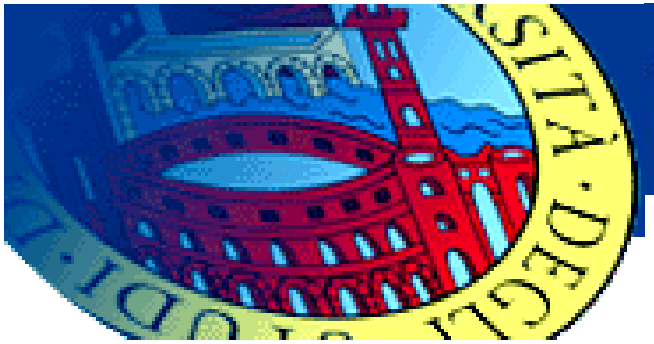


UNIVERSITÀ DEGLI STUDI DI VERONA

Malnutrizione e Sarcopenia

Prof Mauro Zamboni

Dott Andrea Rossi

Clinica Geriatrica-Università di Verona

Rovigo

08 ottobre 2015

1. Definizione
2. Patogenesi
3. Rilevanza clinica

"Sarcopenia is a term that denotes the decline in muscle mass and strength that occurs with healthy aging."

Rosenberg, Am J Clin Nutr 1989

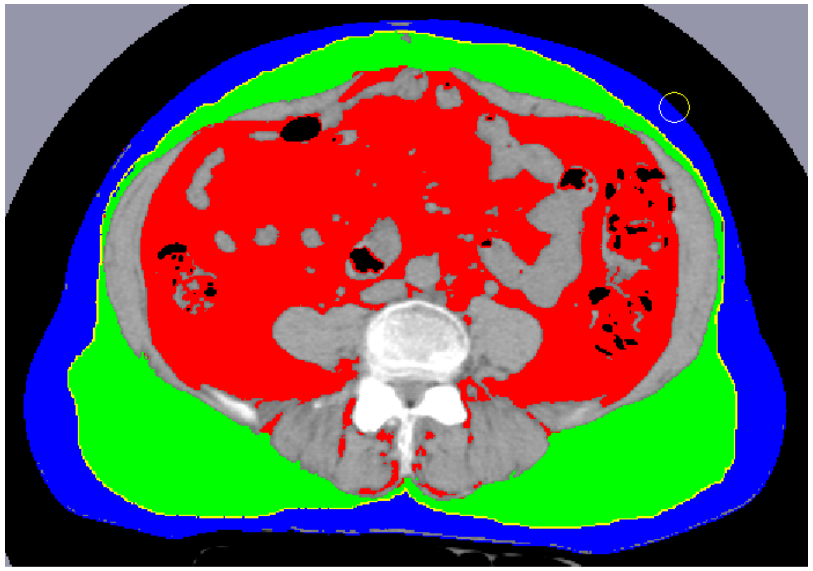
"Sarcopenia is part of normal aging and does not require a disease to occur, although it is accellerated by chronic diseases."

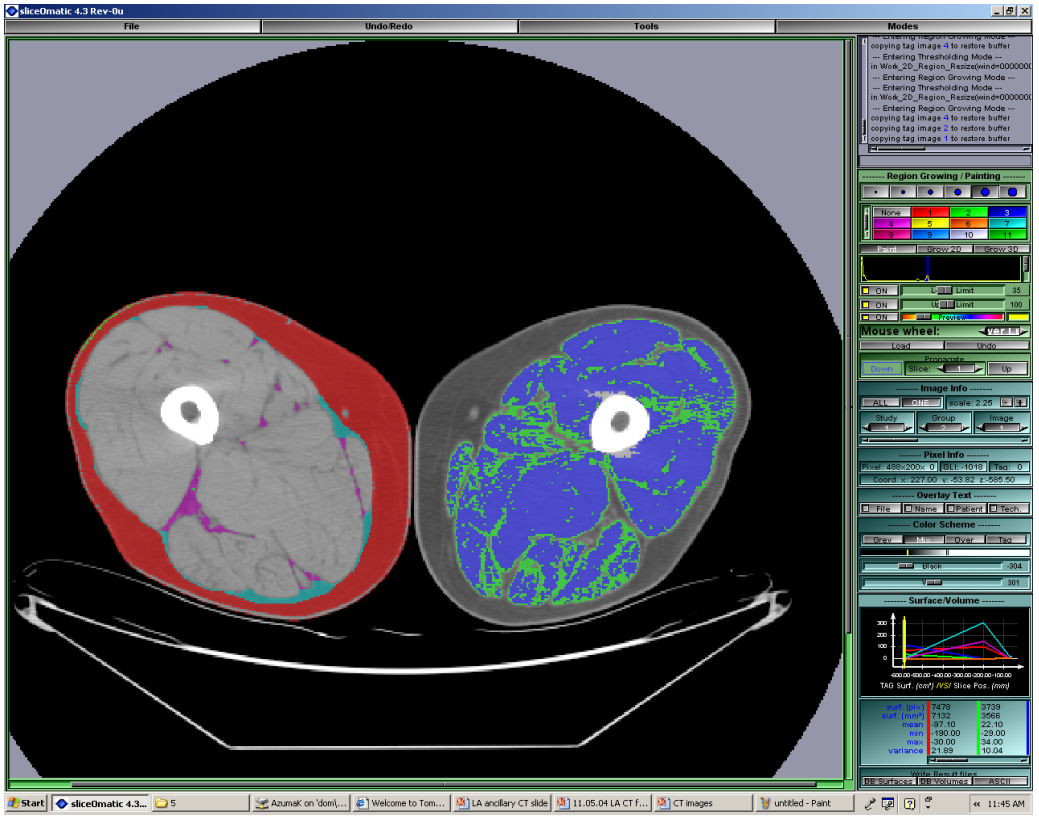
Roubenoff et al, J Gerontol 2000

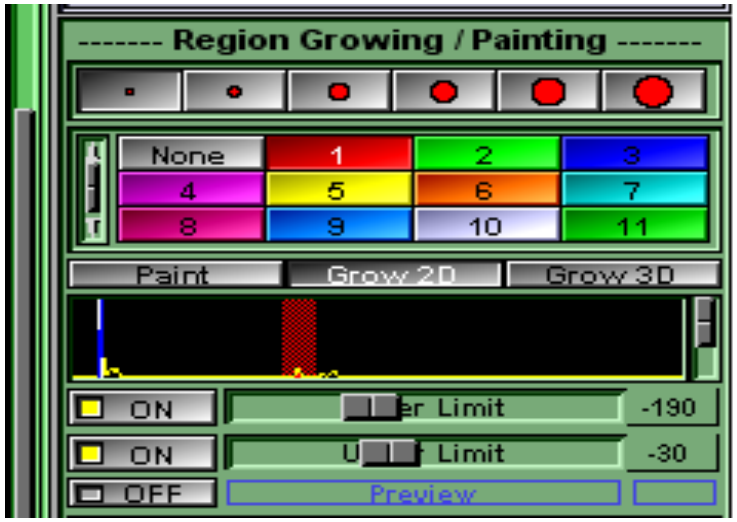
Definizione di Sarcopenia

- Modificazione quantitativa del tessuto muscolare scheletrico?
- Modificazione qualitativa del tessuto muscolare scheletrico?
- **Modificazione funzionale del tessuto muscolare scheletrico?**

CT analysis with Sliceomatic Region Growing Mode Abdomen and Thigh







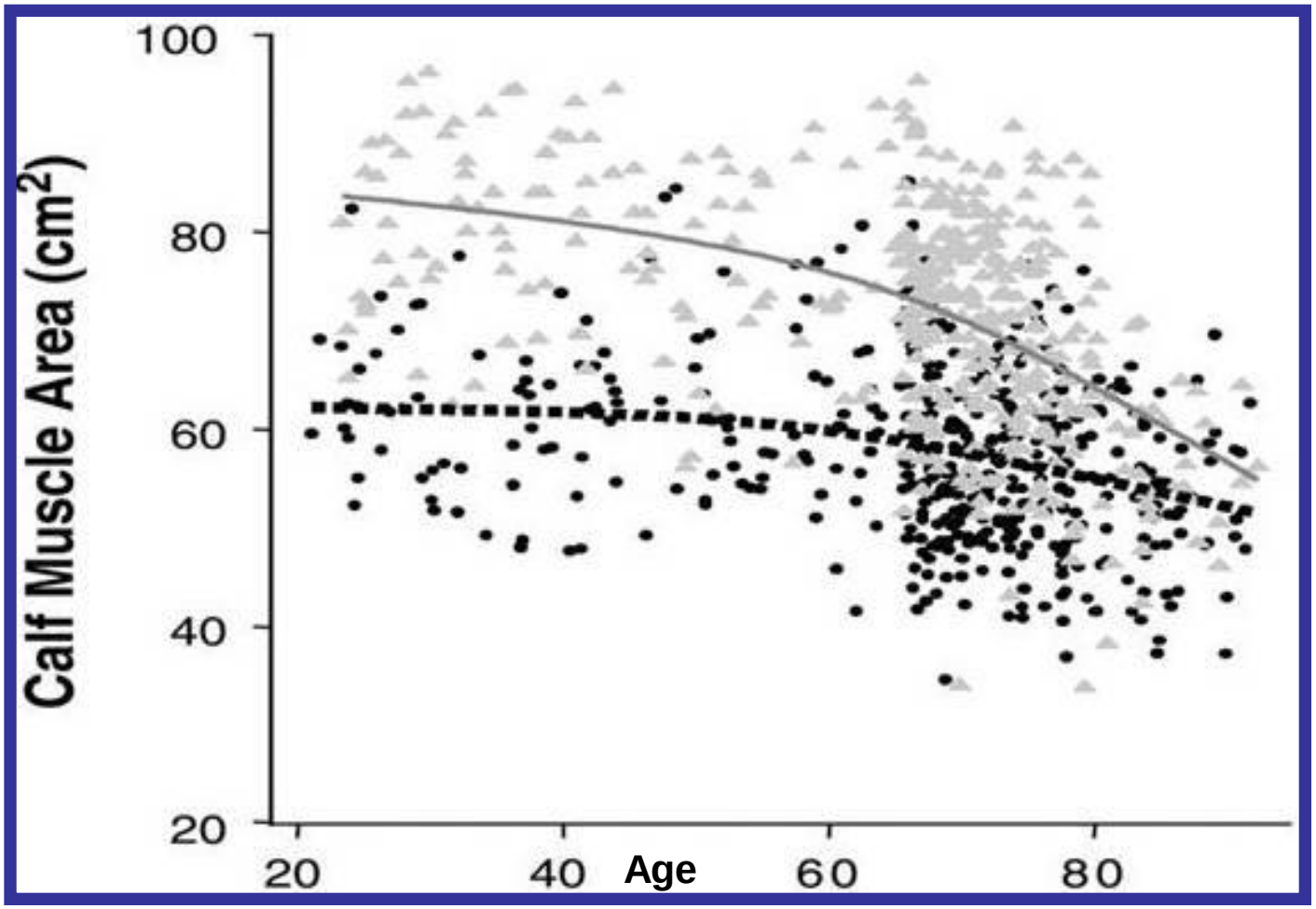
Hounsfield units:

>200 HU for bone

-30 to -190 HU for AT

0 to 100 HU for muscle

La relazione tra età e area della sezione trasversale dei muscoli della gamba in uomini (grigio) e donne (nero) dello Studio InCHIANTI



