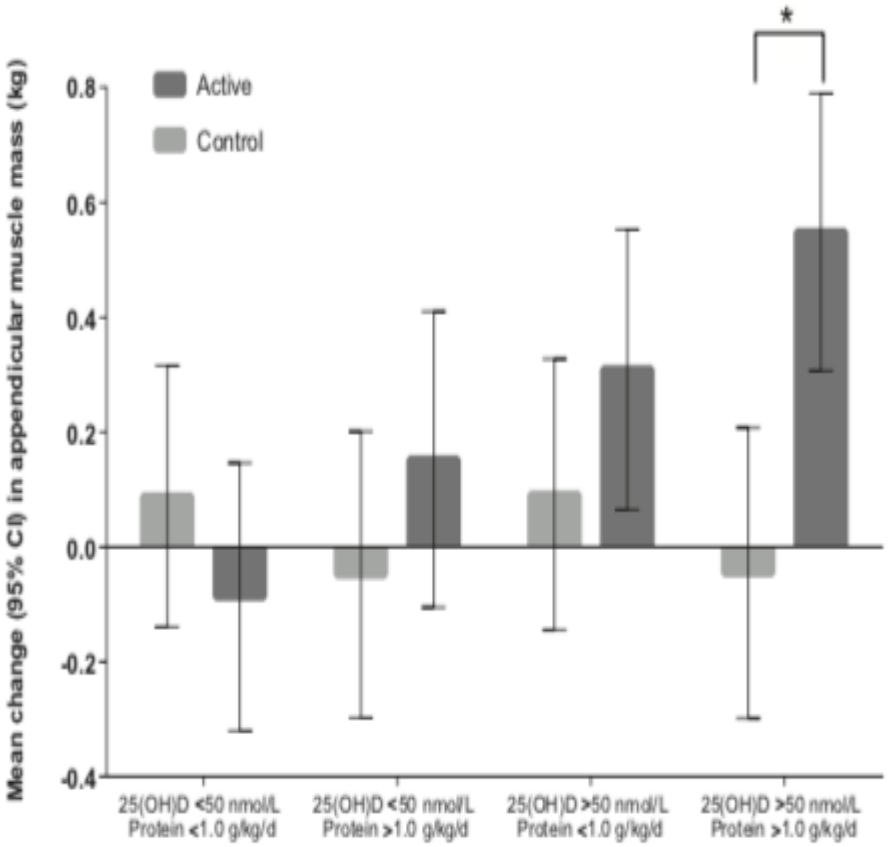


Fig. 1. Effect modification by combined baseline 25(OH)D and baseline protein intake subgroups on mean change (95% CI) in appendicular muscle mass (kg) between active and control in four subgroups (<50 nmol/L 25(OH)D, <1.0 g/kg/d protein, active n = 37 and control n = 37; <50 nmol/L 25(OH)D, ≥1.0 g/kg/d protein, n = 26 and n = 31; ≥50 nmol/L 25(OH)D, <1.0 g/kg/d protein, n = 28 and n = 32; ≥50 nmol/L 25(OH)D, ≥1.0 g/k/d, n = 27 and n = 28).

Nutrition and sarcopenia: A review of the evidence of nutritional influences

Behnaz Abiri & Mohammadreza Vafa

Dec 2017
CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION

Table 1. Results from studies of relationships between macronutrient intakes and sarcopenia outcomes.

First Author (Reference No)	Nutrient(s) Investigated	Intervention or Exposure	Time	Result
Dillon (Dillon, 2013)	Protein	Randomized to daily dose of 15 g essential amino acid (EAA) (n = 7) or placebo (n = 7) in older women (68 ± 2 y).	For 3 months	EAA ameliorated lean body mass (LMB) and basal protein synthesis in older individuals. The acute anabolic response to EAA supplementation is kept over time and can ameliorate LBM.
Vafa (Vafa et al., 2017)	Protein	Among 190 women aged 40–60 yr, data including of muscle strength and function, anthropometric indices, dietary intakes, and physical activity were assessed.	Aged 40–60 y Throughout postmenopause period	There was a positive association between protein intake and fat free mass percentage, but there was not a significant association between protein intake and other variables.
Houston (Houston et al., 2008)	Protein	Dietary protein intake and changes in lean mass (LM) and appendicular lean mass (aLM) were evaluated in 2066 men and women aged 70–79 y who were participating in the Health, Aging, and Body Composition study.	Between 1997–1988	Protein intake was related to 3-y alterations in LM and aLM. Participants in the highest quintile of protein intake lost 40% less LM and aLM than did those in the lowest quintile of protein intake.
Børsheim (Børsheim et al., 2008)	Protein	Twelve glucose intolerant men (n = 5) and women (n = 7) (67 ± 5.6 y) consumed 11 g essential amino acid+arginine two times a day, between meals.	For 16 weeks	Lean body mass and the lower extremity strength score elevated during the study. Advances were also observed in usual gait speed, timed 5-step test, and timed floor-transfer test.
Stinick (Sitnick, Bodine, and Rutledge, 2009)	Fat	Male C57BL/6 mice (n = 120) were randomized into two diet groups: a low fat, high carbohydrate diet and a high fat, low carbohydrate diet. Each diet group were divided into two groups: sedentary or functional overload of the plantaris muscle.	At 5 weeks old For 14 weeks	High fat diet damages the ability of skeletal muscle to hypertrophy in response to increased mechanical load.
Welch (Welch, MacGregor, and Minnihane, 2014)	Fat	Body composition (fat free mass (FFM; in kg) and the fat free mass index (FFMI; kg FFM/m^2) was assessed in 2689 women aged 18–79 y and then figured according to quintile of dietary fat.	Between 1996–2000	Positive relationships were shown between the polyunsaturated-to-saturated fatty acid ratio and indices of FFM, and inverse relationships were shown with percentage of fat energy, saturated fatty acids, monounsaturated fatty acids, and trans fatty acids.
Smith (Smith et al., 2011)	Fat	Sixteen older adults (≥65 y of age) randomized to daily omega-3 fatty acids or corn oil intake.	8 weeks	Omega-3 fatty acid supplementation enhanced the hyperaminoacidemia-hyperinsulinemia-induced elevate in the rate of muscle protein synthesis, which was coexist with greater enhances in muscle mTOR and p70s6k phosphorylation, but had not impact on the basal rate of muscle protein synthesis. Corn oil had not impact on muscle protein synthesis and anabolic pathways.
Fiaccavento (Fiaccavento et al., 2010)	Fat	δ-sarcoglycan-null dystrophic hamsters were received a diet enriched in omega-3 α-linolenic fatty acid.	From weaning until death	Omega-3 α-linolenic fatty acid modulated the sarcolemma lipid composition and protein pattern, and conserved appropriate morpho-functional quality in dystrophic skeletal muscles.

Table 2. Results from studies of relationships between sarcopenia with micronutrient intakes and dietary acid-base load.

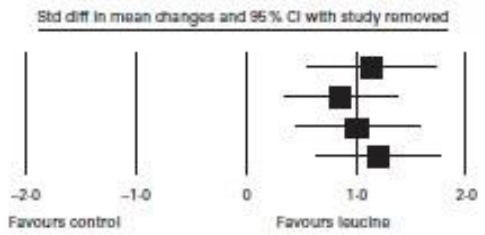
First Author (Reference No)	Nutrient(s) Investigated	Intervention or Exposure	Time	Result
Abiri (Abiri et al., 2016)	Vitamin D	Seventy one women randomized to daily intake of vitamin D (1000 IU) ($n = 37$) or placebo ($n = 34$).	Aged 40–55 y For 3 months	Vitamin D supplementation led to improvement of muscle functions and body composition, but had no significant impact on muscle strength.
Marantes (Marantes et al., 2011)	Vitamin D	Examined the relationship of skeletal muscle mass and strength with each of 25(OH)D, 1,25$(OH)_2$D, and PTH quartiles, in 311 men and 356 women.	Men: mean age, 56 y; range, 23–91 y Women: mean age, 57 y; range, 21–97 y	There was no consistent relationship between 25(OH)D or PTH and any of measurements of muscle mass or strength, in both men and women. But, in those who are younger than 65, there was a positive significant relationship between 1,25$(OH)_2$D levels and skeletal mass in both men and women.
Scott (Scott et al., 2010)	Vitamin D	Appendicular lean mass percentage (%ALM), body fat, leg strength, leg muscle quality (LMQ), physical activity (PA), and serum 25(OH)D were measured in 686 older adults.	62 ± 7 years old Mean follow up of 2.6 ± 0.4 years	Subjects with 25(OH)D $\leq$ 50 nM had lower mean %ALM, leg strength, LMQ and PA.
Visser (Visser, Deeg, and Lips, 2003)	Vitamin D	In men and women of the Longitudinal Aging Study Amsterdam, grip strength ($n = 1080$) and appendicular skeletal muscle mass ($n = 331$) were meseared.	Aged 65 y In 1995–1996 after a 3-yr follow-up	Lower 25(OH)D and higher PTH concentrations increased the risk of sarcopenia in older men and women.
Bartali (Bartali et al., 2008)	Antioxidant micronutrients	Longitudinal survey of 698 community-dwelling persons. Serum micronutrient concentrations and physical function were assessed.	65 y or older Follow up from 2001–2003	Low serum level of vitamin E is related to subsequent decrease in physical function.
Lauretani (Lauretani et al., 2007)	Antioxidant micronutrient (selenium)	Plasma selenium and hip, grip, and knee strength in a cross-sectional survey of 891 men and women from InCHIANTI Study were measured.	65 y or older	Low plasma selenium was related to poor skeletal muscle strength.
Kelaiditi (Kelaiditi et al., 2012)	Antioxidant micronutrients	Nutrient intake and body composition were measured among 2570 women.	Aged 18–79 y	Differences for fat free mass index were significant for vitamin C, magnesium, potassium, and total carotene intakes, but not significant for vitamin E and selenium.
Bobeuf (Bobeuf et al., 2011)	Antioxidant micronutrients (vitamins E/C)	Fifty-seven men and women randomized into four groups: control-placebo; resistance training (RT); vitamins E/C supplementation (AS); AS+RT.	Mean age 65 ± 3.8 y For 6 months	A significant impact on body composition was shown, but no difference was shown on strength gain, in AS+RT.
Dominguez (Dominguez et al., 2006)	Mineral (magnesium)	Muscle performance and serum magnesium were measured in 1138 men and women of InCHIANTI study.	Aged 66.7 ± 15.2 y Between 1998–2000	Serum magnesium levels were significantly related to muscle performance.
Moslehi (Moslehi et al., 2013)	Mineral (magnesium)	Randomized into daily intake of magnesium supplement (250 mg) or placebo.	Aged 40–55 y For 8 weeks	There was significant increase in lean body mass only in the intervention group. Handgrip strength and muscle function ameliorated in the intervention group. There were not significant differences in elevating knee extension strength between two groups at the end of study.
Dawson-Hughes (Dawson-Hughes, Harris, and Ceglia, 2008)	Dietary acid-base load	Potassium in 24-h urine collections, lean body mass percentage, and physical activity were assessed in 384 men and women.	Aged $\geq$ 65 y 3-y trial	Higher consumption of foods rich in potassium may conserve muscle mass.

