MÚSCULO, ENVEJECIMIENTO E INACTIVIDAD

VI CURSO DE EGRESADOS DE ALMA
"ACTIVIDAD FÍSICA, CAÍDAS Y FRACTURAS"
SANTA MARTA, COLOMBIA

Paulo Villas Boas
Disciplina de Geriatria
Departamento de Clínica Médica
Faculdade de Medicina de Botucatu - Unesp

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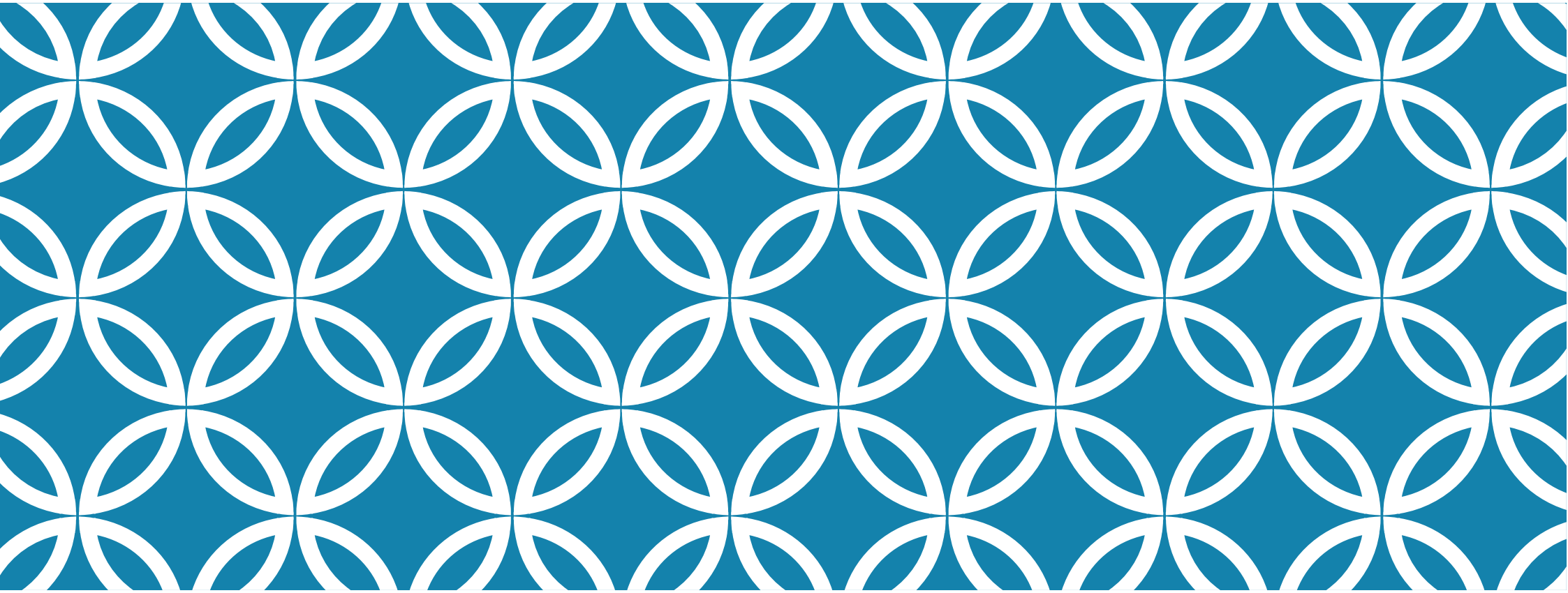
paulo.boas@unesp.br