Lauretani, F. et al. J Appl Physiol 95: 1851-1860 2003

Journal of Applied Physiology

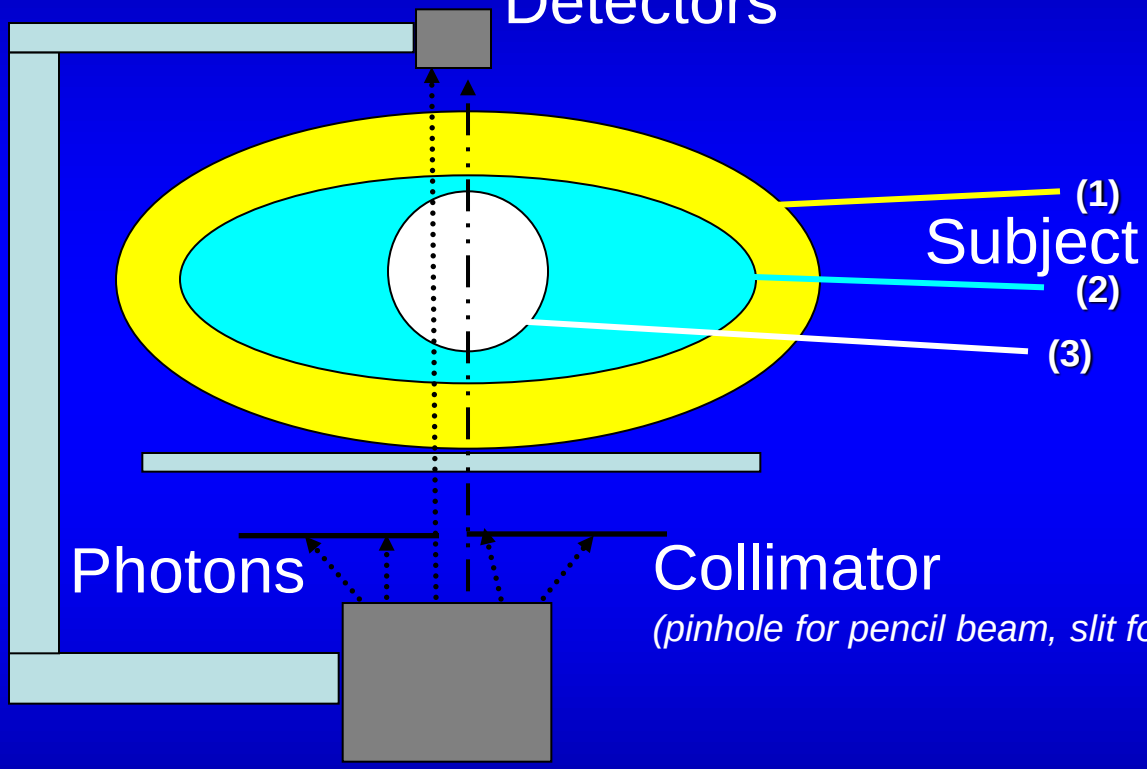
Equipment

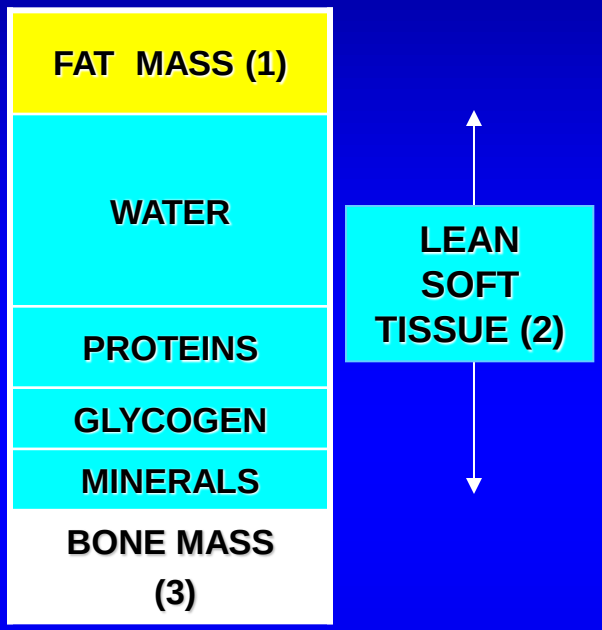
BK94 (OU site) will use the GE Lunar Prodigy Advance™, system # PA+300532 (see below).
Other makes/models include:

- GE Lunar iDXA™
- GE Lunar Prodigy Pro™ or Primo™
- GE Lunar DPX Pro™, Bravo™, or Duo™
- Hologic Discovery A (serial# xxxxxxx)

NOTE: Densitometrist should be trained and certified to use the specific scanner model.

Dual Energy X-ray Absorbiometry

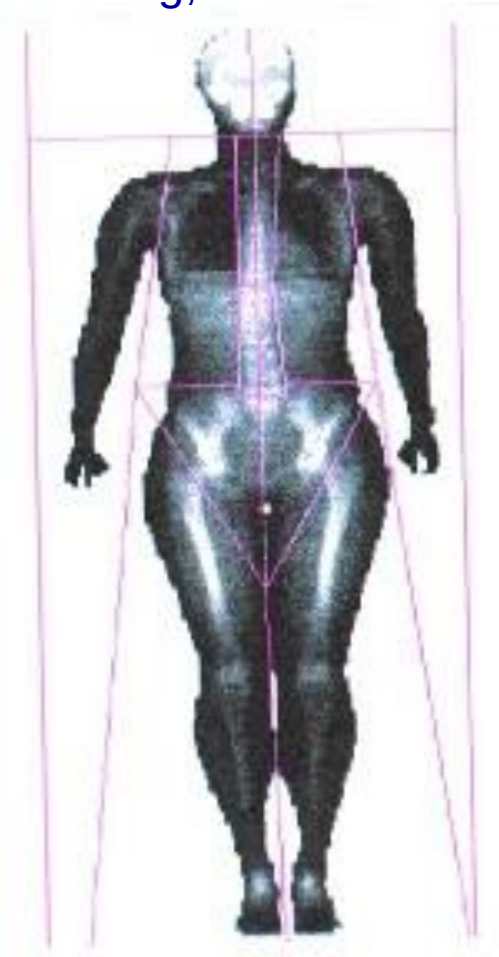




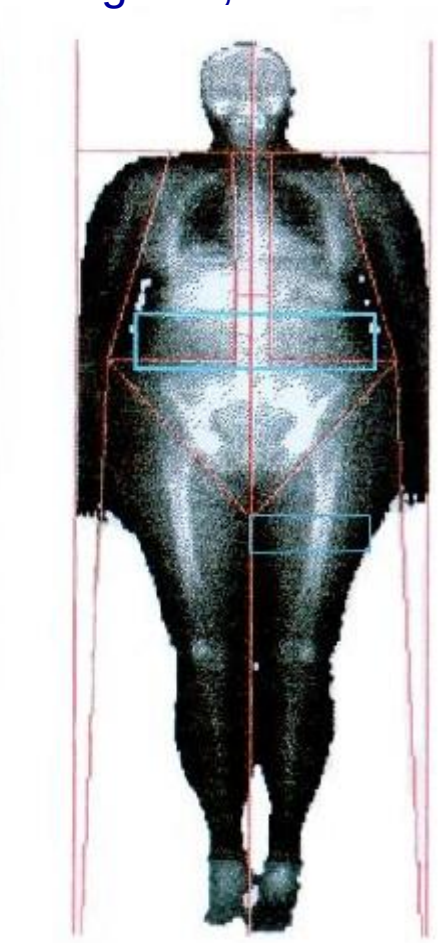
X –Ray source *(provides a broad photon beam filtered producing two main energy peaks. The difference in attenuation between the two energy peaks is particular to each element)*

TOTAL BODY Dual-energy X-ray Absorpiometry (DXA)

Total body. Women
59 kg, BMI 22.6

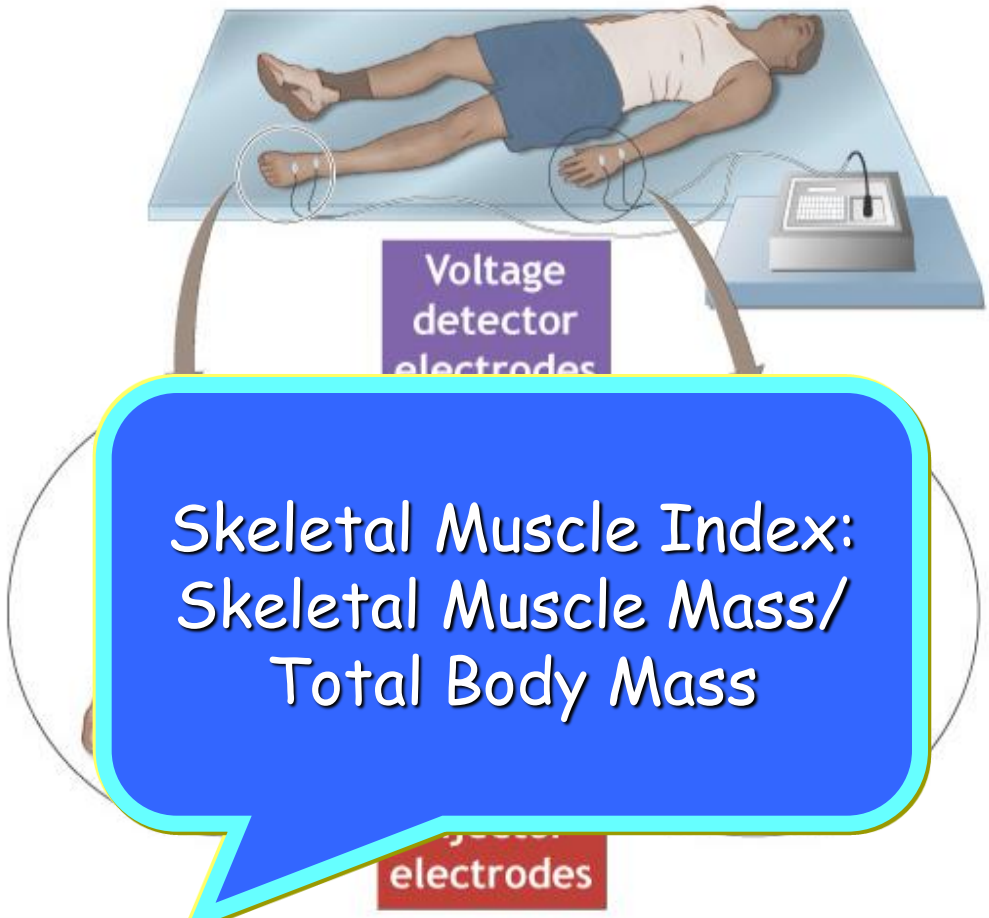


Total body. Women
kg 104, BMI 34

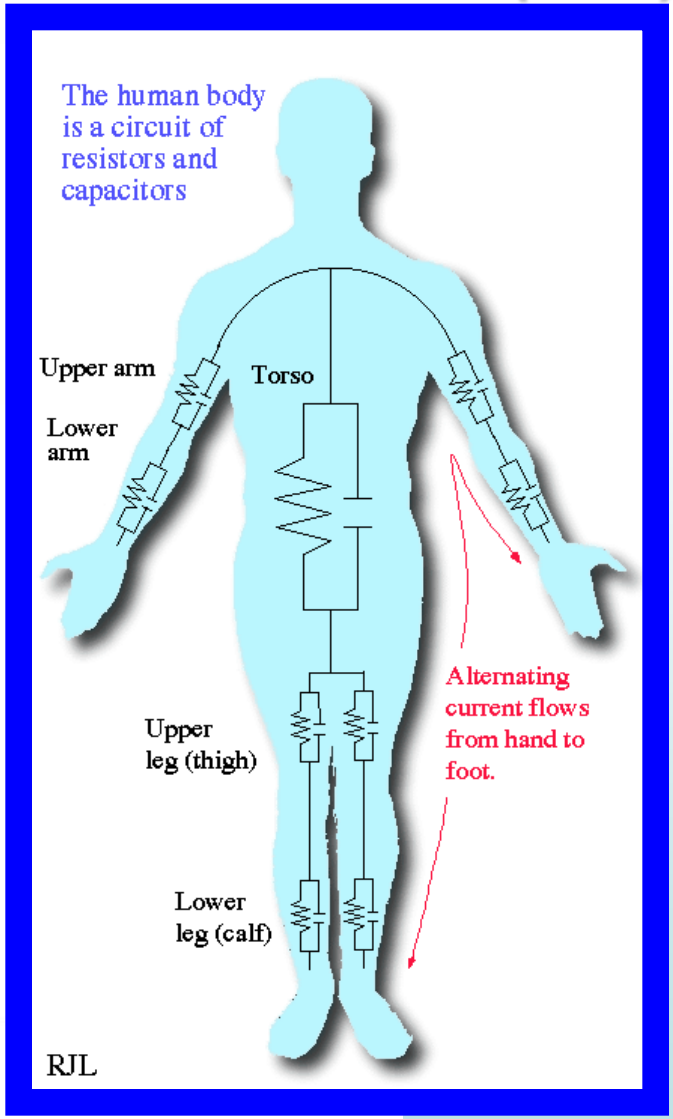


Brownbill RA and Ilich JZ, 2004

Bioelectrical impedance assessment (BIA)



Skeletal Muscle Index:
Skeletal Muscle Mass/
Total Body Mass



Normal: SMI >37.0% in men, SMI >28% in women.

