



Instituto de Envejecimiento



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Centro de Investigación Biomédica en Red  
Fragilidad y Envejecimiento Saludable

## VI CURSO DE ALMA

# Obesidad, sarcopenia y osteoporosis.

Dra. Lizbeth González Avila  
25 de febrero de 2020



# Health and Economic Costs of Physical Inactivity

Joanna Kruk

## Abstract

Physical inactivity has reached epidemic levels in developed countries and is being recognized as a serious public health problem. Recent evidence shows a high percentages of individuals worldwide who are physically

per week in addition to usual activities. Living in sedentary lifestyle is one of the leading causes of deaths and a high risk factor for several chronic diseases, like cancer, cardiovascular disease, diabetes type 2, and osteoporosis. This article summarizes evidence for relative risk of the civilization diseases attributable to physical inactivity and the most important conclusions available from the recent investigations computing the economic costs specific to physical inactivity. The findings provide health and economic arguments needed for people to understand the

for prevention of physical inactivity.

**Keywords:** Physical inactivity - civilization diseases - risk factors - economic costs

**Table 2. Economic Costs Per Years of Diseases Attributable to Physical Inactivity**

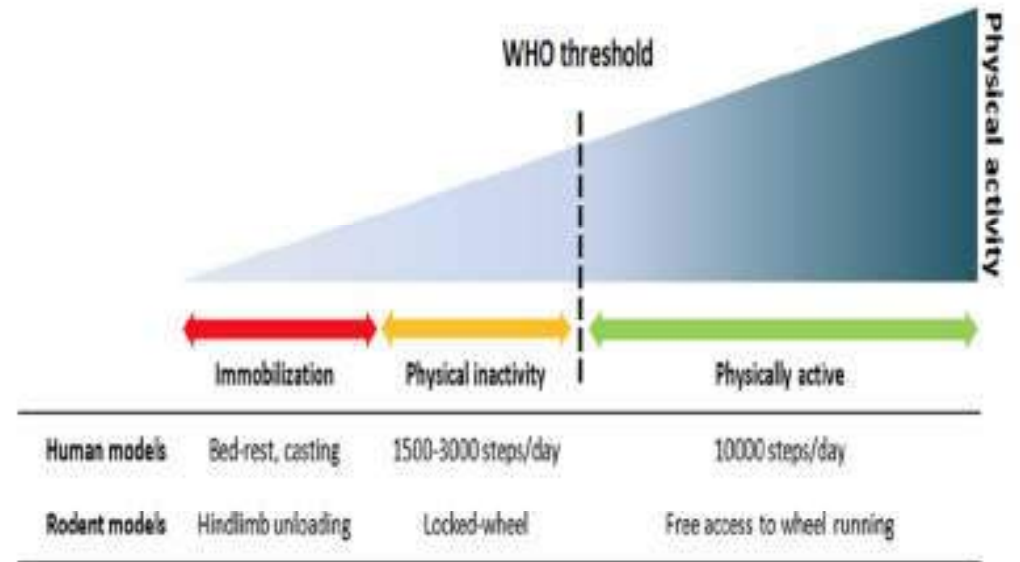
Country/State	Direct costs	Indirect costs	Source
Canada (2007)	\$ 2.4 billion	\$ 4.3 billion	Janssen (2012)
China (2007)	USD 3.5 billion	USD 3.3 billion	Zhang and Chaaban (2013)
Australia (2008)	\$ 719 million	\$ 9.299 million	Medibank (2008)
Czech Republic (2008)	Total healthcare costs Kč 14,637 million		Maresova (2014)
New Zealand (2010)	\$ 614 million	\$ 262-396 million	Wellington Regional Strategy 2013
Switzerland (2001)	Sfr 1,579 million	Sfr 805 million	Martin et al. (2001); Scarborough et al. (2011)
United Kingdom (2006-2007)	£ 936 million	£ 7,264 million	Allender et al. (2007)
California Countries (2006)	USD 7.9 billion	USD 12.3 billion	Chenoweth and Associates, Inc (2009)
USA (2003)	Total costs for all adults USD 251.11 billion		Chenoweth and Leutzinger (2006)