Ανασκόπηση και Μετα-ανάλυση: Λευκίνη ως συμπλήρωμα προάγει την πρωτεϊνοσύνθεση

(a)

Statistics with study removed

Study name	Comparison	Std diff in mean changes	Lower limit	Upper limit	Z value	P value
Deutz (2011)[25]	Leucine v. control	1·14	0·56	1·72	3·85	0·000
Dillon (2009)[17]	Leucine v. control	0·86	0·35	1·37	3·32	0·001
Ferrando (2010)[16]	Leucine v. control	1·01	0·45	1·56	3·54	0·000
Katsanos (2006)[6]	Leucine v. control	1·20	0·64	1·76	4·18	0·000

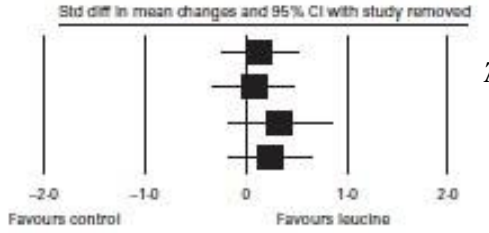


Ρυθμό πρωτεϊνοσύνθεσης

(b)

Statistics with study removed

Study name	Comparison	Std diff in mean changes	Lower limit	Upper limit	Z value	P value
Deutz (2011)[25]	Leucine v. control	1·14	−0·24	0·52	0·73	0·468
Dillon (2009)[17]	Leucine v. control	0·08	−0·31	0·47	0·39	0·697
Ferrando (2010)[16]	Leucine v. control	0·34	−0·16	0·83	1·32	0·186
Katsanos (2006)[6]	Leucine v. control	0·24	−0·17	0·65	1·15	0·251

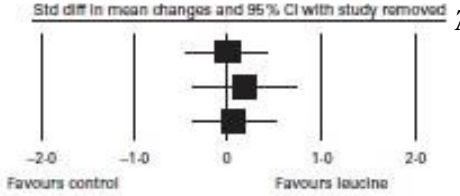


Άλιπη μαζα σώματος

(c)

Statistics with study removed

Study name	Comparison	Std diff in mean changes	Lower limit	Upper limit	Z value	P value
Deutz (2011)[25]	Leucine v. control	−0·01	−0·43	0·41	−0·04	0·969
Dillon (2009)[17]	Leucine v. control	0·19	−0·38	0·74	0·64	0·523
Katsanos (2006)[6]	Leucine v. control	0·06	−0·38	0·51	0·27	0·787

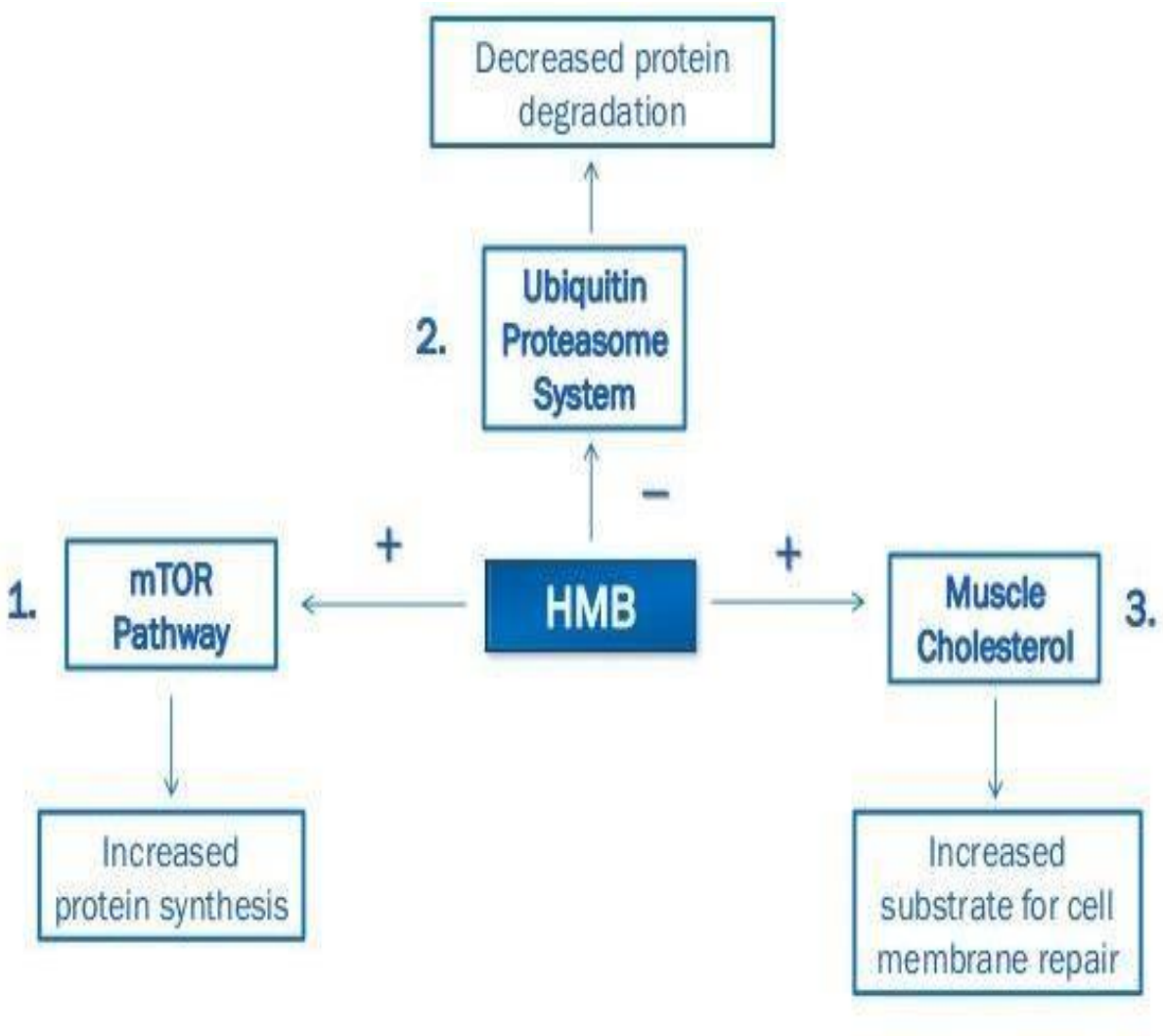


Άλιπη μάζα των ποδιών

Fig. 7. Results of sensitivity analysis for the examination of the influence of individual studies on pooled estimates as determined using the leave-one-out approach: (a) muscle protein fractional synthetic rate; (b) lean body mass; (c) leg lean mass.