Class I sarcopenia: SMI between 31.0 and 37% in men, SMI between 22.0 and 28.0% in women.

Class II sarcopenia: SMI <31.0% in men, SMI <22.0% in women.

Janssen I,
J Appl Physiol 2001

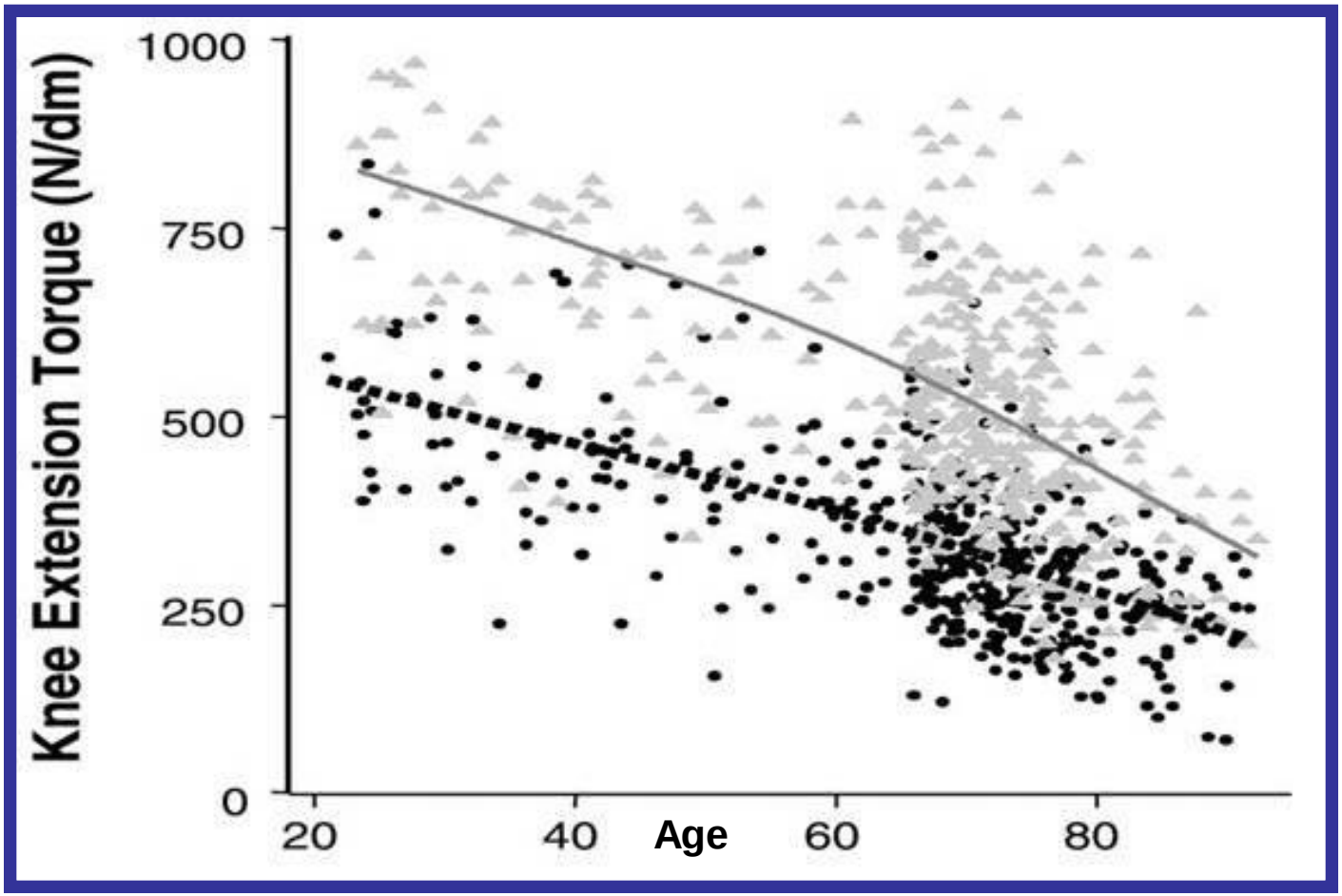
Equipment

- Dinamometria isocinetica

HANDGRIP

Criterio per screening della sarcopenia basato sull'handgrip:
per gli uomini < 30 kg
per le donne < 20 kg

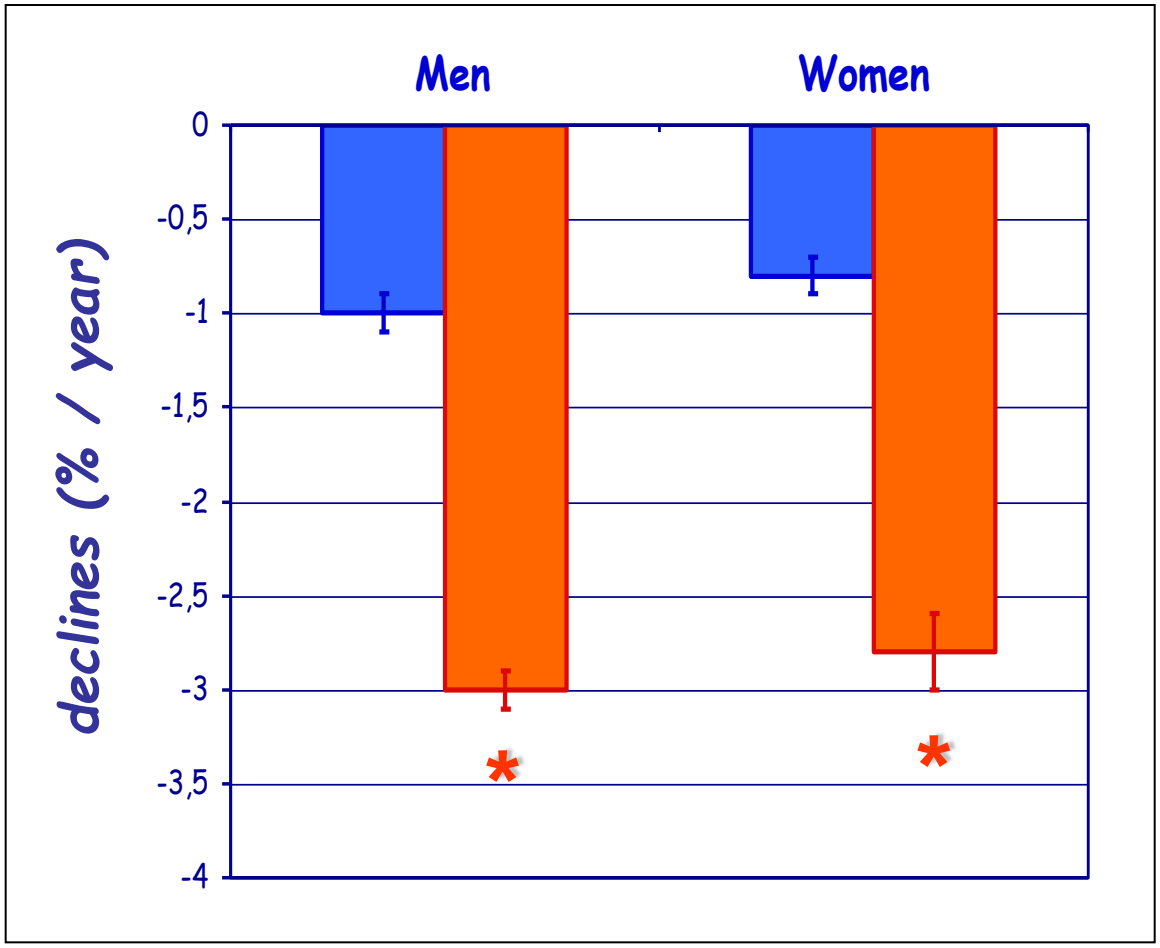
La relazione tra età e "Picco di Forza" degli estensori degli arti inferiori in uomini (grigio) e donne (nero) dello Studio InCHIANTI



Lauretani, F. et al. J Appl Physiol 95: 1851-1860 2003

Journal of Applied Physiology

Qualitative changes in muscle: longitudinal data

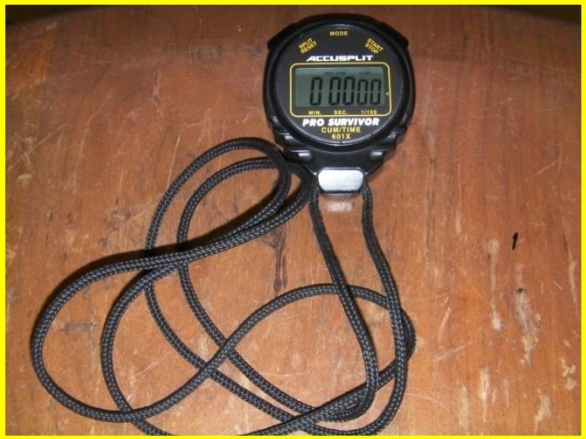


Loss of leg lean mass (Blue bar) and muscle strength (orange bar) in older adults Results from the Health, Aging and Body Composition Study

* Gender difference: $p < .01$, † Racial difference: $p < .05$

Goodpaster et al. J Gerontol Med Sci, 2006, 61 (10), 1059- 1064

SHORT PHYSICAL PERFORMANCE BATTERY



Criterio per screening della sarcopenia basato su Gait speed: velocità inferiore a 0.8 m/sec

1. **Balance Tests**

< 10 sec (0 pt)

pt
pt
pt
pt
0 pt

3. **Chair Stand Test**

Pre-test
Participants fold their arms across their chest and try to stand up once from a chair

unable → Stop (0 pt)

able

5 repeats
Measures the time required to perform five rises from a chair to an upright position as fast as possible without the use of the arms

≤11.19 sec	4 pt
11.20-13.69 sec	3 pt
13.70-16.69 sec	2 pt
>16.7 sec	1 pt
>60 sec or unable	0 pt

NEJM 1995, Guralnik J

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]

[1]Servicio de Geriatría, Hospital Universitario Ramón y Cajal, Madrid, Spain
[2]AZ Damiaan Hospital, Oostende, Belgium
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[4]Clermont Université, UFR Médecine, UMR 1019, F-63001 Clermont-Ferrand, France
[5]Institutionen för Folkhälso- och Vårdvetenskap/Klinisk Nutrition och Metabolism, Uppsala Universitet, Uppsala, Sweden
[6]Istituto di Medicina Interna e Geriatria, Università Cattolica del Sacro Cuore, Roma, Italy
[7]Department of Ageing and Health, Guys and St Thomas' NHS Foundation Trust, London, UK
[8]Département de Réhabilitation et Gériatrie, Hôpitaux Universitaires de Genève, Geneva, Switzerland
[9]Gérontopôle de Toulouse, Hospital La Grave-Casselardit, Toulouse, France
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[11]Geriatrická Klinika I Lékařská Fakulta, Univerzita Karlova v Praze, Prague, Czech Republic
[12]Department of Geriatrics, University of Antwerp, Ziekenhuisnetwerk Antwerpen (ZNA), Antwerp, Belgium
[13]Department of Biomedical and Surgical Sciences, Division of Geriatrics, University of Verona, Verona, Italy

Age and Ageing 2010; 39: 412–423

Criteria for the diagnosis of sarcopenia

Diagnosis is based on documentation of criterion 1 plus (criterion 2 or criterion 3).