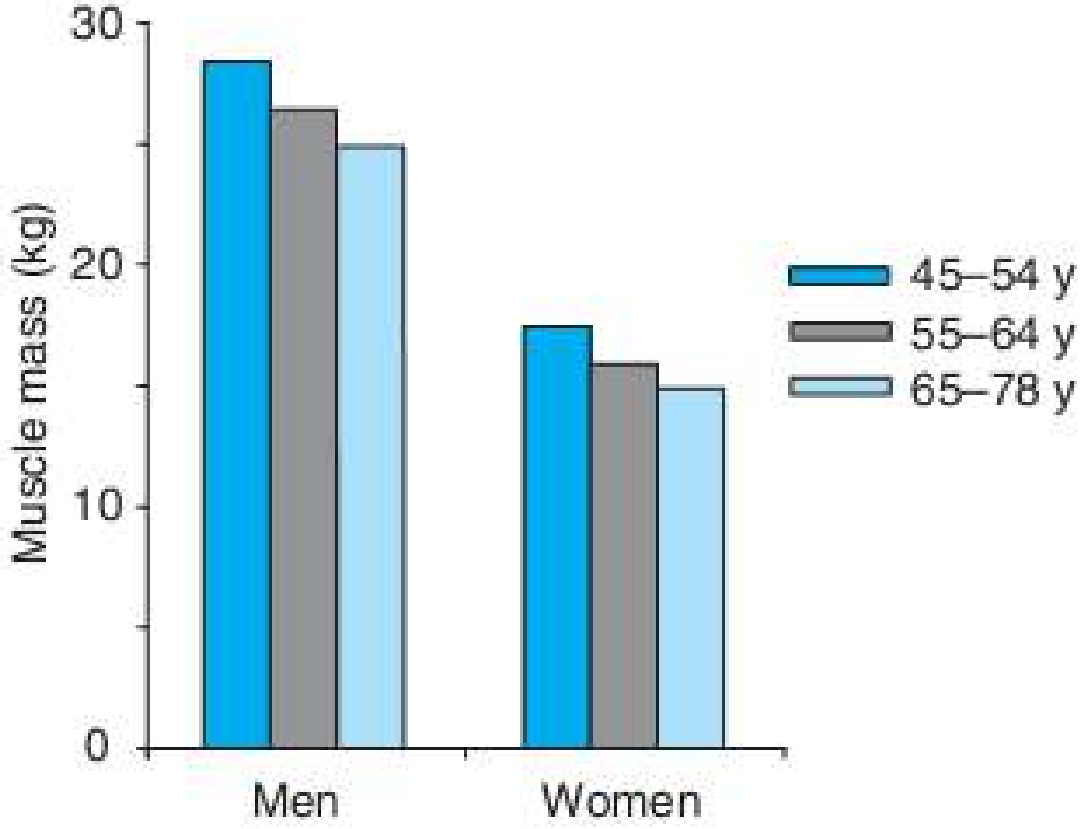
PLAN DE PRESENTACIÓN

- Músculo y envejecimiento
  - Reducción de masa muscular
- Inactividad
  - Causas
  - Clasificación
  - Quantidad perdida de masa muscular
- Conclusiones



MÚSCULO E ENVEJECIMIENTO

MASA MUSCULAR Y SEXO



Frontera et al J Appl Physiol. 1991;71:644.

REDUCCIÓN DE LA MASA MUSCULAR

- Después de 50 años

- Masa muscular - ↓ 1 a 2% por año
- Força muscular – ↓1,5% por año
  - **Después 60 anos**
    - **Masa muscular - ↓ 3% por año**

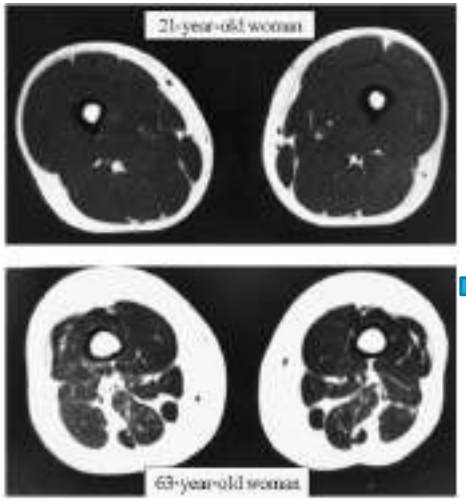


Table 1. Age-related reductions in quadriceps muscle fiber sizes.

Study	Gender	Age (years)	Percent reduction Type I	Type II
Larsson et al.[52]	M	22–65	1	25
Essen-Gustavsson and Borges[23]	M	20–70	15	19
	F	20–70	25	45
Lexell et al.[56]	M	15–83	1	29
Hakkinen et al.[35]	M	29–61	+8	10
Fiatarone Singh et al.[27]	M and F	72–98	+7	60
Hikida et al.[37]	M	58–78	24	40

Percentages compiled by the author from published data.

Vandervoort. Muscle Nerve 25:17–25, 2002.

Myoesteatose: presencia de tejido adiposo intermuscular y intramuscular

Reinders et al.
Am J Epidemiol. 2016;183(1):53–60

CAUSAS DE LA REDUCCIÓN DE MASA MUSCULAR (SARCOPENIA)