(Xu Rong .et al., 2015)

β-hydroxy β-methylbutyrate



Μετα-ανάλυση για την επίδραση της β-υδροξυ-β-μεθυλοβουτυρικό οξύ (HMB) σαν συμπλήρωμα διατροφής. Control n=140, experiment elderly n=147

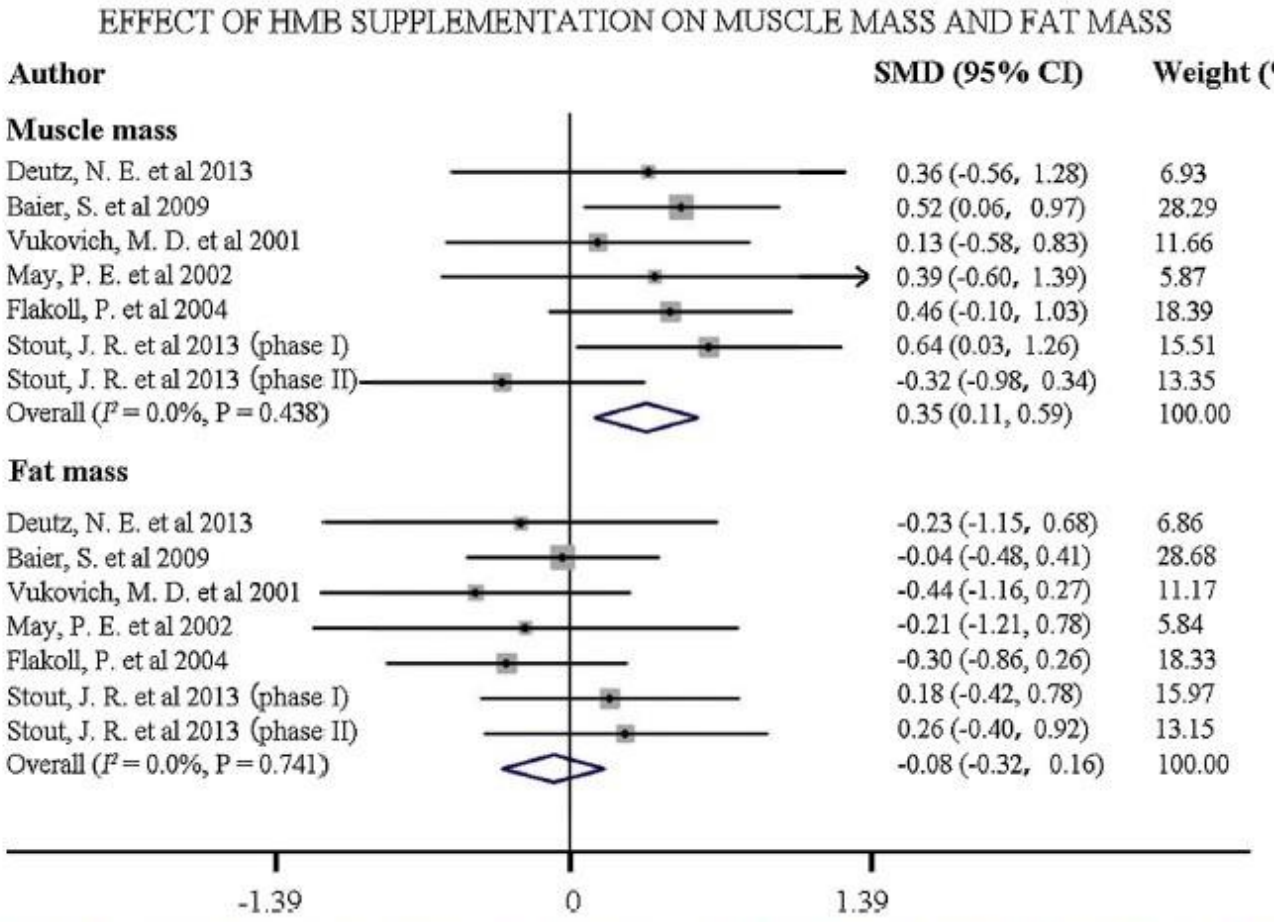


Fig. 3. Forest plot for changes in muscle mass and fat. The horizontal lines represent 95% CI. The diamond data markers indicate the standard mean difference (SMD) of HMB supplementation on muscle mass and fat mass.

(Wu et al., 2015)

Παρεμπόδιση των υποδοχέων της μυοστατίνης μπορεί να ανατρέψει την σαρκοπενία?? Πολλά υποσχόμενη μέθοδος θεραπείας της σαρκοπενίας. Δοκιμασμένη σε ποντίκια.

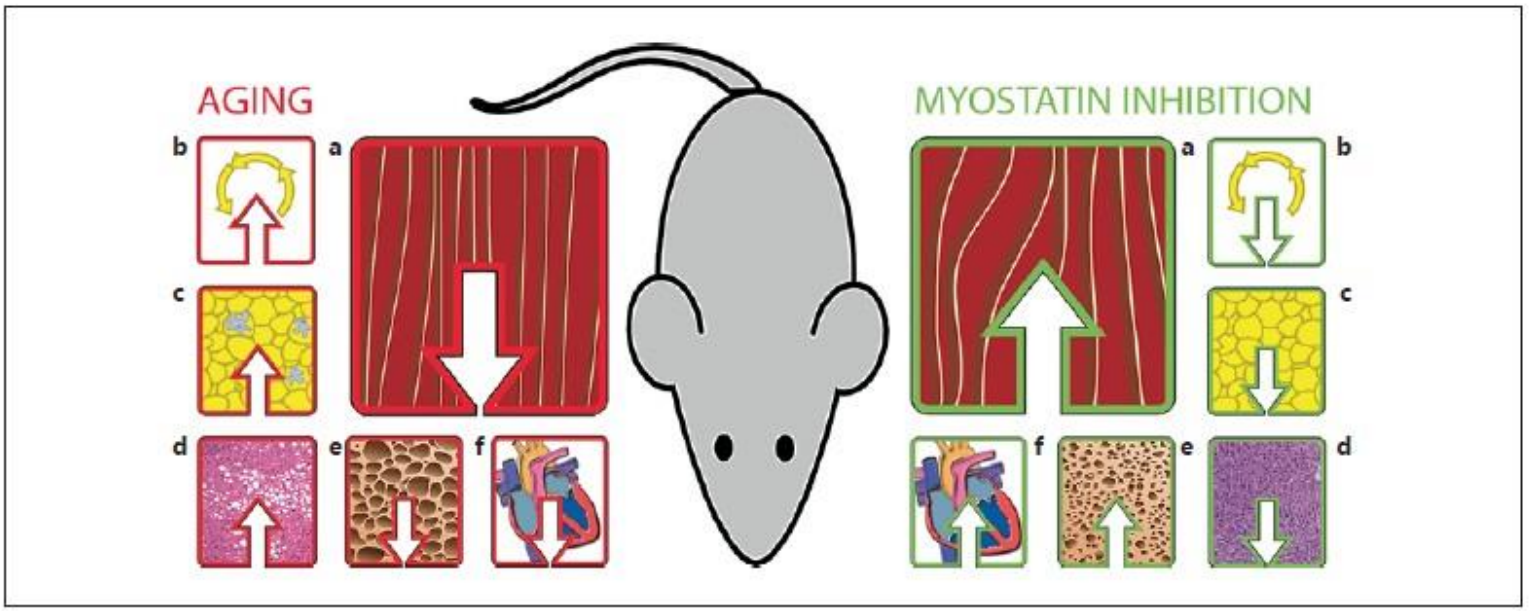


Fig. 1. Conditions of aging (left panel) affected by myostatin deletion and/or inhibition (right panel). **a** Age-associated reductions in muscle mass and fiber cross-sectional area are directly reversed by short-term myostatin inhibition [25, 26]. **b** Increases in circulating glucose and triglyceride concentrations, elicited by high-fat feeding in mouse models and consequences of human aging, are significantly improved by myostatin inhibition and deletion [21, 22]. **c**, **d** Though the mechanisms appear to be indirect (e.g. as a result of greater metabolic demands of increased muscle mass), diet-mediated increases in fat mass, macrophage infiltration and inflammation (**c**) and ectopic lipid accumulation in the liver (**d**) are prevented in mice with mutations in the myostatin gene [28, 32]. These observations could prove meaningful in the context of aging given the prevalence of obesity and type 2 diabetes. **e** Age-related declines in bone mineral content and density are attenuated in myostatin-deficient mice [27]. Combined with its effects on muscle, myostatin inhibition could significantly impact osteoporotic fracture risk. Reductions in cardiac ejection fraction with advancing age are also prevented in myostatin-deficient mice [27]. **f** Moreover, myostatin deletion protects against aortic atheromatous lesions in mice genetically predisposed to atherosclerosis [29]. The mechanisms through which disruption of myostatin signaling conveys cardiovascular protection are not understood.

(White et al., 2014)

➢ Σύμφωνα με τους Mobley et al σε δημοσίευση του ISSN δοκιμάστηκε η in- vitro προσέγγιση για να διαπιστώσουν εαν η χορήγηση HMB , κρεατίνης ή L-λευκίνης θα μπορούσε να αποτρέψει την δράση της μυοστατίνης σε C2C12 κύτταρα.

➢ Τα αποτελέσματα έδειξαν ότι, η ύπαρξη λευκίνης και HMB απέτρεψε τη δράση της MSTN .