1- Low muscle mass

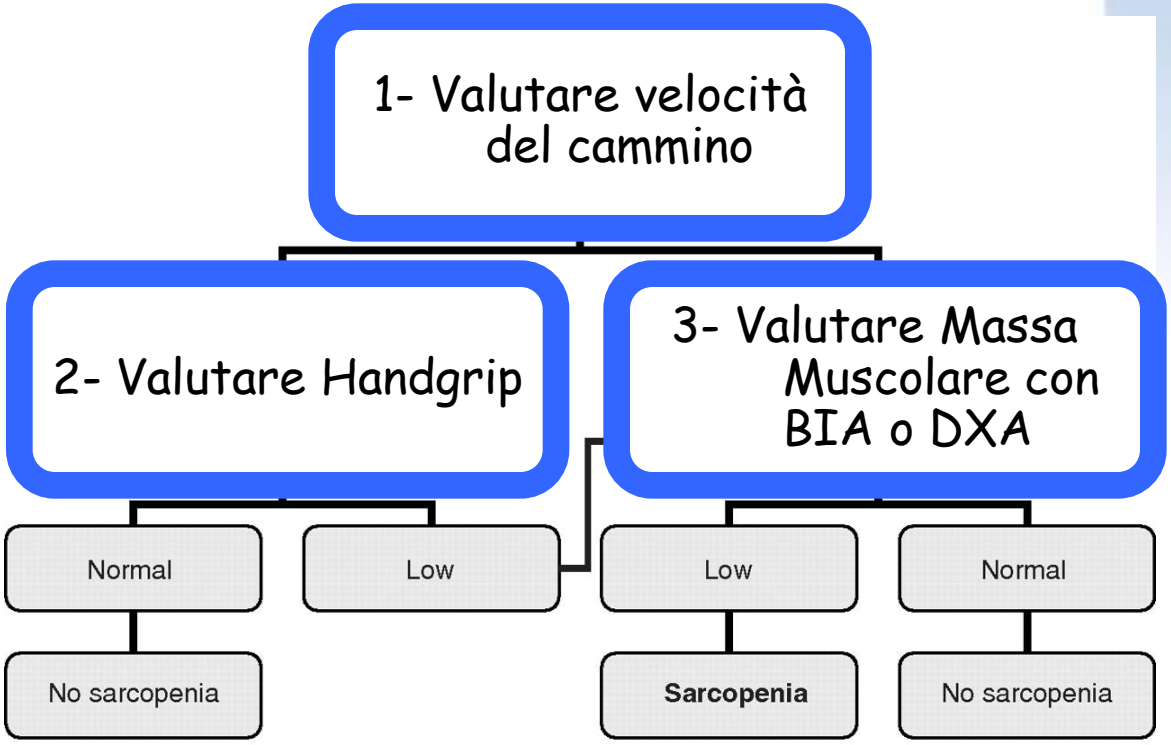
2-Low muscle strength

3- Low physical performance

Cruz-Jentoft Alfonso J et al Sarcopenia: European Consensus on Definition and Diagnosis. Report of the European Working Group on Sarcopenia in Older People- Age and Ageing,2010 ; 1-12

Sarcopenia case finding

EWGSOP-suggested algorithm in older individuals



* Comorbidity and individual circumstances that may explain each finding must be considered

+ This algorithm can also be applied to younger individuals at risk

Cruz-Jentoft, A. J. et al. Age Ageing 2010 ; 1-12

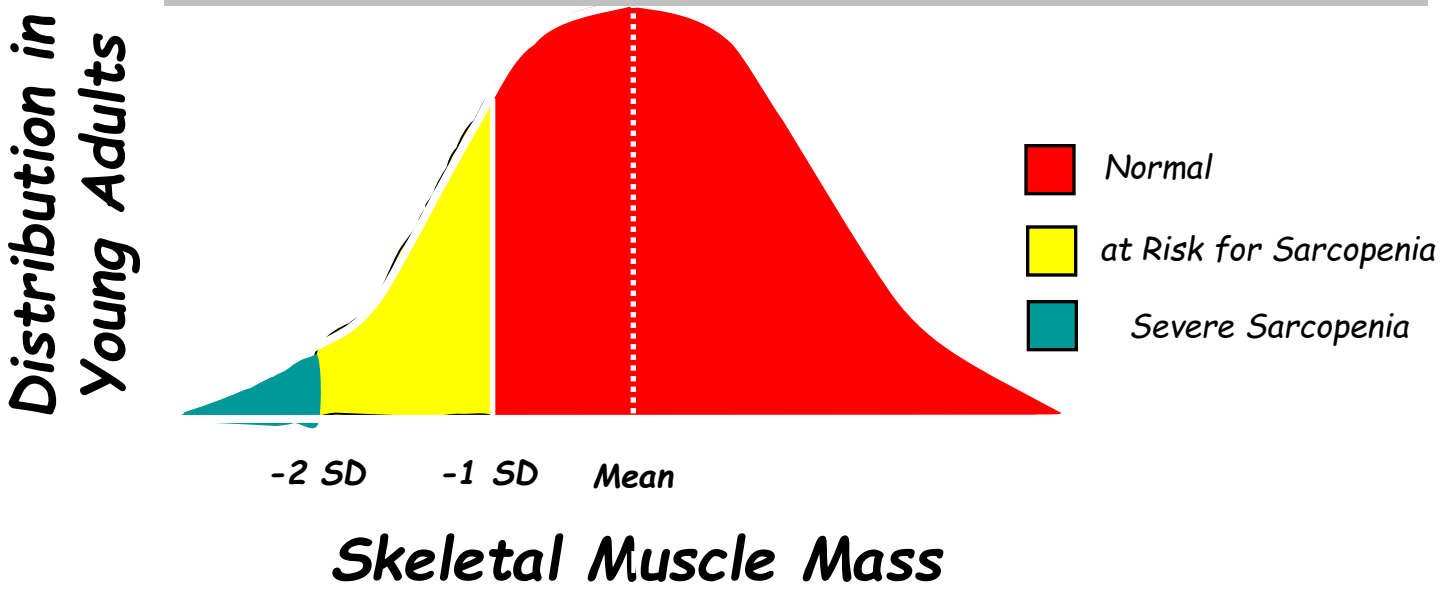
Operative definitions based on muscle mass

appendicular Fat Free Mass (Kg)/h $(mt)^2$

Baumgartner et al, Am J Epidemiol 1998, 147 (8), 755-763

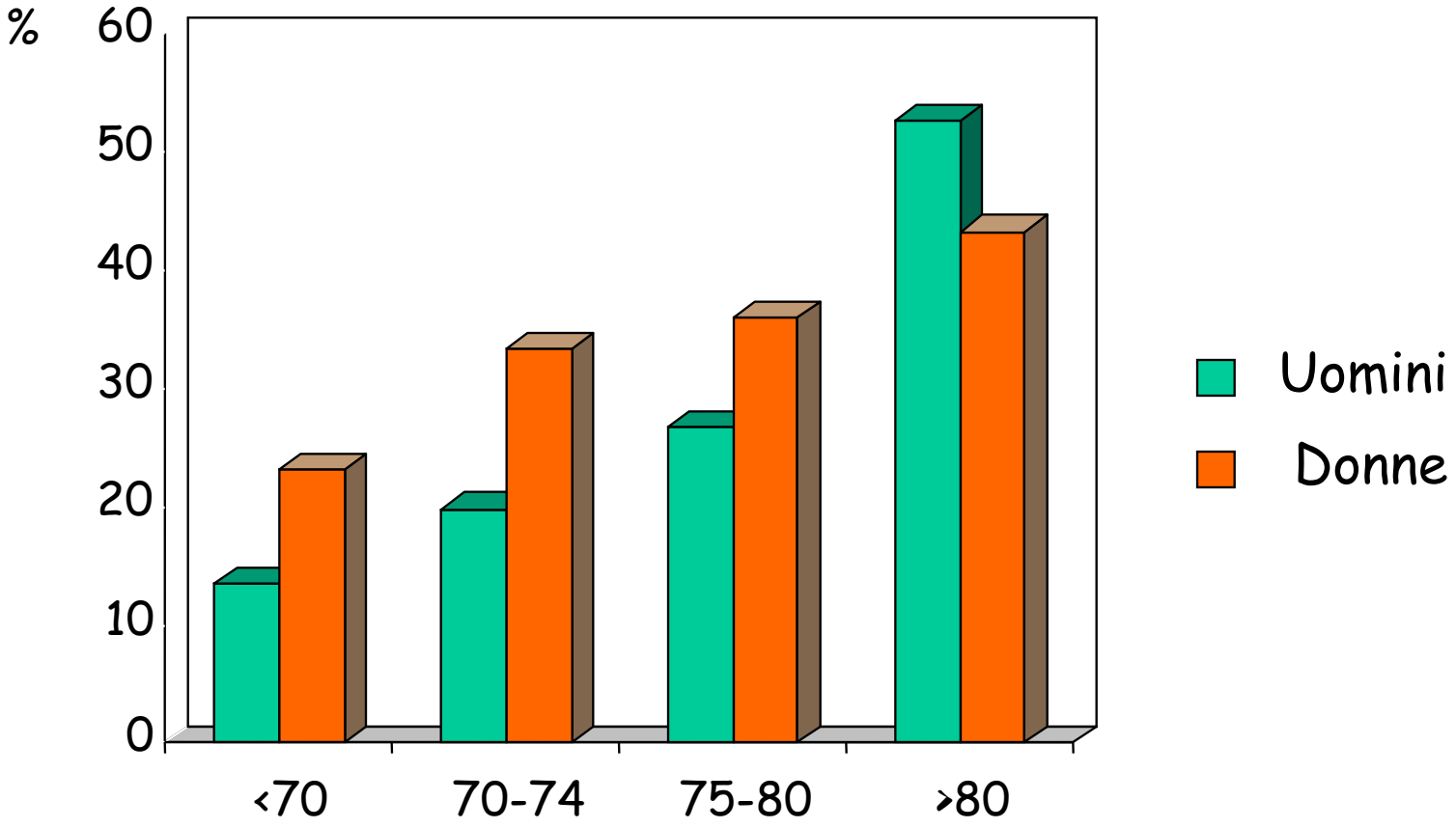
total Fat Free Mass (Kg)/ body weight (kg)

Janssen et al, J Am Geriatr Soc 2002, 50 (5), 889-896



Prevalenza di Sarcopenia -The New Mexico Elder Health Survey (n =883)