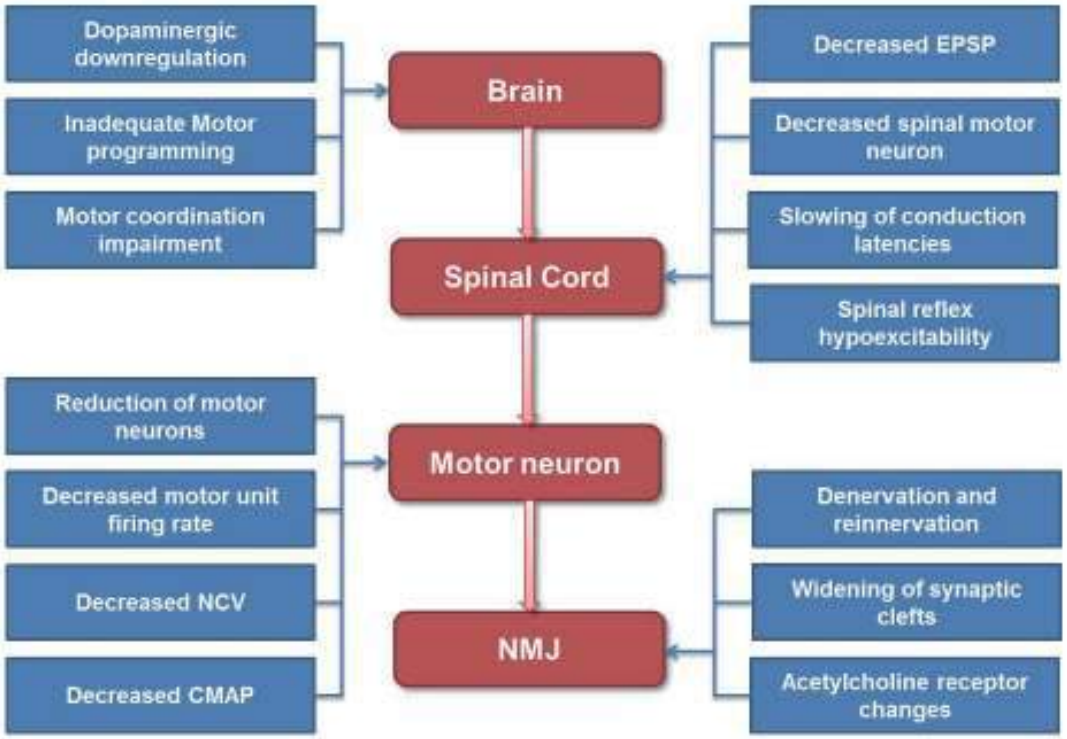
↓síntesis intrínseca proteínas musculares

↓ Proliferación de mioblastos
Diferenciación y la acumulación de proteínas en el músculo mecanismos de señalización: PI3-Kinase, MAP Kinase

↓30 a 50% PMT
Reinervacion por brotes colaterais com formación de grandes unidades motoras

Morley et al. J Cachexia Sarcopenia Muscle (2014) 5:253–259
Landi et al. European Ger Med 2016;7:197-200
Wolfe. *Am J Clin Nutr* 2006;84:475–82

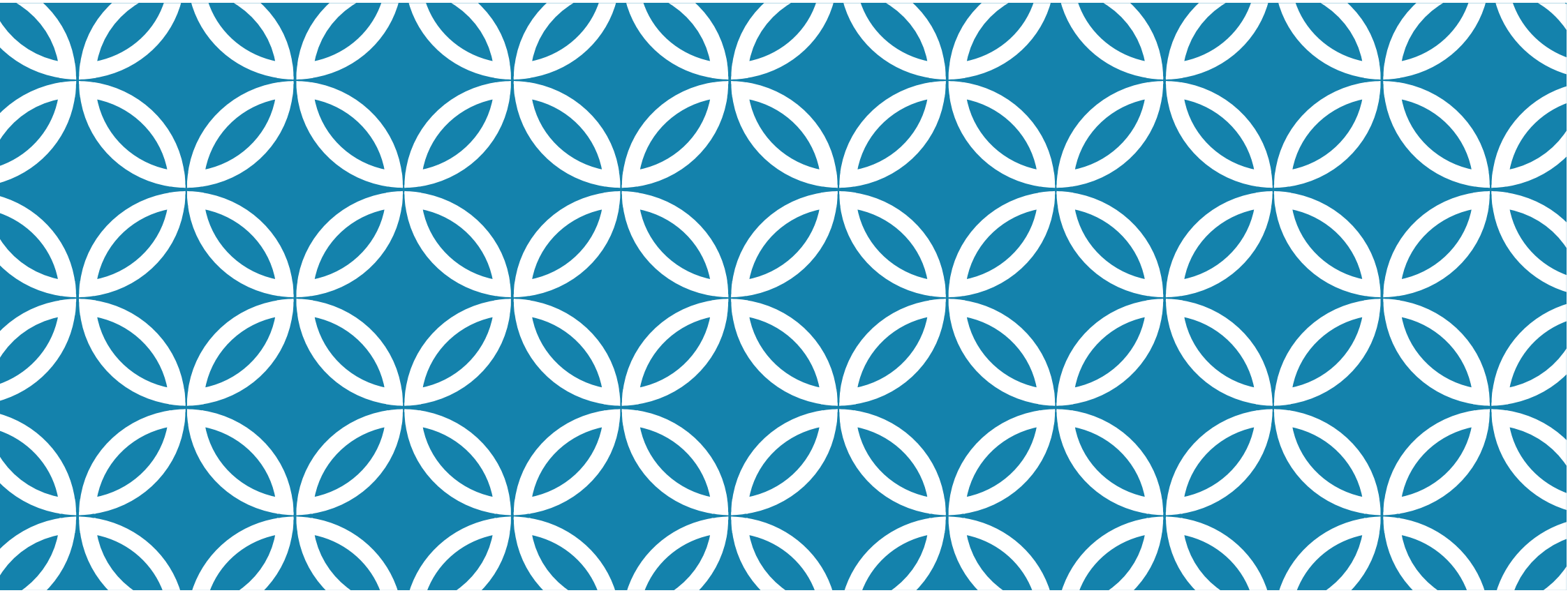
MECANISMOS NEUROLÓGICOS - REDUCCIÓN DE MASA MUSCULAR (SARCOPENIA)