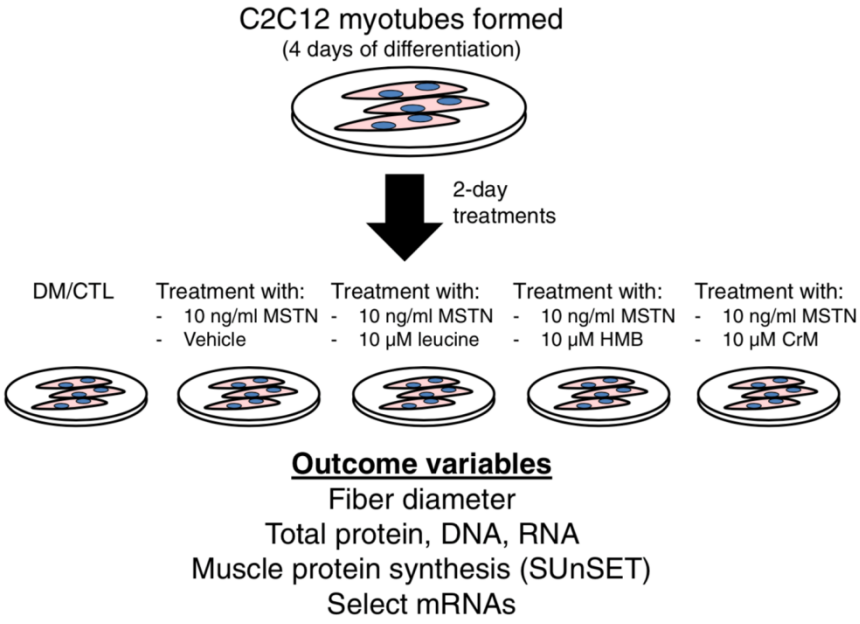


Figure 1 Study design. After four days of differentiation, cells were treated for two days (three times per day) with differentiation media (DM) and vehicle (10 mM Tris-NaCl), 10 ng/ml recombinant GDF-8 MSTN, 10 ng/ml MSTN and 10 μM leucine, 10 ng/ml MSTN and 10 μM of HMB, or 10 ng/ml MSTN and 10 μM creatine monohydrate.

(Mobley et al., 2014)

Γιατί οι ηλικιωμένοι χρειάζονται περισσότερη πρωτεΐνη;

★Ανεπαρκής πρόσληψη πρωτεΐνης με τη διατροφή (απώλεια όρεξης, γαστρεντερικά προβλήματα, μειωμένη ενεργειακή πρόσληψη, αλλαγές στις διατροφικές προτιμήσεις)

★Μείωση στην αξιοποίηση της διαθέσιμης πρωτεΐνης (αντίσταση στη μεταγευματική σύνθεση πρωτεΐνης, αντίσταση στην ινσουλίνη, υψηλότερη χρησιμοποίηση από το έντερο και το ήπαρ)

★Υψηλότερες βασικές ενεργειακές ανάγκες (οξείες και χρόνιες παθήσεις, φλεγμονώδεις παθήσεις, αυξημένη οξείδωση των πρωτεϊνών)

★25-30 γρ υψηλής ποιότητας πρωτεΐνης απαιτούνται για το κατώφλι της μέγιστης ενεργοποίησης της σύνθεσης μυϊκής πρωτεΐνης

Ο ρόλος των ω3 ΛΟ

- Σε πρόσφατη μετα-ανάλυση που περιλάμβανε 68 κλινικές μελέτες. Η χορήγηση ω-3 λιπαρών οξέων μακράς αλύσου έδειξε μείωση των φλεγμονοδών δεικτών IL-6,TNF-a και CRP.
- Συνδυασμός διατροφής , αερόβιας και αναερόβιας άσκησης συντελούν σε αποδοτικότερα αποτελέσματα.

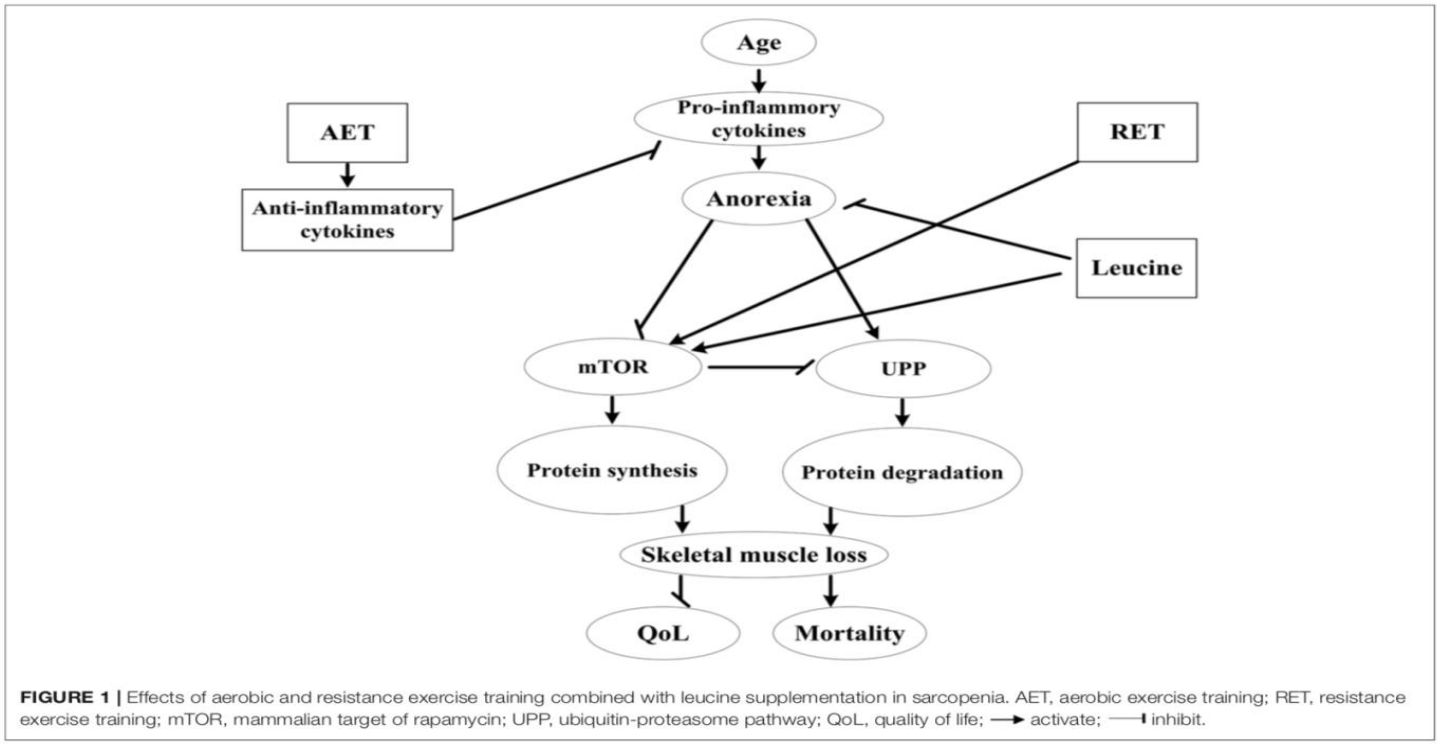


FIGURE 1 | Effects of aerobic and resistance exercise training combined with leucine supplementation in sarcopenia. AET, aerobic exercise training; RET, resistance exercise training; mTOR, mammalian target of rapamycin; UPP, ubiquitin-proteasome pathway; QoL, quality of life; → activate; ⊣ inhibit.

(Robinson et al, 2017)

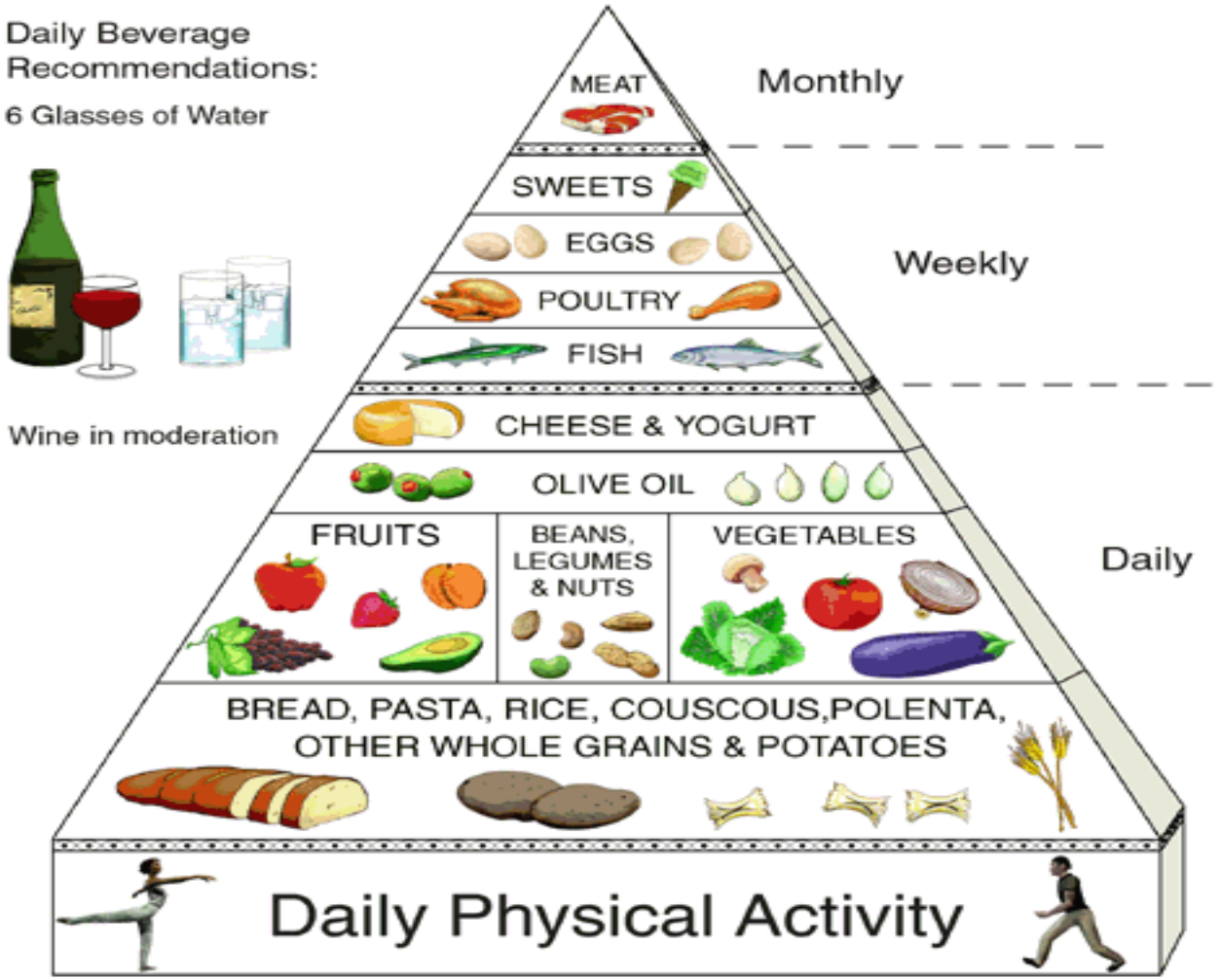
Καταλληλότερη διατροφή για την αντιμετώπιση της σαρκοπενίας είναι η Μεσογειακή διατροφή