Baumgartner et al, 1998



massa muscolare appendicolare (Kg)

altezza $(mt)^2$

Modificazioni qualitative del tessuto muscolare con l'invecchiamento

Modificazioni istologiche e cellulari del tessuto muscolare scheletrico

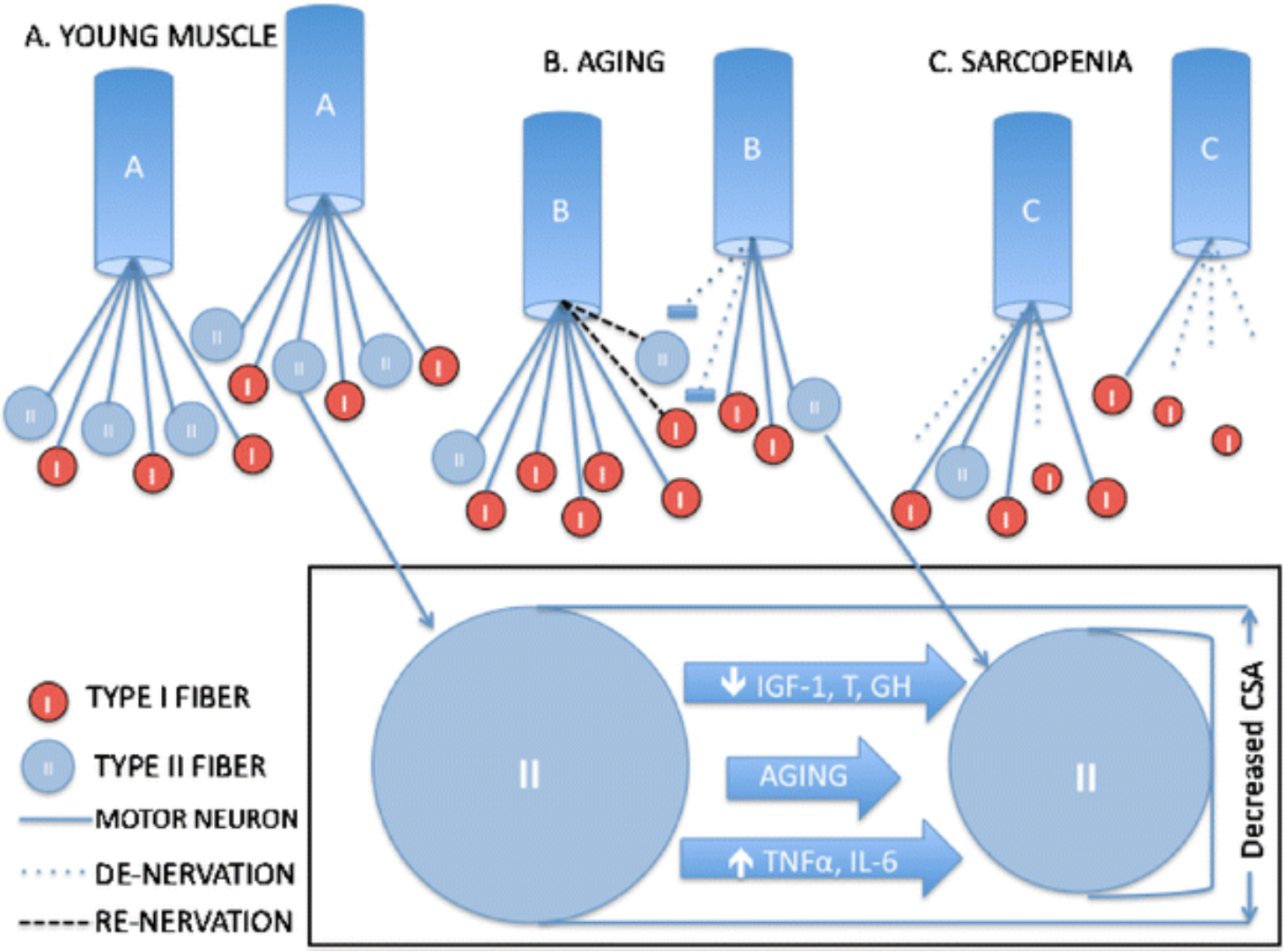
Infiltrazione di tessuto adiposo
Inter e intra-muscolare

hystological changes-1

- Decrease in myofiber cross sectional area
- Decrease in cross-bridging between Fibers
- Decrease in Number and Size of Mithocondria
- Decrease in protein synthesis, particularly of myosin
- Decrease in type II fibers
- Decrease in motor unit

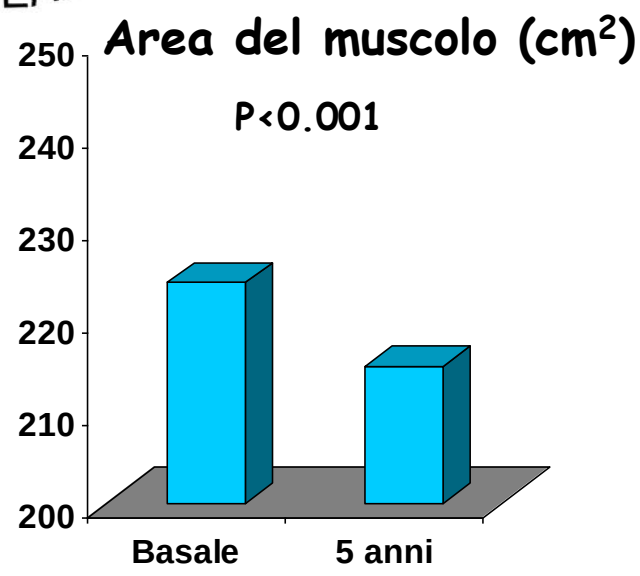
Thomas DR, Clinical Nutrition 26: 389-399, 2007
Ryall et al, Biogerontology 9: 213-228, 2008
Lang et al, Osteoporosis Int 21: 543-559, 2010

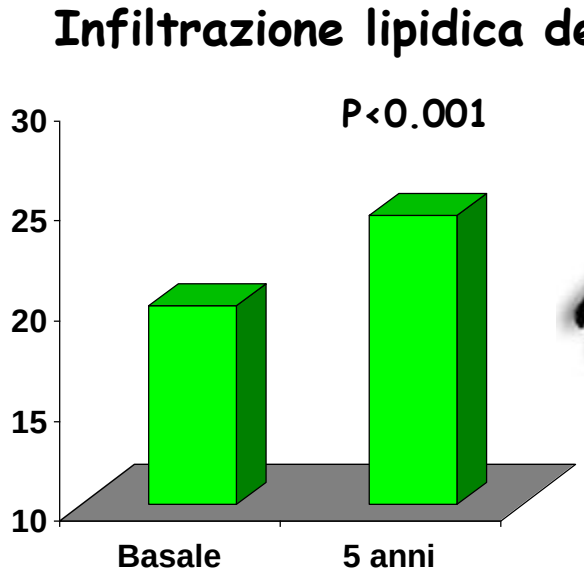
hystological changes-2



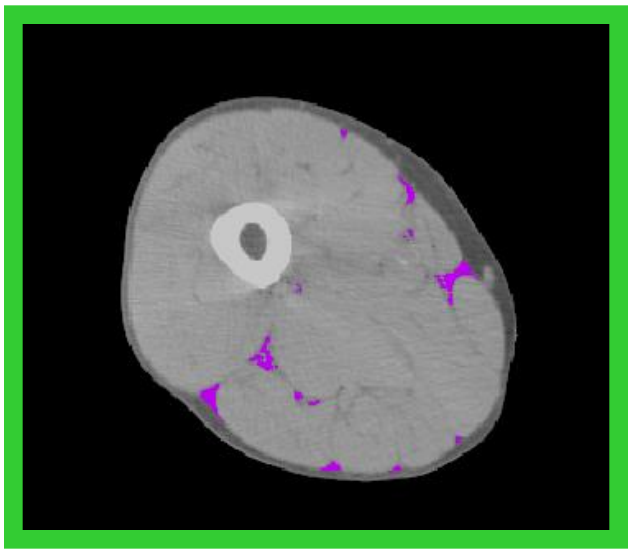
Lang T et al, Osteoporos Int 2010, 21, 543-559

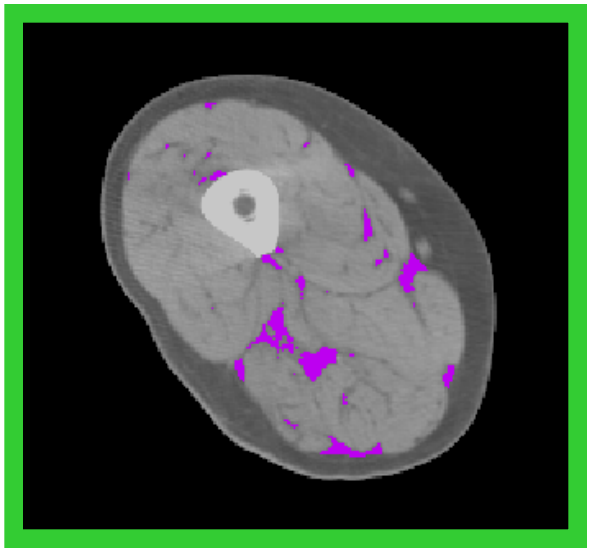
Modificazione della composizione corporea della coscia valutate mediante TAC nella popolazione in studio (n=1981) nel periodo di 5 anni di follow-up