\*Abbreviations: Kč-Czech korone; Sfr-Switzerland frank

# The brown bear as a translational model for sedentary lifestyle-related diseases

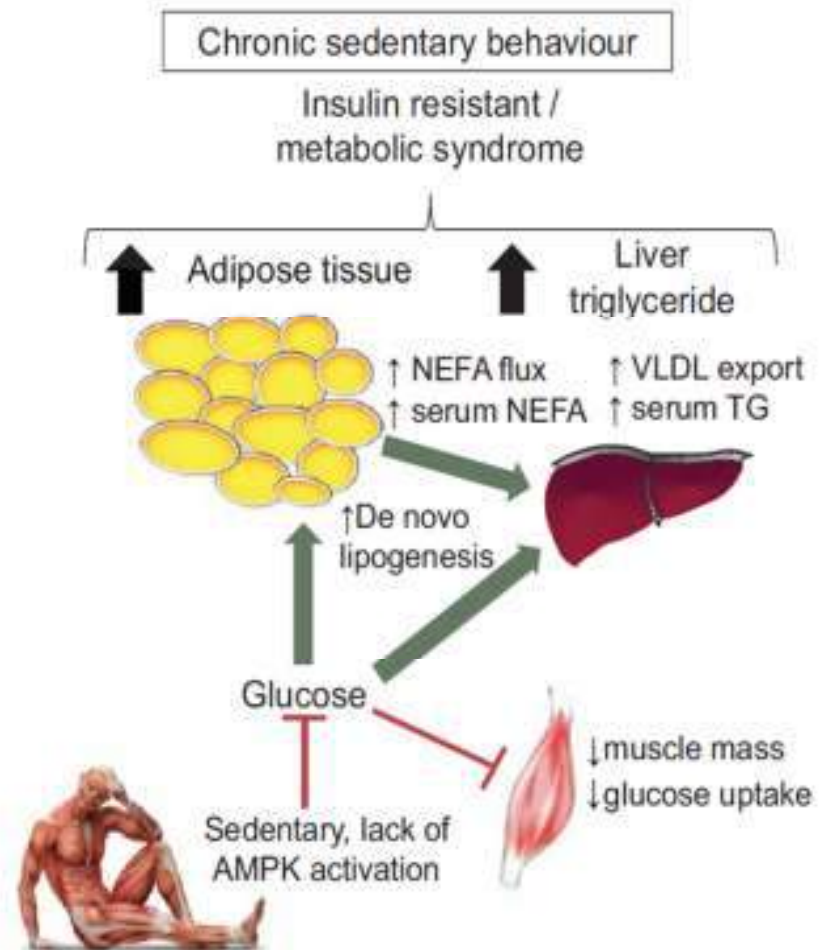
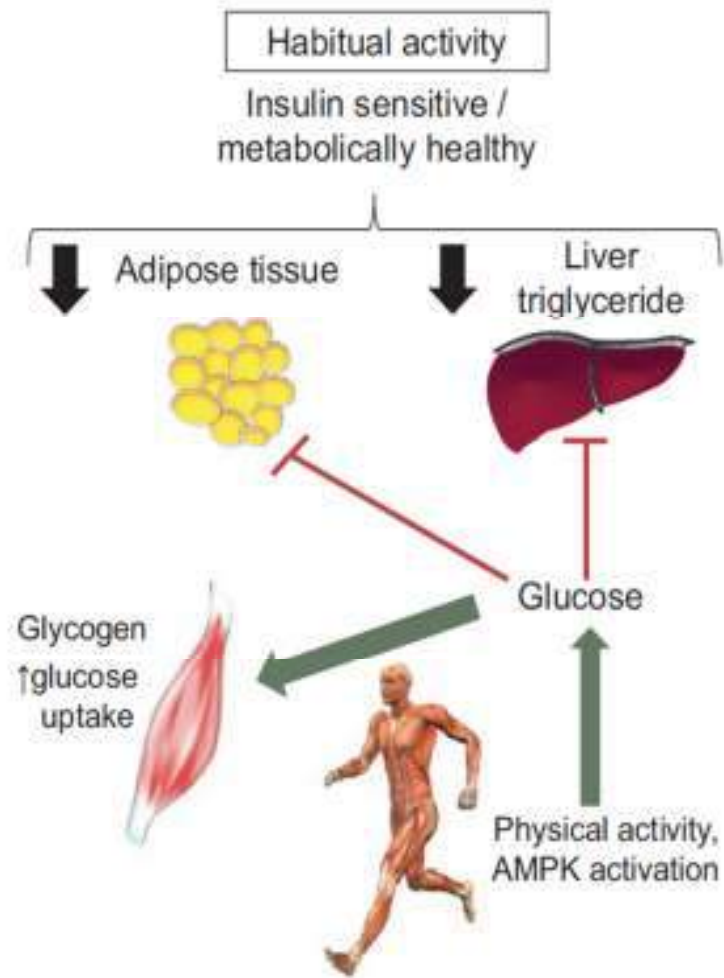
Q. Frøbert<sup>1</sup>, A. M. Frøbert<sup>2</sup>, J. Kindberg<sup>3,4</sup>, J. M. Arnemo<sup>5</sup> & M. T. Overgaard<sup>2</sup>