Όρος που επινοήθηκε από τον ***φυσιολόγο*** **Ancel Keys το 1960,** για να περιγράψει το μοντέλο διατροφής, το οποίο ακολουθούσαν οι λαοί των μεσογειακών χωρών στη **Μελέτη των Επτά Χωρών**.

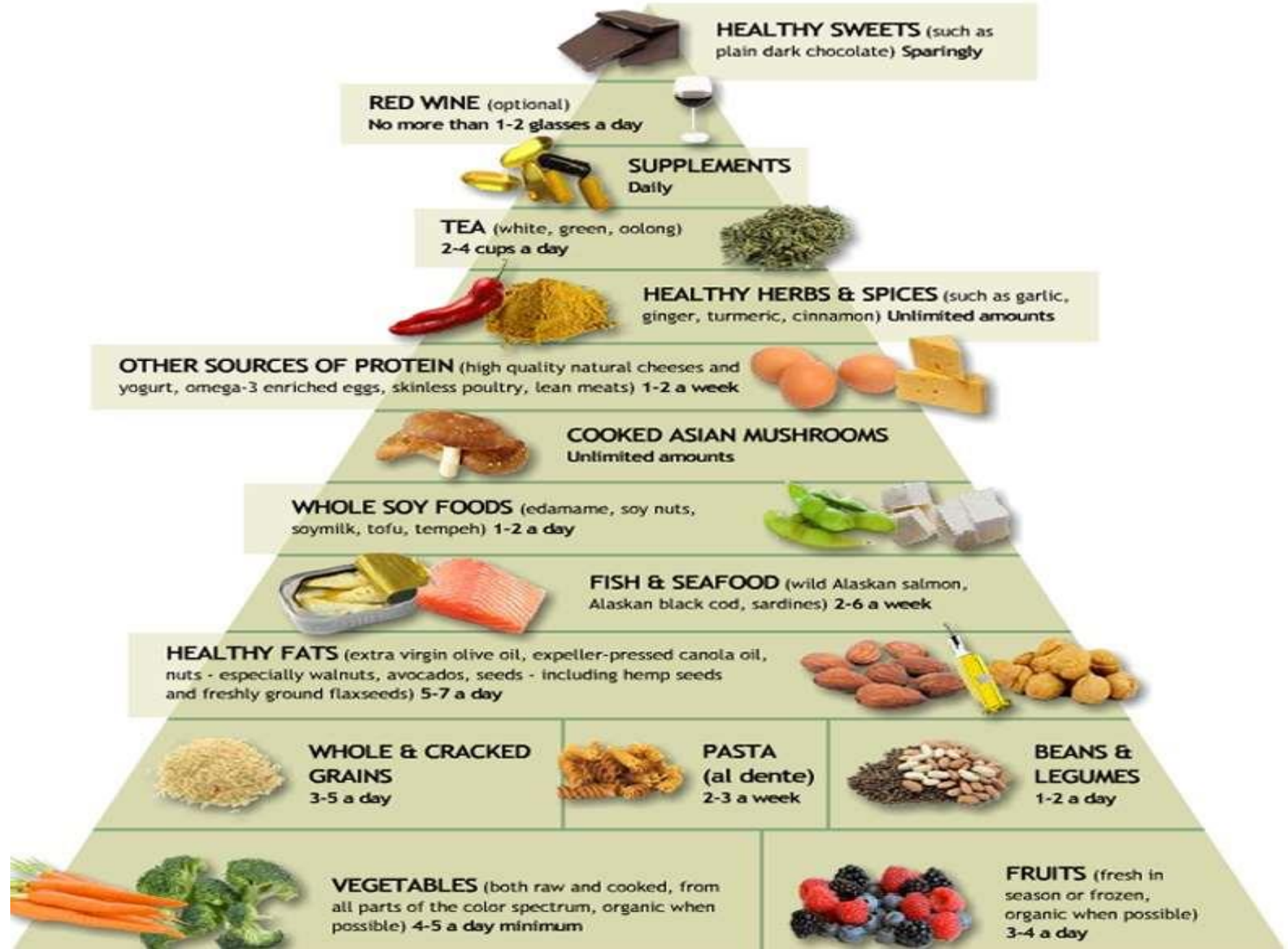
Μεσογειακή διατροφή

Στη Διεθνή Διάσκεψη για τις Μεσογειακές Διατροφές το 1993 αποφασίστηκε τι θα θεωρείται υγιεινή, παραδοσιακή Μεσογειακή διατροφή και το 1995 μια ομάδα επιστημόνων του Πανεπιστημίου Χάρβαρντ δημιούργησε την "Πυραμίδα της Μεσογειακής Διατροφής"

The Traditional Healthy Mediterranean Diet Pyramid

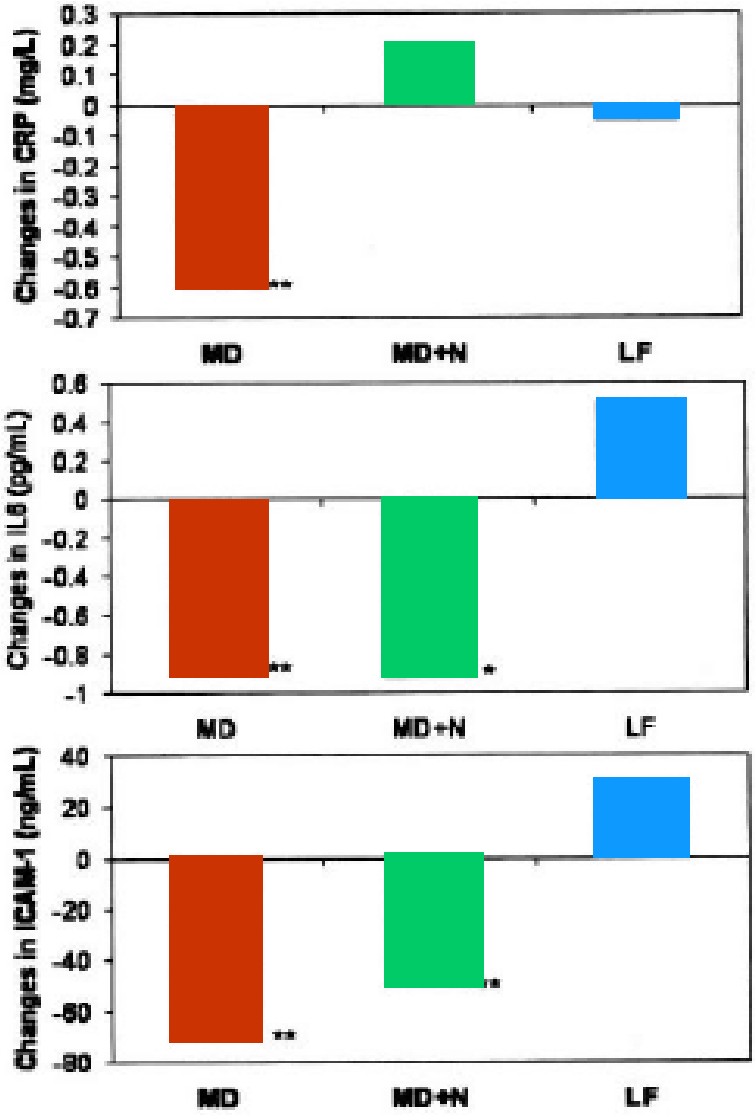


- Αντιφλεγμονώδης πυραμίδα


HEALTHY SWEETS (such as plain dark chocolate) Sparingly
RED WINE (optional)
No more than 1-2 glasses a day
SUPPLEMENTS
Daily
TEA (white, green, oolong)
2-4 cups a day
HEALTHY HERBS & SPICES (such as garlic, ginger, turmeric, cinnamon) Unlimited amounts
OTHER SOURCES OF PROTEIN (high quality natural cheeses and yogurt, omega-3 enriched eggs, skinless poultry, lean meats) 1-2 a week
COOKED ASIAN MUSHROOMS
Unlimited amounts
WHOLE SOY FOODS (edamame, soy nuts, soymilk, tofu, tempeh) 1-2 a day
FISH & SEAFOOD (wild Alaskan salmon, Alaskan black cod, sardines) 2-6 a week
HEALTHY FATS (extra virgin olive oil, expeller-pressed canola oil, nuts - especially walnuts, avocados, seeds - including hemp seeds and freshly ground flaxseeds) 5-7 a day
WHOLE & CRACKED GRAINS
3-5 a day
PASTA (al dente)
2-3 a week
BEANS & LEGUMES
1-2 a day
VEGETABLES (both raw and cooked, from all parts of the color spectrum, organic when possible) 4-5 a day minimum
FRUITS (fresh in season or frozen, organic when possible)
3-4 a day

Ερευνητικά δεδομένα αποδεικνύουν και την αντιφλεγμονώδη δράση της Μεσογειακής δίαιτας

Mediterranean dietary pattern superior to low fat diet in reducing inflammation



Study Participants: 772 adults at high risk for CVD
Treatment (3 months)

- Mediterranean-style diet with virgin olive oil, N=257
- Mediterranean-style diet with mixed nuts, N=258
- Low-fat diet, N=257

Estruch R et al. Ann Intern Med 2006; 145: 1-11.