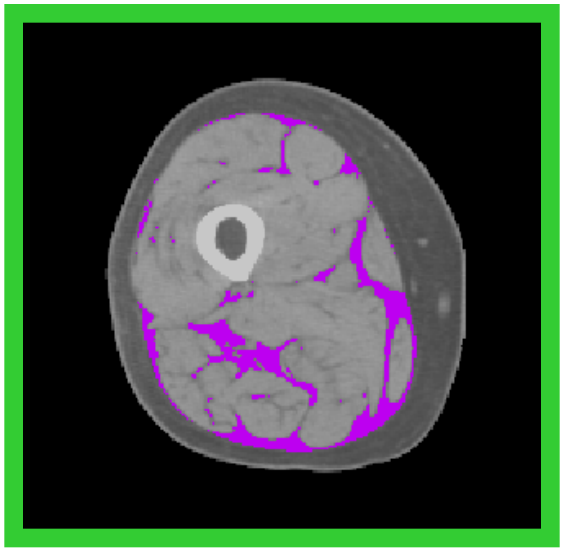




Health ABC



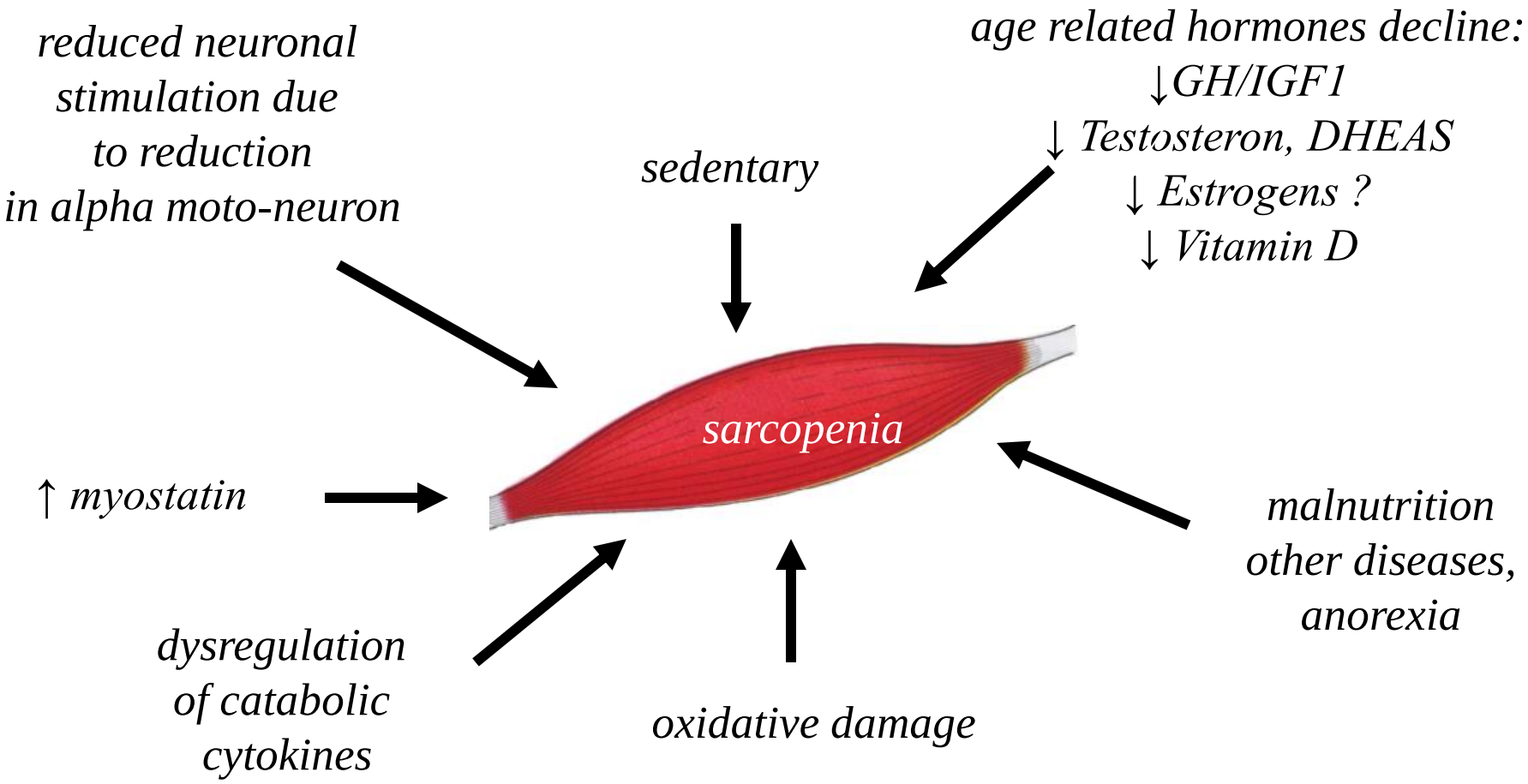




Rossi AP et al. J Geront 2011

1. Definizione
2. Patogenesi
3. Rilevanza clinica

Mechanisms involved in Sarcopenia

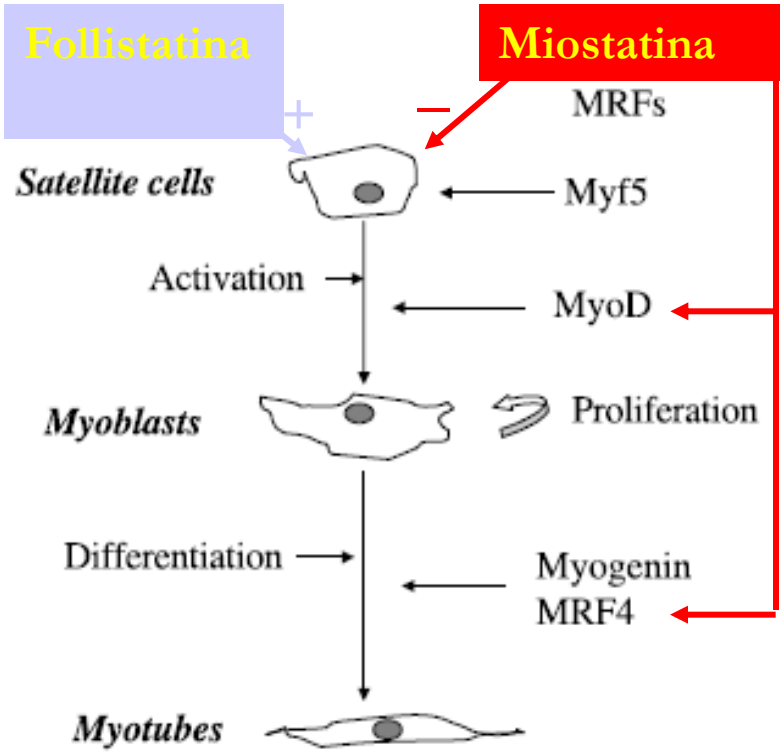


Vitamina D

- *Livelli Vitamina D associati a forza muscolare*
- *Bassi livelli di vitamina D associati ad aumentato rischio di miopatia da statina*
- *Supplementazione Vitamina D aumenta forza muscolare e riduce il rischio di caduta*

Miostatina

La Miostatina appartiene alla famiglia dei Transforming Growth Factor-β ed è un inibitore della crescita muscolare (McPherron et al., 1997)



-Agonista dei recettori per l'attivina di tipo I (ActR2A e ActR2B)

-Inibitore della sintesi ed attivazione dei fattori regolazione miogena- MRF (myoD)

-Inibitore della attivazione, proliferazione differenziazione delle cellule satelliti

-Modulatore della differenziazione delle cellule mesenchimali verso la linea adipogenica

Welle, 2002; Siriett, 2006; McCroskery, 2003

FIG. 2. A fullblood Belgian Blue bull showing the double muscling phenotype.

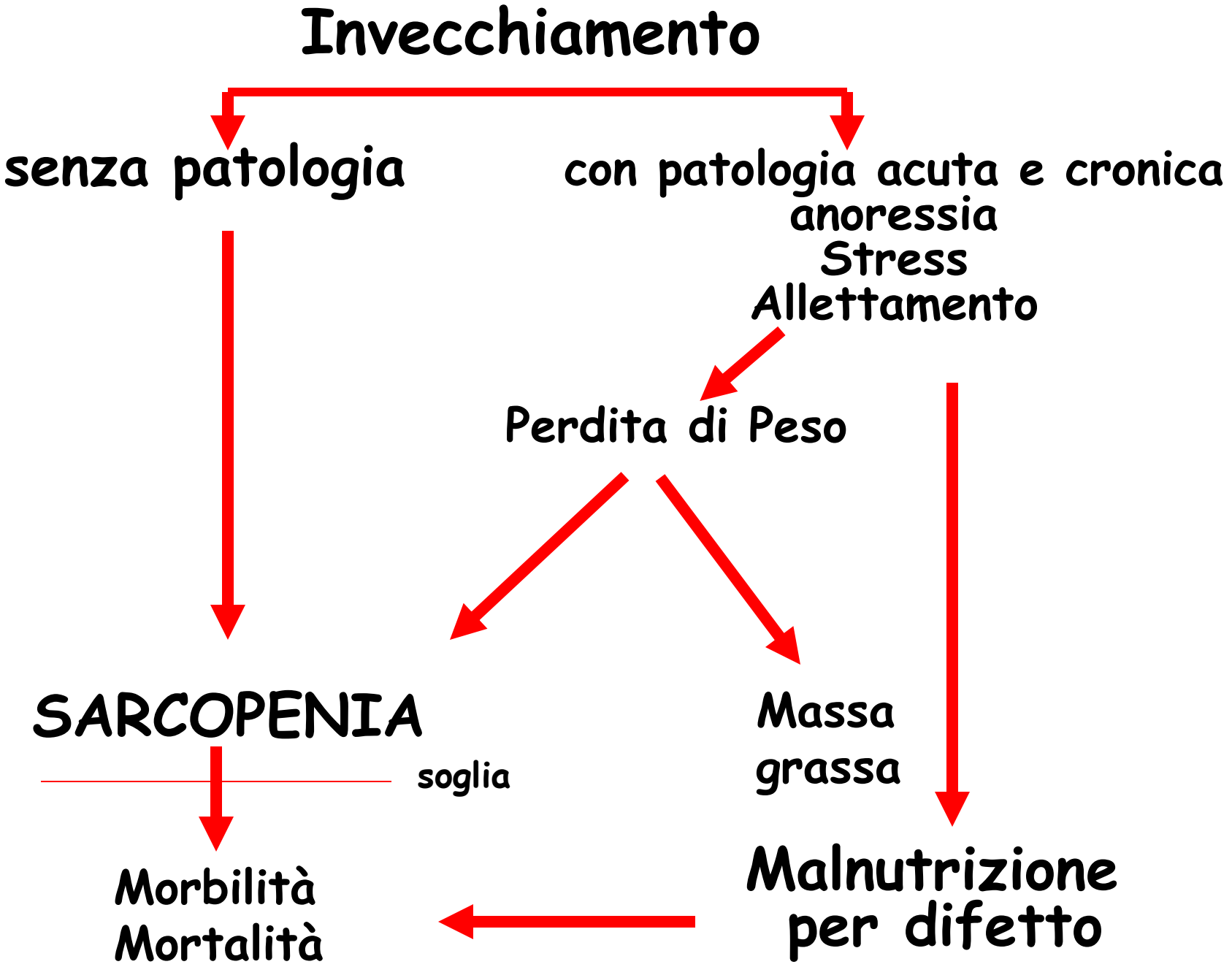
Effect of 10 Days of Bed Rest on Skeletal Muscle in Healthy Older Adults

Table. Effects of 10 Days of Bed Rest in Older Adults

	No. of Participants (N = 12)*	Mean (95% Confidence Interval)			*P* Value
		Bed Rest			
		Before	After	Change	
Muscle fractional synthetic rate, % per h†	10	0.077 (0.059 to 0.095)	0.051 (0.035 to 0.067)	−0.027 (−0.007 to −0.047)	.02
% Change				−30.0 (−7.0 to −54.0)	
DEXA lean mass, kg‡	10				
Whole body		48.05 (40.61 to 55.49)	46.51 (39.57 to 53.45)	−1.50 (−0.62 to −2.48)	.004
% Change				−3.2 (−1.4 to −5.0)	
Lower Extremity		15.01 (12.41 to 17.61)	14.06 (11.85 to 16.27)	−0.95 (−0.42 to −1.48)	.003
% Change				−6.3 (−3.1 to −9.5)	
Isokinetic muscle strength, Nm per s§	11	120 (96 to 145)	101 (81 to 121)	−19 (−11 to −30)	.001
% Change				−15.6 (−8.0 to −23.1)	

Abbreviation: DEXA, dual-energy x-ray absorptiometry; Nm, Newton meter.
*One participant was excluded from all analyses because of insufficient protein intake.
†Because of a technical error, the muscle fractional synthesis rate measurement was excluded for 1 participant.
‡One participant was excluded from the DEXA analysis because the scan before bed rest was not administered.
§Isokinetic knee extension at 60° per second.

Kortbein JAMA. 2007;297(16):1769-1774


Invecchiamento
senza patologia
con patologia acuta e cronica
anoressia
Stress
Allettamento
Perdita di Peso
SARCOPENIA
soglia
Massa grassa
Morbilità
Mortalità
Malnutrizione per difetto

1. Definizione
2. Patogenesi
3. Rilevanza clinica

"Sarcopenia, the loss of muscle mass and strength with age, is becoming recognized as a major cause of disability and morbidity in the elderly population."

Roubenoff and Hughes, 2000

Relazione tra Sarcopenia e Disabilità.