From the <sup>1</sup>Department of Cardiology, Faculty of Health, Örebro University, Örebro, Sweden; <sup>2</sup>Department of Chemistry and Bioscience, Aalborg University, Aalborg, Denmark; <sup>3</sup>Department of Wildlife, Fish and Environmental Studies, Swedish University of Agricultural Sciences, Uppsala, Sweden; <sup>4</sup>Norwegian Institute for Nature Research, Trondheim; and <sup>5</sup>Department of Forestry and Wildlife Management, Inland Norway University of Applied Sciences, Koppang, Norway



- Fracturas osteoporóticas
- Caídas
- Hospitalizaciones
- Calidad de vida

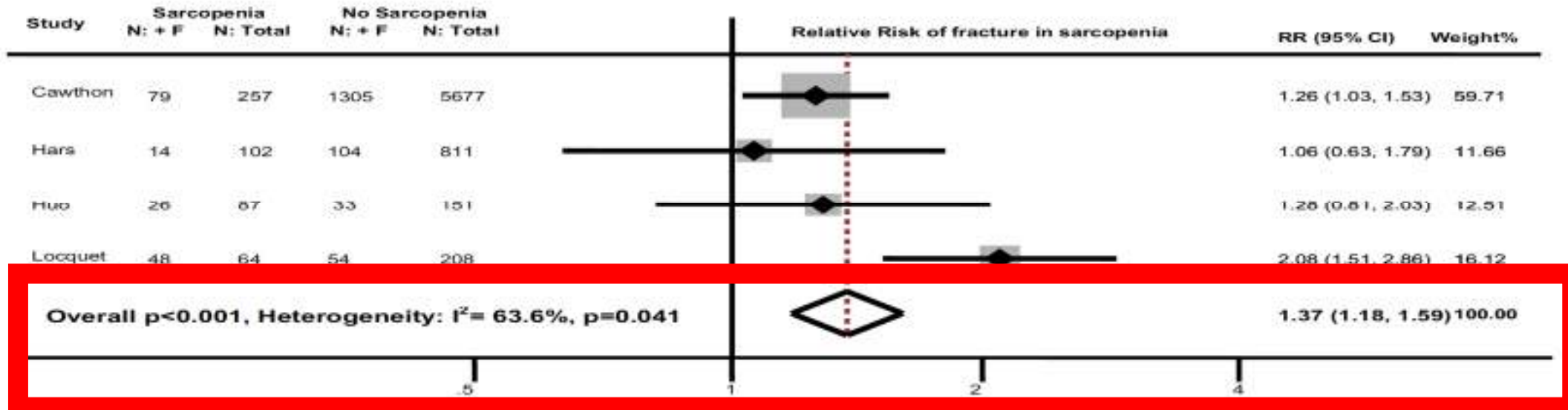




## Sarcopenia and osteoporosis in older people: a systematic review and meta-analysis

Barbara Rubek Nielsen<sup>1</sup> · Jawdat Abdulla<sup>1</sup> · Hanne Elkjær Andersen<sup>1</sup> · Peter Schwarz<sup>2</sup> · Charlotte Suetta<sup>3</sup>

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- Mayor riesgo de **fracturas osteoporóticas** en personas sarcopenicas que no sarcopenicas RR 1.37 (1.18 – 1.59)
- Heterogeneidad entre los estudios.
- Osteosarcopenia (5-37%) un mejor predictor de deterioro físico, caídas y fracturas que la osteopenia o la sarcopenia sola.

# **Comparative performance of current definitions of sarcopenia against the prospective incidence of falls among community-dwelling seniors age 65 and older**

H. A. Bischoff-Ferrari<sup>1,2</sup> · J. E. Orav<sup>3</sup> · J. A. Kanis<sup>4</sup> · R. Rizzoli<sup>5</sup> · M. Schlögl<sup>1,2</sup> · H. B. Staehelin<sup>6</sup> · W. C. Willett<sup>7</sup> · B. Dawson-Hughes<sup>8</sup>

- n=445 ancianos de la comunidad de la comunidad (71<sup>a</sup>), seguimiento de caídas a 3 años.
- 231 presentaron caídas (514 caídas).
- 45%= 1 caída.
- 24%= 2 caídas.
- 31%= 3 caídas
  
- Sarcopenia (11%) y caídas (RR=1.54; 95%CI 1.09–2.18).
  