EPSP - excitatory postsynaptic potentials
NCV - nerve conduction velocity
CMAP - compound muscle action potentials
NMJ – neuromuscular junction

Kwon, et al. J Bone Metab 2017;24:83-88

Landi et al. European Ger Med 2016;7:197-200



INATIVIDAD

INACTIVIDAD DEL MÚSCULO ESQUELÉTICO

- Causas
  - Lesión
  - Enfermedad
  - Inactividad física

- Classificacion
  - Período relativamente prolongado (> 10 días)
  - Período corto de desuso muscular (<10 días)

B.T. Wall et al. Ageing Research Reviews 2013 ;12(4):898-906

INACTIVIDAD FÍSICA

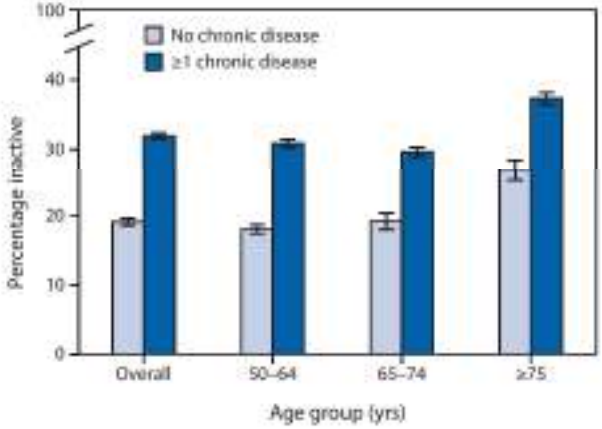
Physical Inactivity Among Adults Aged 50 Years and Older — United States, 2014

Kathleen B. Watson, PhD[1]; Susan A. Carlson, PhD[1]; Janelle P. Gunn, MPH[1]; Deborah A. Galuska, PhD[1]; Ann O'Connor, MPA[1]; Kurt J. Greenlund, PhD[1]; Janet E. Fulton, PhD[1]

MMWR / September 16, 2016 / Vol. 65 / No. 36

Characteristic	Sample: Unweighted sample size no. (%)	Prevalence of inactivity: % prevalence† (95% CI)	Prevalence of inactivity: aPR§ (95% CI)
Total	**276,919 (100.0)**	**27.5 (27.2–27.9)**	—
Sex			
Male	114,367 (47.8)	25.5 (25.0–26.0)	Ref
Female	162,552 (52.2)	29.4 (29.0–29.9)	1.1 (1.1–1.2)
Age group (yrs)			
50–64	133,362 (57.8)	25.4 (25.0–25.9)	Ref
65–74	82,474 (24.4)	26.9 (26.3–27.5)	1.1 (1.0–1.1)
>75	61,083 (17.8)	35.3 (34.5–36.1)	1.3 (1.3–1.4)

FIGURE 2. Prevalence of self-reported physical inactivity among adults aged ≥50 years, by chronic disease status* and age group — Behavioral Risk Factor Surveillance System, 2014



"During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?"