Mediterranean dietary pattern attenuates inflammation: The ATTICA Study

Study Participants:
1514 men, 18-87 y
1528 women, 18-89 y
Attica area of Greece

	Tertile of Diet Score (Based on Healthful Dietary Components)			
	1 Low Adherence	**2** Medium	**3** High Adherence	**P-value**
C-reactive protein (mg/L)	2.0 ± 1.8	1.8 ± 2.1	1.6 ± 1.5	0.01
Interleukin-6 (pg/mL)	2.1 ± 0.9	1.84 ± 1.1	1.45 ± 0.99	0.02
TNF-alpha (pg/mL)	5.8 ± 1.3	5.5 ± 1.4	5.1 ± 2.1	0.07
Amyloid A (mg/L)	5.2 ± 6.2	4.4 ± 4.6	3.6 ± 5.4	0.19
White blood cell (x 1000 count)	7.4 ± 1.3	6.9 ± 2.7	6.2 ± 1.4	0.001
Homocysteine	12.4 ± 5.8	11.7 ± 6.4	10.5 ± 6.0	0.03

Chrysohoou et al. J Am Coll Cardiol 2004;44:152-8

Ρόλος της άσκησης στη σαρκοπενία

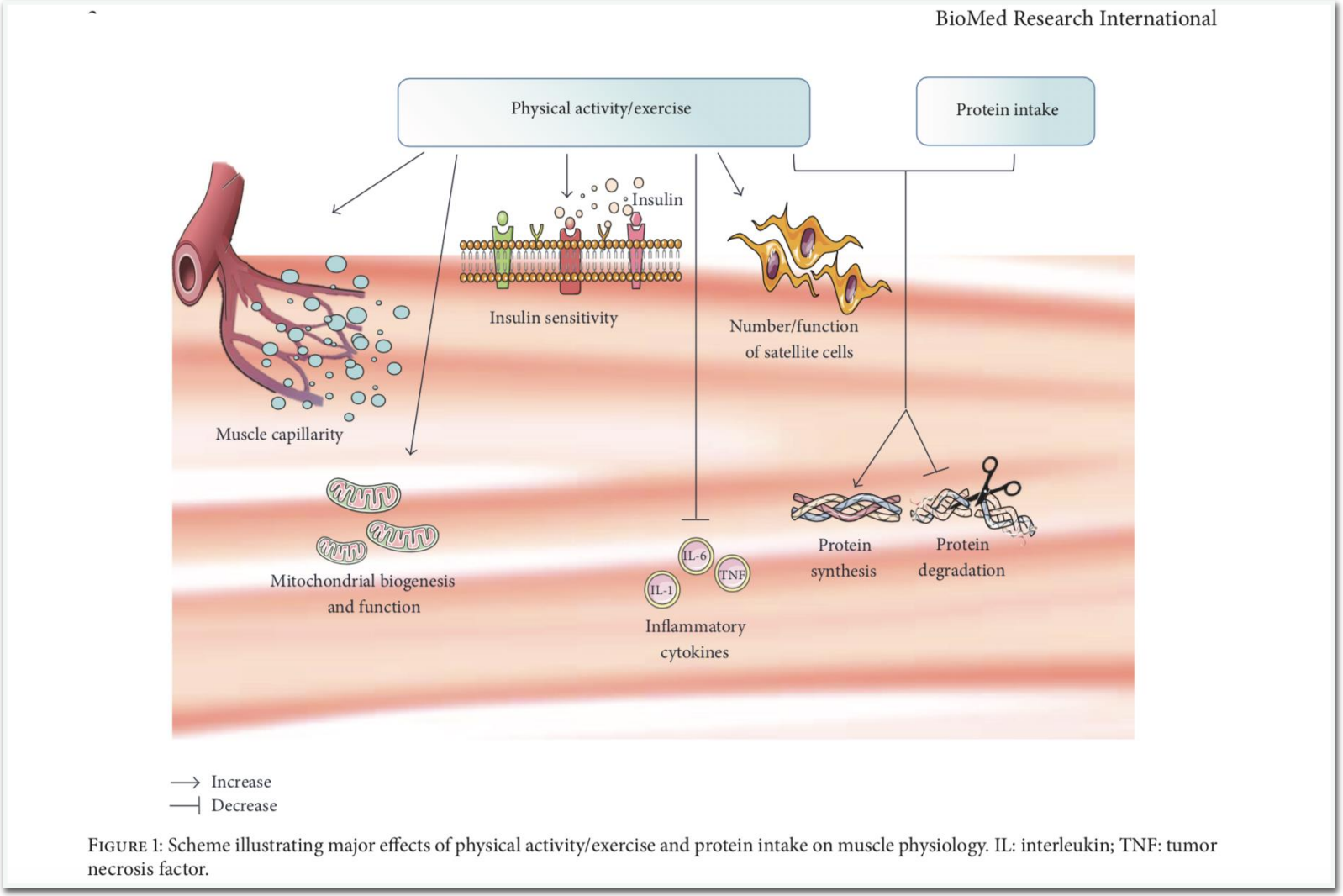
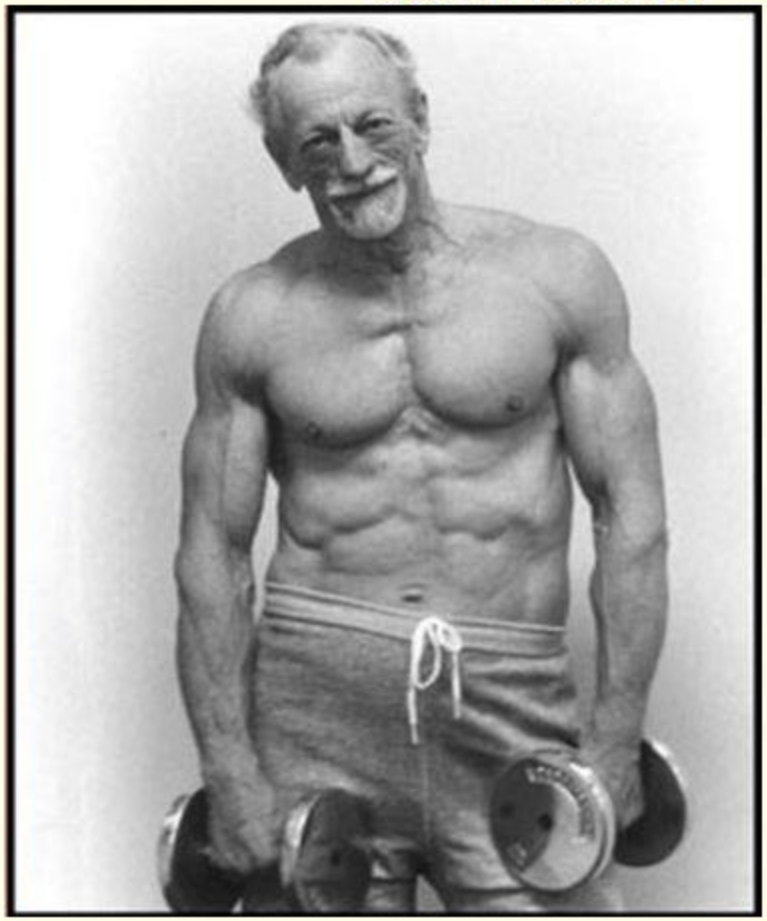