- La definición de Baumgartner y la definición de Cruz-Jentoft tuvieron la mayor validez para predecir la tasa de caídas.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

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## Original Research

## Sarcopenic obesity is associated with lower indicators of psychological health and quality of life in Koreans

Yoonsu Cho<sup>a, b</sup>, So-Youn Shin<sup>c, d, e</sup>, Min-Jeong Shin<sup>a, b, f, \*</sup>

Table 3 – Odds ratios and 95% CIs for the psychological health according to type of obesity

	Obesity subtype					
	GO		P value	SO		P value
	Normal (n = 8432)	GO (n = 3089)		Normal (n = 10538)	SO (n = 983)	
Perceived stress <sup>*</sup>						
Unadjusted <sup>†</sup>	1.00 (ref)	1.05 (0.96-1.15)	.302	1.00 (ref)	1.14 (0.99-1.31)	.066
Multivariate adjusted <sup>‡</sup>	1.00 (ref)	1.11 (1.01-1.22)	.033	1.00 (ref)	1.24 (1.07-1.44)	.004
Depressive symptom						
Unadjusted <sup>†</sup>	1.00 (ref)	0.92 (0.81-1.04)	.162	1.00 (ref)	1.16 (0.96-1.39)	.123
Multivariate adjusted <sup>‡</sup>	1.00 (ref)	0.98 (0.86-1.12)	.785	1.00 (ref)	1.08 (0.89-1.30)	.458
Suicidal ideation						
Unadjusted <sup>†</sup>	1.00 (ref)	0.94 (0.83-1.05)	.275	1.00 (ref)	1.37 (1.15-1.61)	<.001
Multivariate adjusted <sup>‡</sup>	1.00 (ref)	1.01 (0.89-1.14)	.867	1.00 (ref)	1.26 (1.06-1.50)	.010

<sup>\*</sup> Values are represented as ORs (95% CIs).<sup>†</sup> Differences were tested using unadjusted logistic regression analysis.<sup>‡</sup> Differences were tested using multivariate-adjusted logistic regression analysis after adjusting for sex, age, income, education, alcohol use, smoking status, and physical activity.





*Article*

## **Correlations between the Quality of Life Domains and Clinical Variables in Sarcopenic Osteoporotic Postmenopausal Women**

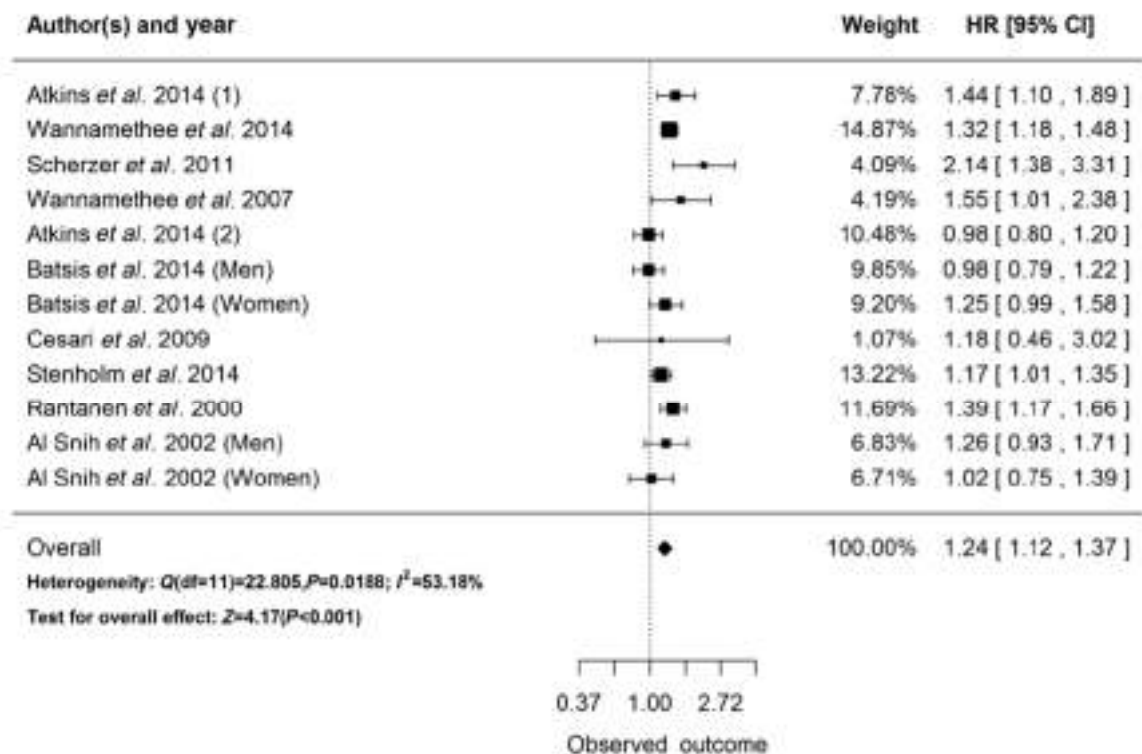
- Estudio observacional con 122 ( $67.02 \pm 8.3$ ) mujeres posmenopausicas.
- Osteoporosis: T-score  $\leq -2.5$ , (DXA).
- Sarcopenia: EWGSOP2
- Calidad de vida: SarQol (Sarcopenia Quality of Life, validación Rumania)
- Se encontró 14% obesidad sarcopenica.
- El IMC e historia de caídas como predictores de sarcopenia.
- Caídas previas y diagnóstico de sarcopenia tienen menor calidad de vida.