INACTIVIDAD FÍSICA

Prevalência e fatores associados à inatividade física em idosos: um estudo de base populacional

Prevalence and factors associated with physical inactivity among the elderly: a population-based study

André Queiroz Ribeiro[I]
Sara Maria Lopes Salgado[I]
Ivani Soleira Gomes[II]
Aline Siqueira Fogal[I]
Karina Oliveira Martinho[I]
Luciene Fátima Fernandes Almeida[I]
Wederson Cândido de Oliveira[I]

Rev. Bras. Geriatr. Gerontol., Rio de Janeiro, 2016; 19(3):483-493

Variáveis	Total n (%)	Prevalência (%)	RP (IC 95%)	Valor *p*
Sexo				0,023*
Feminino	331 (53,3)	66,2	1,0	
Masculino	290 (46,7)	74,5	1,12 (1,02-1,25)	
Faixa etária (anos)				**0,001**#
60 a 69	311 (50,1)	65,3	1,00	
70 a 79	216 (34,8)	71,3	1,09 (0,97-1,22)	
80 e mais	94 (15,1)	82,9	1,27 (1,12-1,44)	

INACTIVIDAD E REDUCCIÓN DEL MÚSCULO ESQUELÉTICO

Study	Model of disuse	Duration of disuse (days)	Muscle loss (%/day)	Strength loss (%/day)	Changes in muscle protein synthesis	Changes in signaling
Kortebein et al. (2007)	Bed-rest	10	0.6	1.5	30% ↓	–
Kortebein et al. (2008)	Bed-rest	10	–	1.3	–	–
Suetta et al. (2009)	Immobilization	14	0.4	1.1	–	–
Ferrando et al. (2010)	Bed-rest	28	0.2	–	30% ↓	–
Hvid et al. (2010)	Immobilization	14	1.0 (type II fiber CSA)	1.8	–	–
Hvid et al. (2011)	Immobilization	14	–	1.6 (single fiber force)	–	–
Smith et al. (2012)	Immobilization	4	2.3	3.5	–	↑ MAFBx and MuRF1 gene expression (4 days)
		14	0.9 (fiber CSA)	1.1		
Drummond et al. (2012)	Bed-rest	7	0.6	–	40% ↓ (postprandial)	↑ mTOR protein content, ↓ mTOR phosphorylation in response to EAA
Deutz et al. (2013)	Bed-rest	10	0.5	0.9 (NS)	21% ↓	

Abbreviations: CSA, cross sectional area; MAFBx, muscle atrophy F-Box/atrogin-1; MuRF1, muscle-specific RING-finger protein 1; mTOR, mammalian target of rapamycin; NS, non-significant.

B.T. Wall et al. Ageing Research Reviews 2013 ;12(4):898-906

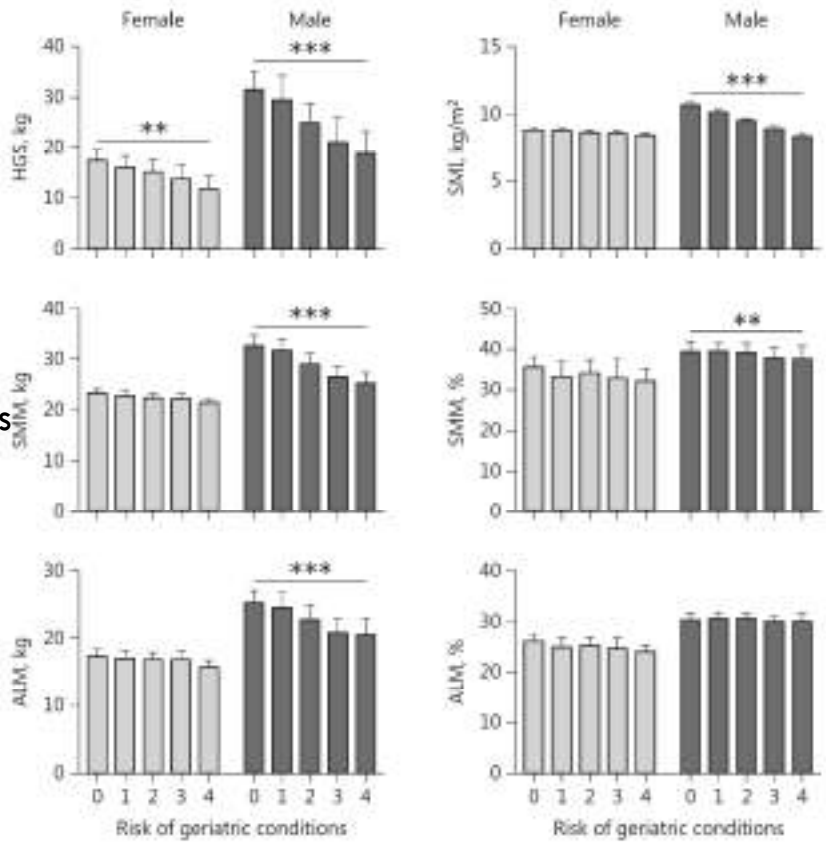
INACTIVIDAD – HOSPITALZACION REDUCCIÓN DEL MÚSCULO

EMPOWER study
373 patients aged 70 > years
(mean age: 79.6 ± 6.38 years)
wards of the VU University Medical Center
risk of 4 geriatric conditions