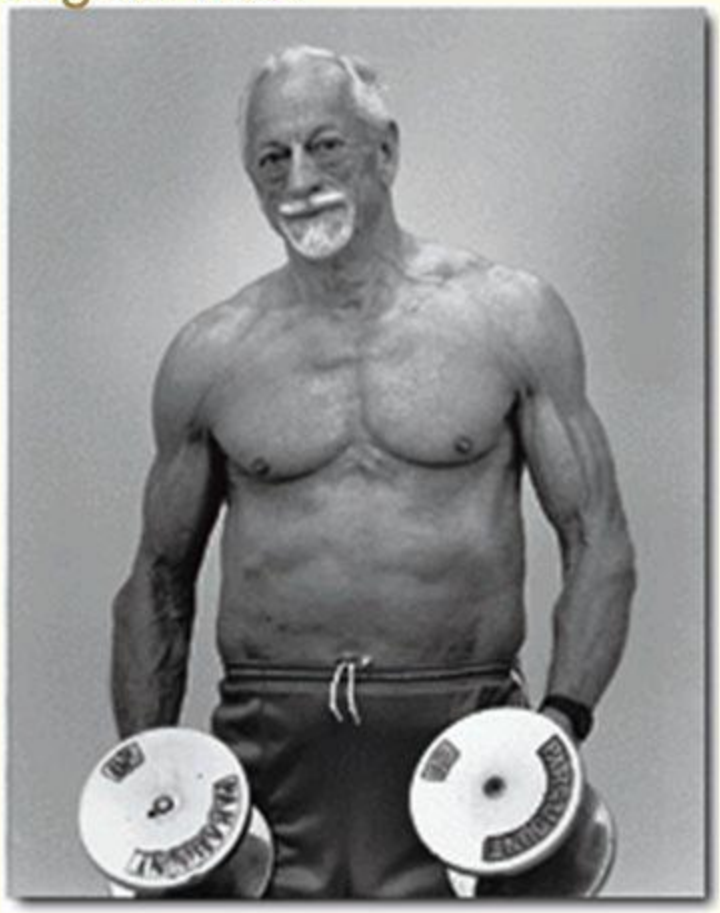
FIGURE 1: Scheme illustrating major effects of physical activity/exercise and protein intake on muscle physiology. IL: interleukin; TNF: tumor necrosis factor.

Age-related changes in body composition

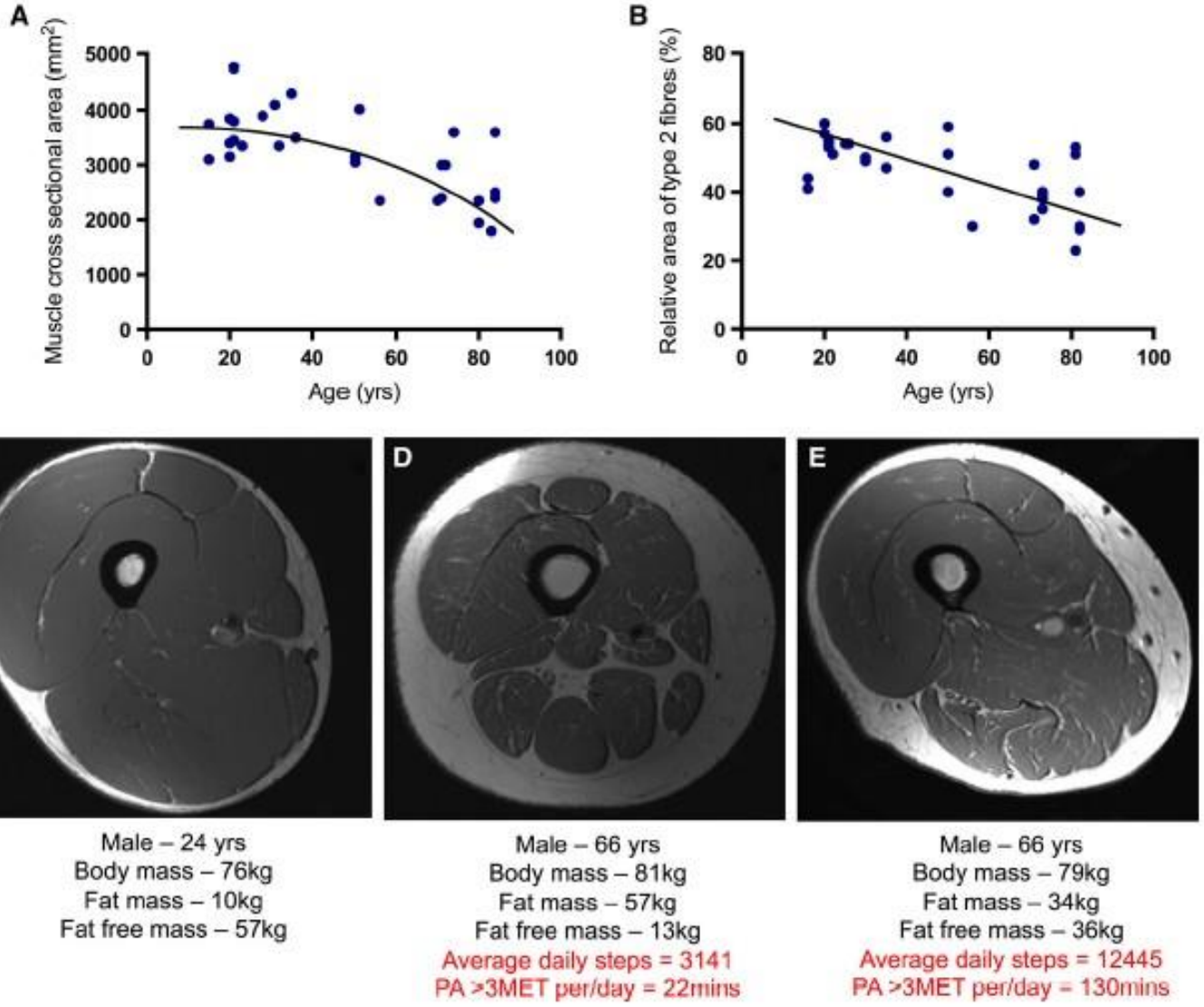
John Turner – Weight Lifter



Age 63



Age 79



(McLeod et al., 2016; Lexel, 1995)

Επαναλαμβανόμενη άσκηση με αντιστάσεις δείχνει να έχει θετικά αποτελέσματα στην πρωτεϊνική σύνθεση (υπερτροφία).

Παρόλο που οι ηλικιωμένοι εμφανίζουν αναβολική αντίσταση, η χρόνια άσκηση σε συνδυασμό με την κατάλληλη πρόσληψη πρωτεΐνης μπορεί να προάγει τη μυϊκή ενδυνάμωση και υπερτροφία, ακόμα και σε άτομα >90.

.

(McLeod et al., 2016)

Exercise to improve functional outcomes in persons with osteoporosis: a systematic review and meta-analysis

A. Varahra[1] · I. B. Rodrigues[2] · J. C. MacDermid[3] · D. Bryant[3] · T. Birmingham[3]

Osteoporos Int. 2018 Feb;29(2):265-286

- Η βελτίωση της μυϊκής ισχύος είναι σημαντικότερη της βελτίωσης της δύναμης
- Ένα πολυδιάσταστο πρόγραμμα προπόνησης ισχύος με προσομοίωση καθημερινών δραστηριοτήτων έχει καλύτερη επίδραση στη βελτίωση δραστηριοτήτων που απαιτούν γρήγορες και εκρηκτικές μυϊκές συσπάσεις, γρήγορη αντίδραση, μυϊκό συντονισμό, και ισορροπία.

Οι έρευνες του εργαστηρίου μας

Signature: Med Sci Monit, 2003; 9(2): CR79-83
PMID: 12601291

www.MEDSCIMONIT.COM
Clinical Research

Received: 2002.08.19
Accepted: 2002.12.30
Published: 2003.02.25

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Health status and socioeconomic factors as determinants of physical activity level in the elderly

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Department of Physical Education, Aristotle University of Thessaloniki, Greece

Summary

Background: The aim of our study was to assess the health status and Physical Activity Level (PAL) of the elderly population and determine the role of health status and socioeconomic factors in PAL.

Material/Methods: A total of 84 subjects (65 men and 19 women) participated in this study. These individuals were living independently, and attending rehabilitation centers for the elderly in Thessaloniki, Greece. The mean age of the subjects was 74.4 years (SD 7.9). Data was collected with a special questionnaire regarding health status and PAL, during individual interviews.

Results: The mean PAL value was 1.519, SD 0.115. Significant positive correlation was found between PAL and educational level ($r=0.286$, $p<0.05$). Regarding the relation of illnesses to PAL, one-way ANOVA indicated that individuals under treatment for heart arrhythmia and myocardial infarction, as well as those who had undergone a by-pass operation, had higher PAL values (1.659 ± 0.0649, 1.551 ± 0.093 and 1.613 ± 0.0978, respectively) compared to those not suffering from any of these disorders (1.512 ± 0.112, 1.515 ± 0.118 and 1.508 ± 0.112 respectively, $p<0.05$ for each comparison). Cancer affected PAL negatively.

Conclusions: In conclusion, the elderly spent most of their time carrying out low-intensity activities and did not participate in leisure activities of high or moderate intensity. Educational level was the only socio-economic factor that was correlated to PAL. The positive effect of certain disorders on PAL might be attributed to patients' compliance with physicians' instructions. Further research is necessary.