## REVIEW ARTICLE

**Association of sarcopenic obesity with the risk of all-cause mortality: A meta-analysis of prospective cohort studies**

Simiao Tian and Yang Xu

Department of Scientific Research Project, Affiliated Zhongshan Hospital of Dalian University, Dalian, China

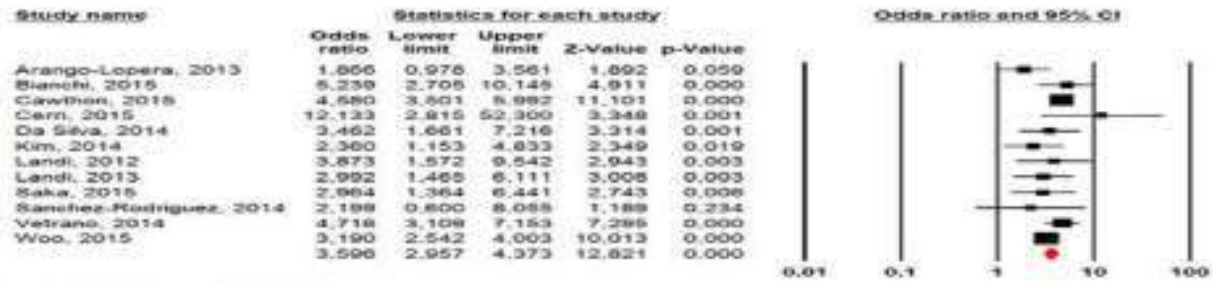


- La osteosarcopenia incrementa HR: 1.24 el riesgo de mortalidad.
- Se incluyeron 35 287 participantes y 14 306 muertes.

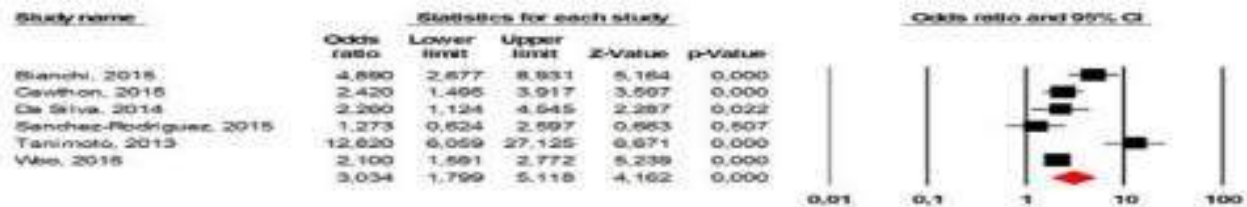
# Health Outcomes of Sarcopenia: A Systematic Review and Meta-Analysis

Charlotte Beaudart<sup>1\*</sup>, Myriam Zaaria<sup>2</sup>, Françoise Pasleau<sup>3</sup>, Jean-Yves Reginster<sup>1</sup>, Olivier Bruyère<sup>1</sup>

<sup>1</sup> Public Health, Epidemiology and Health Economics, University of Liège, Liège, Belgium, <sup>2</sup> Aix-Marseille University, School of Medicine, Marseille, France, <sup>3</sup> Life Sciences Library, University of Liège, Liège, Belgium



**2A. Mortality and sarcopenia**  
Heterogeneity Q-value 16.05; df(Q) 11; p-value 0.14; I<sup>2</sup> 31.4  
\* All ORs were crude ORs.