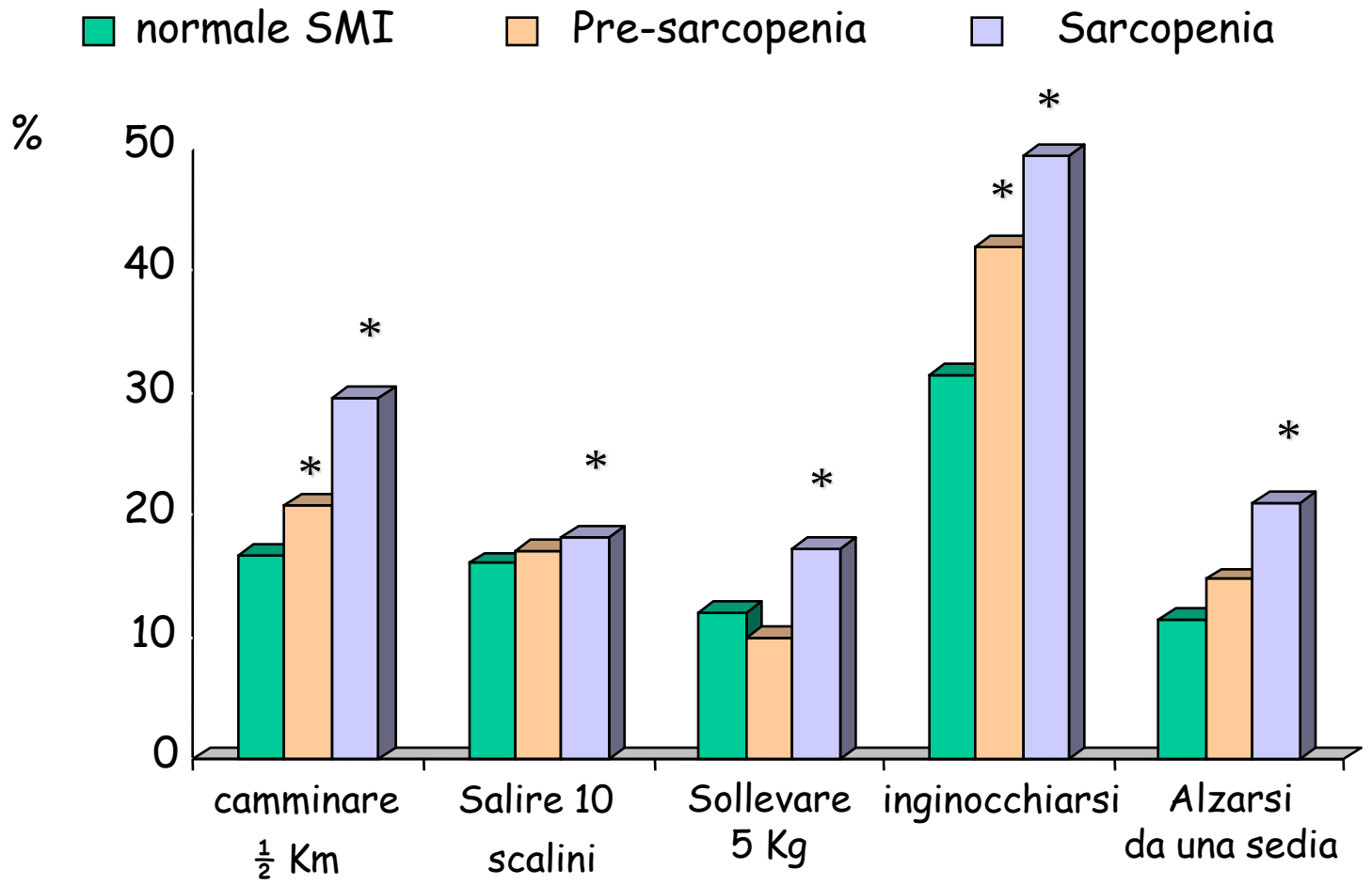
The New Mexico Elder Health Survey (n =883)

	Uomini	Donne
>3 disabilita' all'IADL	3.66 (1.42-10.02)	4.08 (1.52-11.31)
>1 alterazione dell'equilibrio	3.23 (1.13-9.74)	1.77 (0.48-5.75)
>1 anomalia nel cammino	1.87 (0.94-3.74)	1.12 (0.43-2.73)
Uso del bastone	2.29 (1.09-4.88)	1.79 (0.67-4.60)
Caduta nell'anno precedente	2.58 (1.42-4.73)	1.28 (0.60-2.67)

* dopo aggiustamento per eta', obesita', reddito, assunzione di alcolici, fumo, attivita' fisica e comorbilita'

Baumgartner et al, 1998

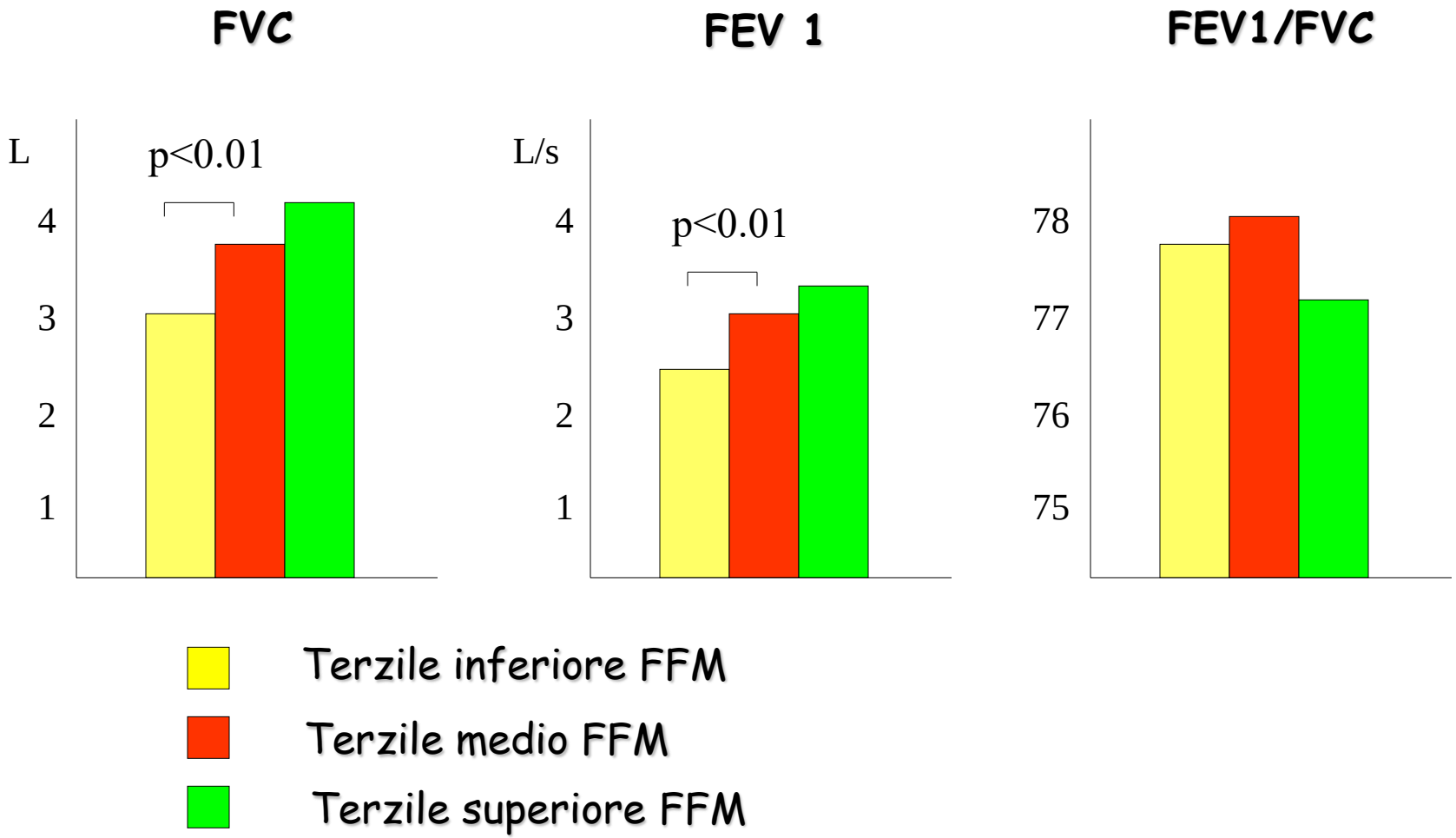
Prevalenza di limitazione funzionale e Sarcopenia
The NHANES III (n =2224 uomini > 60 anni)



* Significativamente maggiore rispetto a SMI normale ($p<0.05$)

Janssen et al, 1998

Funzione respiratoria in relazione a terzili di FFM nei soggetti di sesso maschile dopo aggiustamento per eta' e BMI

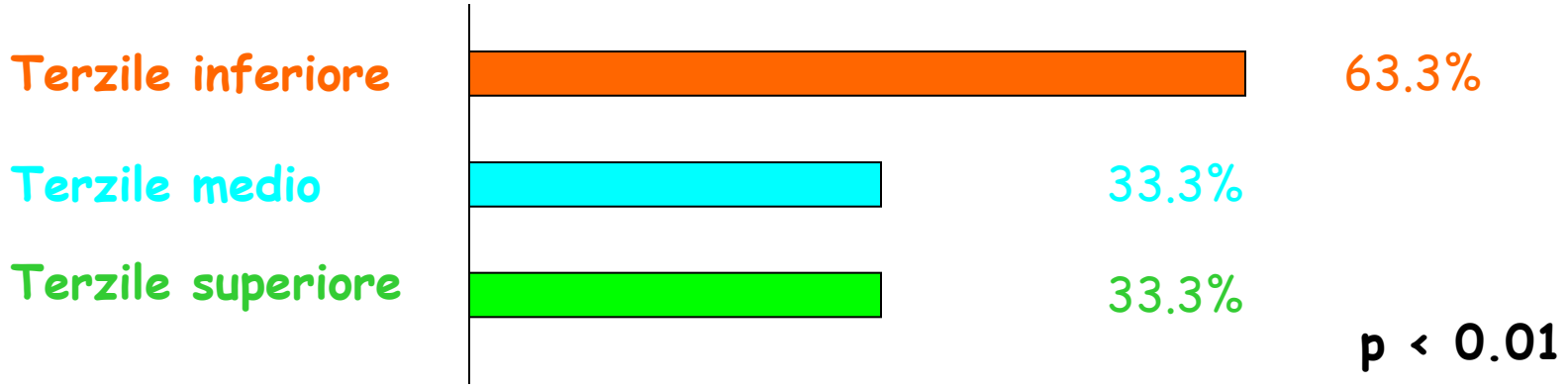


The American Journal of CLINICAL NUTRITION

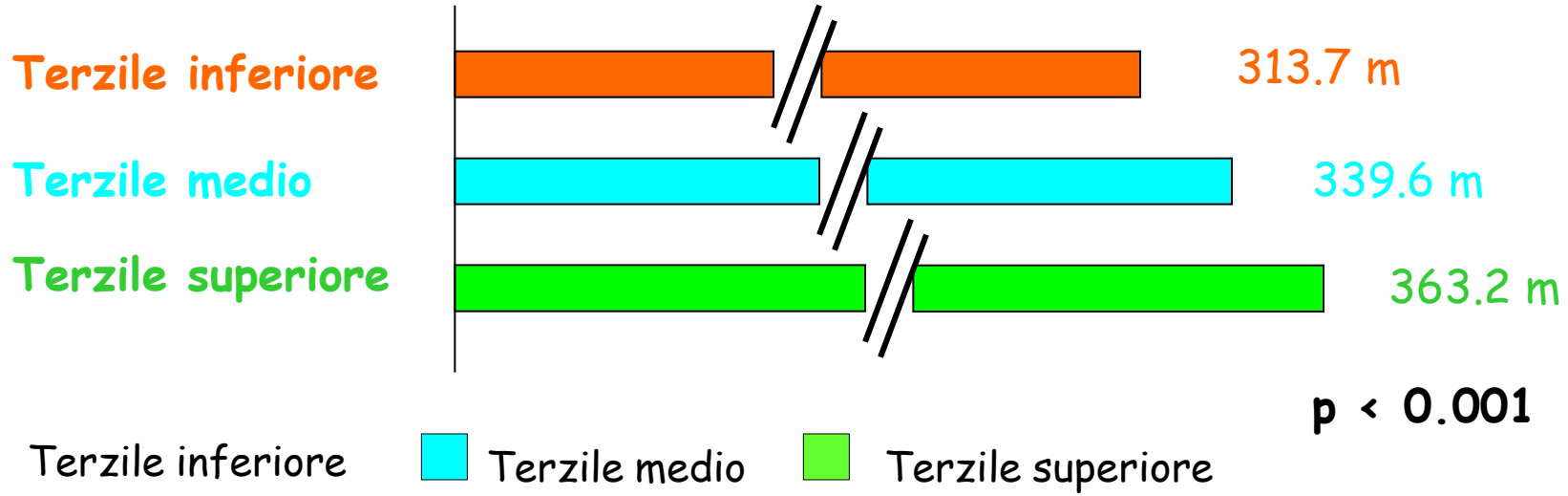
Santana et al, 2001

Stato funzionale e test del cammino dei 6 minuti, in relazione a terzili di forza muscolare della gamba dopo aggiustamento per BMI in 141 donne anziane