Hand grip strength

Skeletal muscle mass

Apendicular lean mass

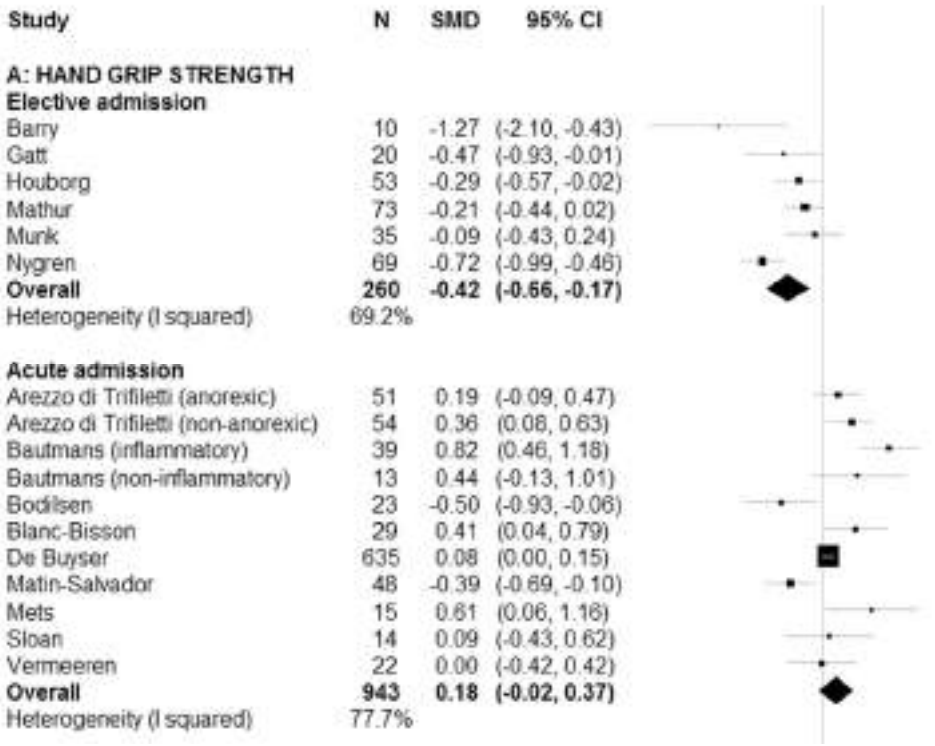


Van Ancum et al. Gerontology 2017;63:507–514

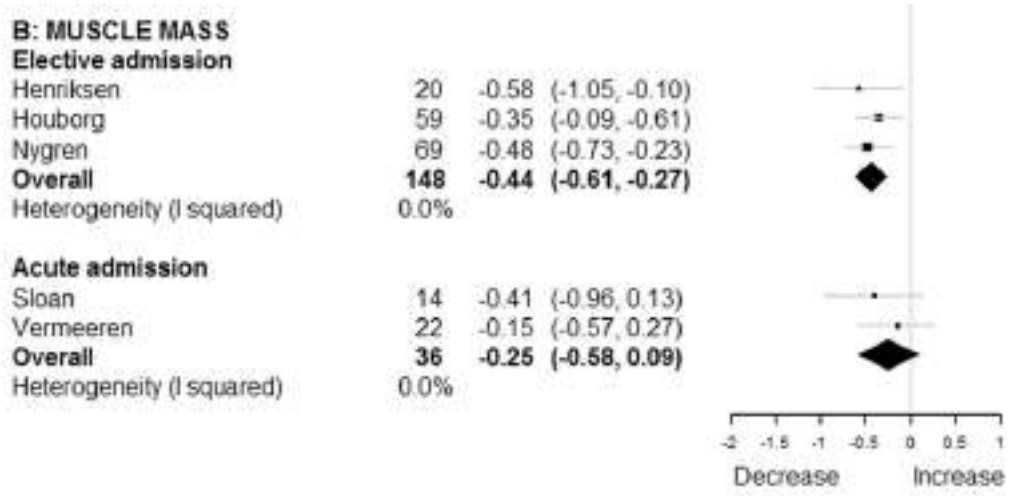
delirium, falls, malnutrition, and functional disability

INACTIVIDAD – HOSPITALZACION REDUCCIÓN DEL MÚSCULO

25 estudios
1,789 pacientes
Edad: 65-89 años
Mediana estancia hospitalaria: 14,7 días