Οι έρευνες του εργαστηρίου μας

International Journal of Food Sciences and Nutrition,
December 2005; 56(8): 561–566

Taylor & Francis
Taylor & Francis Group

Relation of smoking, physical activity and living residence to body fat and fat distribution in elderly men in Greece

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[1]*Department of Nutrition and Dietetics Technological Educational Institution of Thessaloniki, Greece, and* [2]*Department of Physical Activity and Sports Science, Democritus University of Thrace, Greece*

Abstract
It is well-documented that body fat and body fat distribution are related to increased risk for cardiovascular disease, hyperinsulinaemia, and diabetes mellitus. The purpose of this study was to investigate the impact of smoking status, physical activity and place of living on body fat and fat distribution of Greek elderly men. The participants were 144 elderly men of mean age 71.78 ±6.39 years, who were free-living individuals, in Thessaloniki (104 subjects) and in the suburbs (40 subjects). According to our results, 23.9% of men who participated in the study were smokers. No association was found between skinfolds, skinfold ratio and physical activity or smoking. It is worth to mention that a triple percentage of younger elders (60–75 years) smoked, compared to the older ones. This finding could possible explain the absence in anthropometric differences between elderly smokers and non-smokers. Intervention programs aiming to yield information about changing the various modifiable risk factors in the elderly are needed.

Οι έρευνες του εργαστηρίου μας

HORMONES 2013, 12(2):1-8

Research paper

Association of physical activity and sedentary lifestyle patterns with obesity and cardiometabolic comorbidities in greek adults: Data from the National Epidemiological Survey

Maria Hassapidou,[1,2] Sousana K. Papadopoulou,[1,2] George Vlahavas,[2] Efthymios Kapantais,[1] Daphne Kaklamanou,[1] Ioannis Pagkalos,[2] Myrto Kaklamanou,[1] Themistoklis Tzotzas[1]

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ABSTRACT

OBJECTIVE: To investigate the association between physical activity (PA) and sedentary lifestyle (SL) patterns with overweight (OW), obesity (OB), abdominal obesity (AO) and cardiometabolic comorbidities in Greek adults based on data from the National Epidemiological Survey for the prevalence of obesity. DESIGN: Cross-sectional epidemiological survey. Participants were selected via stratified sampling 17,887 men and women, 20-70 years old underwent anthropometric measurements for the estimation of OW, OB and AO prevalence. Assessment of PA, SL patterns and metabolic comorbidities was performed using an in-home questionnaire allowing self-evaluation of diverse activities and self-report for the presence of hypercholesterolemia (HCE), type 2 diabetes mellitus (T2DM) or hypertension (HTN). RESULTS: In men, even small amounts of walking were associated with decreased risk of being OW and AO, while larger amounts were associated with decreased risk of being OB. In women, engagement in entairtainment activities for more than 4 hours per week was associated with less risk of being OW. Concerning cardiometabolic comorbidities, substantial improvement was evidend mainly for men, e.g. significantly reduced risk for HCE, T2DM and HTN by frequent engagement in exercise. On the other hand, frequent TV watching and lonh hours of office work significantly increased the risk of HCE and HTN in men. CONCLUSIONS: In Greek adults, and men in particular, walking activity was significantly associated with lower risk for obesity. In addition, frequent exercise and less sedentary behaviour were associated with reduced risk for cardiometabolic factors, mainly hypercholesterolemia and hypertension.

Οι έρευνες του εργαστηρίου μας

Unpublished data: women had twice prevalence of sarcopenia (OR:2.000, CI:0.176-22.784), sarcopenic obesity (OR:1.960, CI: 0.172-22.321) and abdominal obesity (OR:2.133, CI: 0.963-4.725) compared to the men. Exercise seemed to have a protective role against central obesity and thus possibly against obesity-related co-morbidities in the elderly.

Συνοπτικά, η διατροφή

- Ενεργειακό Ισοζύγιο και επάρκεια σε θρεπτικά συστατικά
- Ενεργειακή πρόσληψη: 25-30Kcal/Kg ΣΒ
- Πρωτεϊνική πρόσληψη ελάχιστη 1.0-1.2g/Kg ΣΒ,
  1.2-1.5g/Kg ΣΒ σε οξεία ή χρόνια διαταραχή
  2g/Kg ΣΒ σε υποθρεψία
  10-15g ΑΑ εκ των οποίων 3g λευκίνη (άπαχο κρέας, προϊόντα ορού γάλακτος, φιστίκια, φακές, μαυρομάτικα φασόλια) (Martone et al., 2017; Landi et al., 2016; Correia et al., 2014; Bauer et al., 2013).

Συνοπτικά, η διατροφή

- Υψηλή πρόσληψη φρούτων και λαχανικών, πλούσια σε φυτοχημικά όπως πολυφαινόλες που έχουν αντιοξειδωτική και αντιφλεγμονώδη δράση στη μυϊκή μάζα και λειτουργία (Robinson et al, 2017; Rabassa et al, 2016) ενώ λόγω των αλάτων καλίου μπορούν να μειώσουν την καταβολική οξείδωση του μυός (Milward, 2012).

- Υψηλή κατανάλωση ψαριών που θα αποδώσει βιταμίνη D και ω3 ΛΟ (Robinson et al., 2017).

Συνοπτικά, η διατροφή

- D: σχετίζεται με διατήρηση μυϊκής μάζας, δύναμης και λειτουργικότητας (Bauer et al., 2015) χαμηλότερο ενδομυϊκό λίπος που δίνει χαμηλότερο κίνδυνο για κάταγμα ισχίου (Visser et al., 2005) και θετικές επιδράσεις στη δύναμη των κάτω άκρων, στην ισορροπία και στο TUGT (Muir et al., 2011). Ηλικιωμένοι με 25(OH) D χαμηλότερη από 25nmol/L είχαν διπλάσια πιθανότητα για σαρκοπενία σε σύγκριση με αντίστοιχη τιμή στα 50nmol/L (Visser et al., 2003).

- Ω3 ΛΟ: Σε μετα-ανάλυση βρέθηκε σε 68 έρευνες ότι η συμπλήρωση με ω3 ΛΟ (EPA, DHA) οδήγησε σε μείωση δεικτών φλεγμονής (CRP, Il-6, TNF-a) (Huang et al, 2014). Επίσης αυξάνουν τη σύνθεση μυϊκής πρωτεΐνης μέσω της σηματοδότησης του mTOR μονοπατιού (Smith et al., 2016).

Συνοπτικά, η διατροφή

- Επαρκής κατανάλωση γαλακτοκομικών προϊόντων (2.5 μερίδες) για 3 μήνες σε αδύναμες ηλικιωμένες σχετίσθηκε με υψηλότερη μυϊκή μάζα και μυϊκή μάζα άκρων αλλά και καλύτερες επιδόσεις στο TUGT και στη δύναμη χειρολαβής (Padaveli-Bagatini et al., 2013). Η κατανάλωση ρικότας (210g/d) για 12 εβδομάδες σε ηλικιωμένους άντρες σχετίσθηκε με αυξημένη μυϊκή μάζα άκρων και καλύτερη ισορροπία (Aleman-Mateo et al., 2014).

- Υψηλή συμμόρφωση στη ΜΔ σχετίστηκε με καλύτερη λειτουργική ικανότητα και απόδοση στο τεστ βαδίσματος και χαμηλότερο κίνδυνο για ανάπτυξη κινητικής αναπηρίας (Shahar et al., 2012; Talegawkar et al., 2012; Henriquez et al., 2012; Milaneschi et al., 2011).

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Συνοπτικά, η άσκηση

- Η αερόβια αυξάνει τα μυϊκά μιτοχόνδρια ενώ η άσκηση με αντιστάσεις έχει επίδραση στην εγκάρσια επιφάνεια μυϊκής ίνας και αυξάνει το μέγεθος των μυϊκών ινών τύπου ΙΙ με αποτέλεσμα την αύξηση δύναμης και λειτουργίας του μυός (Landi et al., 2014).

- Διαφορετικά πρωτόκολλα άσκησης κύρια αερόβιας και HIIT τροποποιούν την έκφραση συγκεκριμένων πρωτεϊνών που συμβάλουν στη βιογένεση μιτοχονδρίων και στη λειτουργία τους (mFABP, muscle fatty acid binding protein και PGC-1a, peroxisome proliferator activated receptor gamma coactivator- 1 alpha) (Cartee et al., 2016).

Συνοπτικά, η άσκηση

- Σημαντική προσαρμογή της χρόνιας άσκησης αποτελεί η δραστηριοποίηση των δορυφορικών κυττάρων, που οδηγεί στην αύξηση του αριθμού των μυϊκών πυρήνων που ενσωματώνονται στις μυϊκές ίνες (Martone et al., 2017; Calvani et al., 2013).

- Μείωση της συστηματικής φλεγμονής, μείωση του TNF-a που οδηγεί σε μείωση της απόπτωσης των μυϊκών πυρήνων και μειώνει τη μυϊκή ατροφία, ενώ βελτιώνει τη μυϊκή μάζα και δύναμη (Browen et al., 2015; Mavros et al., 2014).

Άρα …

- Ο συνδυασμός άσκησης και διατροφής σε μία πολυπαραγοντική παρέμβαση είναι ίσως η μόνη πηγή για την εξασφάλιση ποιοτικής ζωής κατά τη γήρανση.

- Θα πρέπει να εφαρμοστούν καλά σχεδιασμένες μελέτες στους αδύναμους και σαρκοπενικούς πληθυσμούς, τους πληθυσμούς που πάσχουν από διατροφική ανεπάρκεια ή τους πληθυσμούς που διατρέχουν κίνδυνο υποσιτισμού.

- Η εκτίμηση της σαρκοπενίας μέσω μιας τυποποιημένης διάγνωσης θα διευκολύνει την ανεύρεση κατάλληλων επιλογών θεραπείας και πρόληψης.


Thank you!!!