% disabili

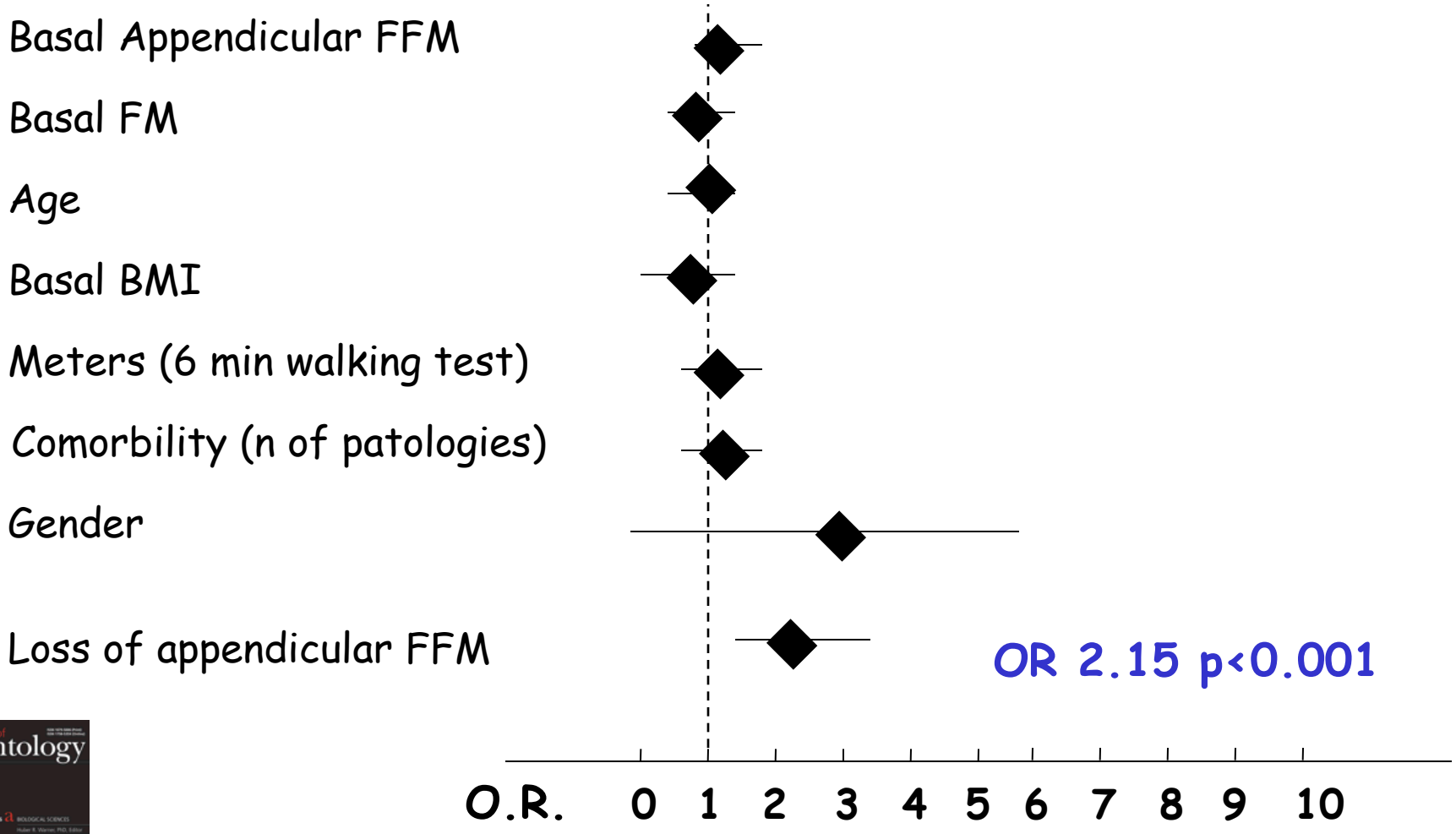


Test del cammino



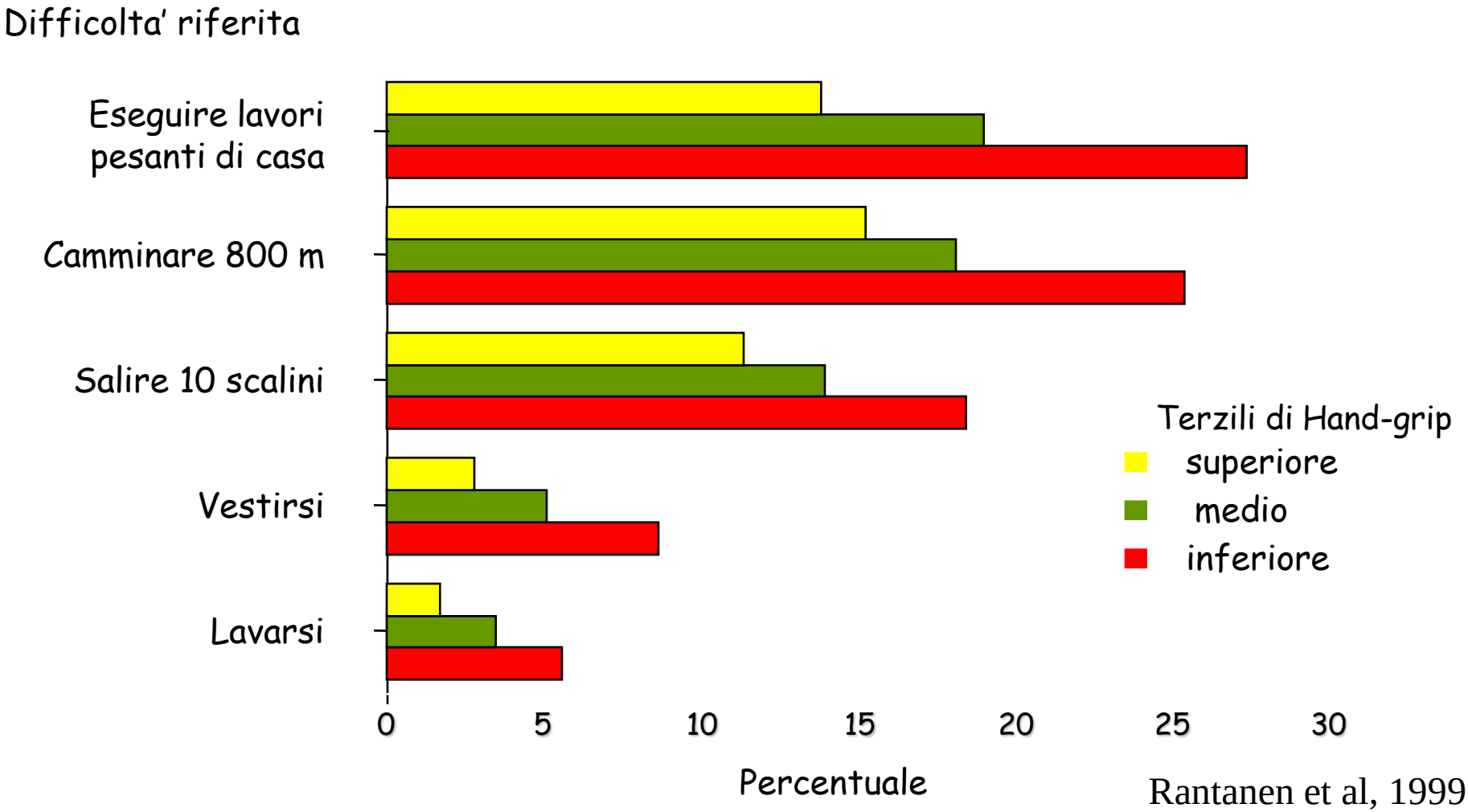
Zamboni et al, JAGS 1999

Predictors of worsening disability during the follow-up period 5.5 years (160 subjects older 70)

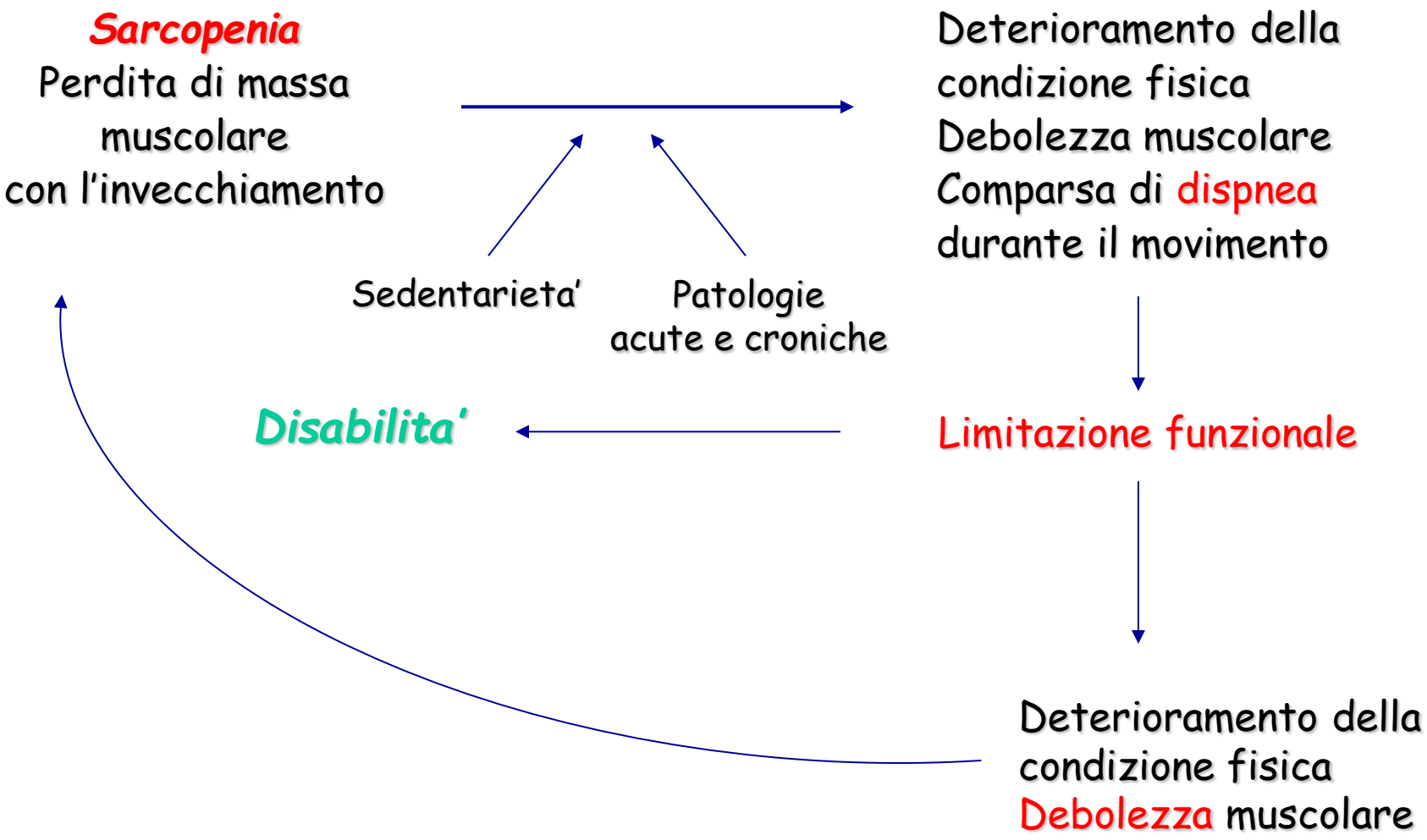


Fantin et al, 2007

Prevalenza di limitazione funzionale nel 1991-93 in relazione ai terzili di forza muscolare misurata con Hand-grip 25 anni prima (3,218 uomini sani 45-68 anni al basale)



Rantanen et al, 1999


Sarcopenia
Perdita di massa muscolare con l'invecchiamento
Deterioramento della condizione fisica
Debolezza muscolare
Comparsa di dispnea durante il movimento
Sedentarieta'
Patologie acute e croniche
Limitazione funzionale
Disabilita'
Deterioramento della condizione fisica
Debolezza muscolare