Study	N	SMD	95% CI
A: HAND GRIP STRENGTH			
Elective admission			
Barry	10	-1.27	(-2.10, -0.43)
Gatt	20	-0.47	(-0.93, -0.01)
Houborg	53	-0.29	(-0.57, -0.02)
Mathur	73	-0.21	(-0.44, 0.02)
Munk	35	-0.09	(-0.43, 0.24)
Nygren	69	-0.72	(-0.99, -0.46)
Overall	**260**	**-0.42**	**(-0.66, -0.17)**
Heterogeneity (I squared)	69.2%		
Acute admission			
Arezzo di Trifiletti (anorexic)	51	0.19	(-0.09, 0.47)
Arezzo di Trifiletti (non-anorexic)	54	0.36	(0.08, 0.63)
Bautmans (inflammatory)	39	0.82	(0.46, 1.18)
Bautmans (non-inflammatory)	13	0.44	(-0.13, 1.01)
Bodilsen	23	-0.50	(-0.93, -0.06)
Blanc-Bisson	29	0.41	(0.04, 0.79)
De Buyser	635	0.08	(0.00, 0.15)
Matin-Salvador	48	-0.39	(-0.69, -0.10)
Mets	15	0.61	(0.06, 1.16)
Sloan	14	0.09	(-0.43, 0.62)
Vermeeren	22	0.00	(-0.42, 0.42)
Overall	**943**	**0.18**	**(-0.02, 0.37)**
Heterogeneity (I squared)	77.7%		

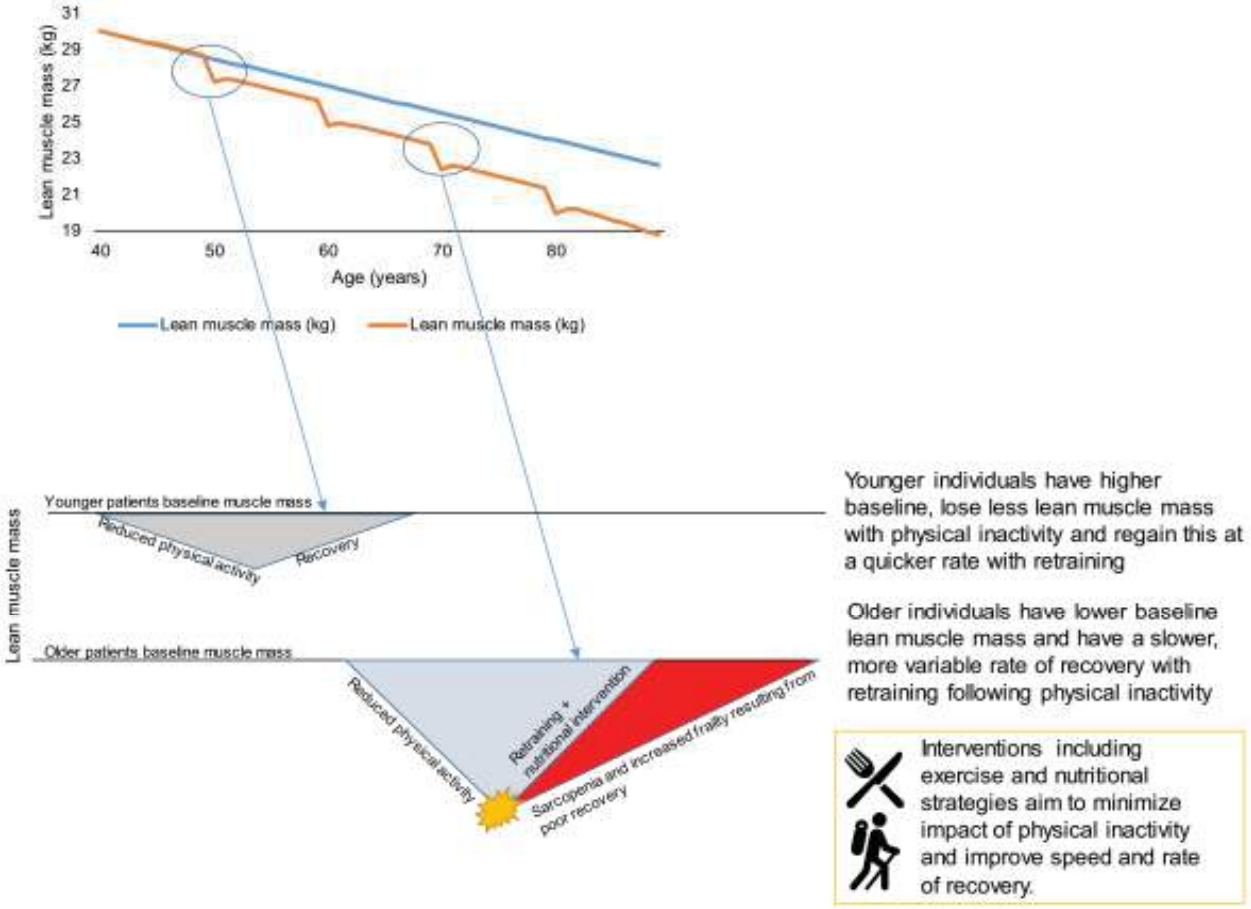


B: MUSCLE MASS			
Elective admission			
Henriksen	20	-0.58	(-1.05, -0.10)
Houborg	59	-0.35	(-0.09, -0.61)
Nygren	69	-0.48	(-0.73, -0.23)
Overall	**148**	**-0.44**	**(-0.61, -0.27)**
Heterogeneity (I squared)	0.0%		
Acute admission			
Sloan	14	-0.41	(-0.96, 0.13)
Vermeeren	22	-0.15	(-0.57, 0.27)
Overall	**36**	**-0.25**	**(-0.58, 0.09)**
Heterogeneity (I squared)	0.0%		

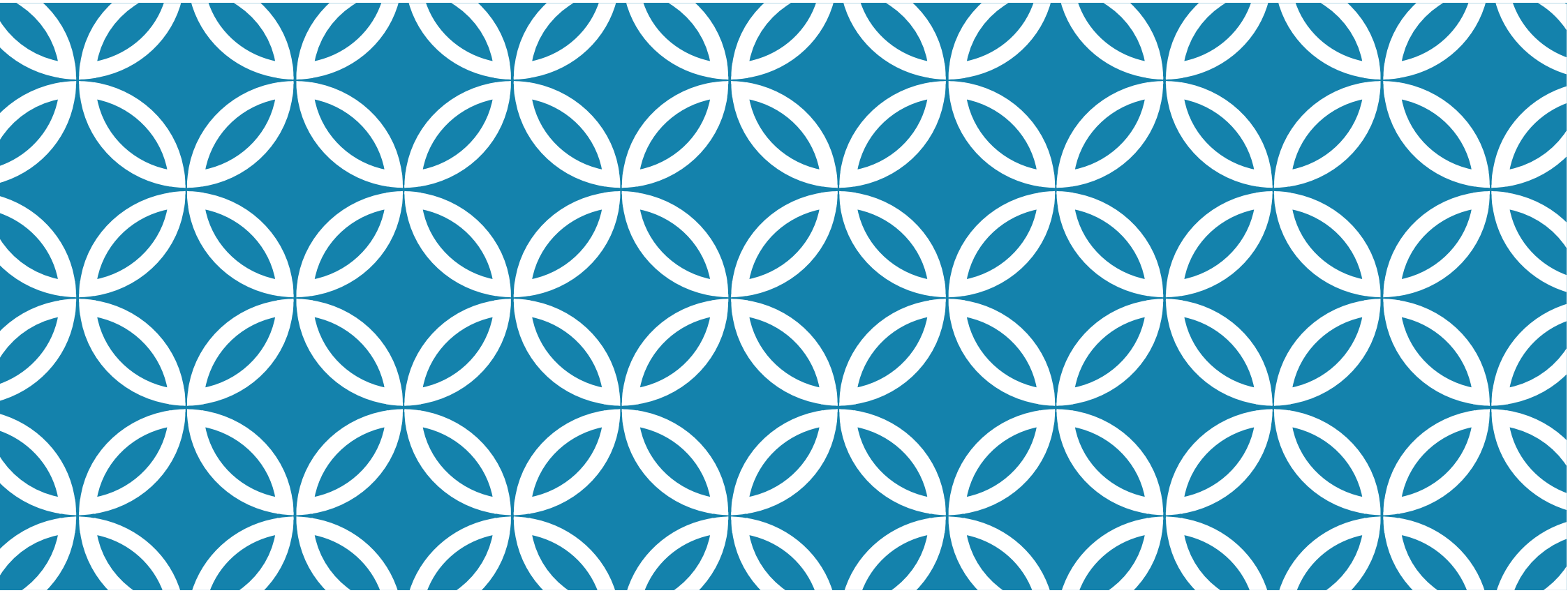
-2 -1.5 -1 -0.5 0 0.5 1
Decrease Increase

Van Ancum et al. Experimental Gerontology 2017;92: 34-41

CATABOLIC CRISIS – CONDICCIONES AGUDAS



Bowden Davies et al.
Ther Adv Endocrinol Metab 2019, 10: 1–15



CONCLUSIONES

CONCLUSIONES

- El envejecimiento conduce a una reducción de la masa muscular
- Varios mecanismos contribuyen a este aspecto
- Inactividad
  - Varias causas
- En la Hospitalización
  - Pérdida de masa muscular y fuerza muscular
  - Depende de la razón de la hospitalización

AGRADECIMIENTOS

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¡GRACIAS POR LA ATENCIÓN!

paulo.boas@unesp.br