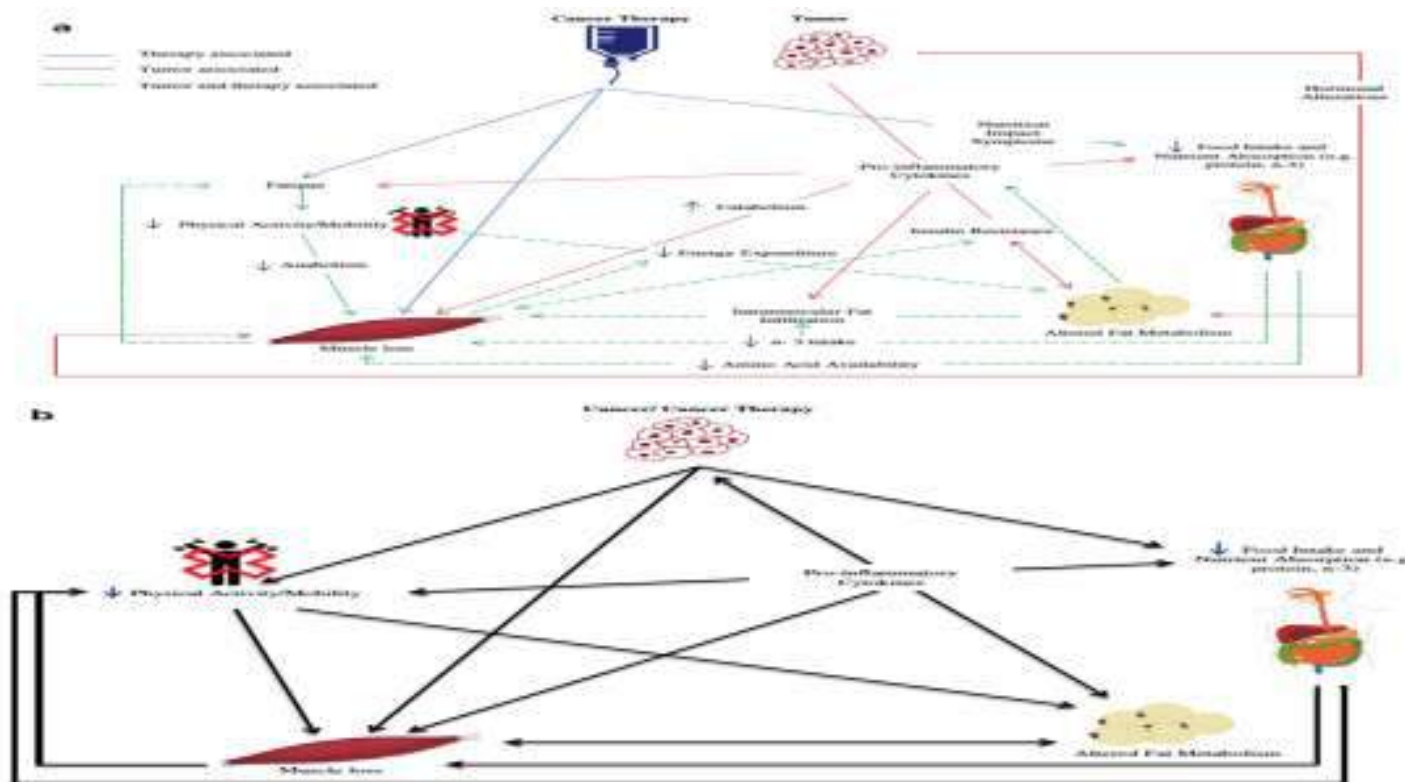
**2B. Functional disability and sarcopenia**  
Heterogeneity Q-value 27.99; df(Q) 5; p-value =0.001; I<sup>2</sup> 82.1  
\* Only the OR reported in the Cawthon et al. study was age-adjusted. All other ORs were crude

- 772 referencias.
- 17 revisión sistematica.
- Disminución de la funcionalidad OR of 6 studies 3.03 (95% CI 1.80±5.12)
- Mortalidad OR 3.5 (2.95-4.37)
- Riesgo de caídas, hospitalización, estancia hospitalaria

## Clinical Implications of Sarcopenic Obesity in Cancer

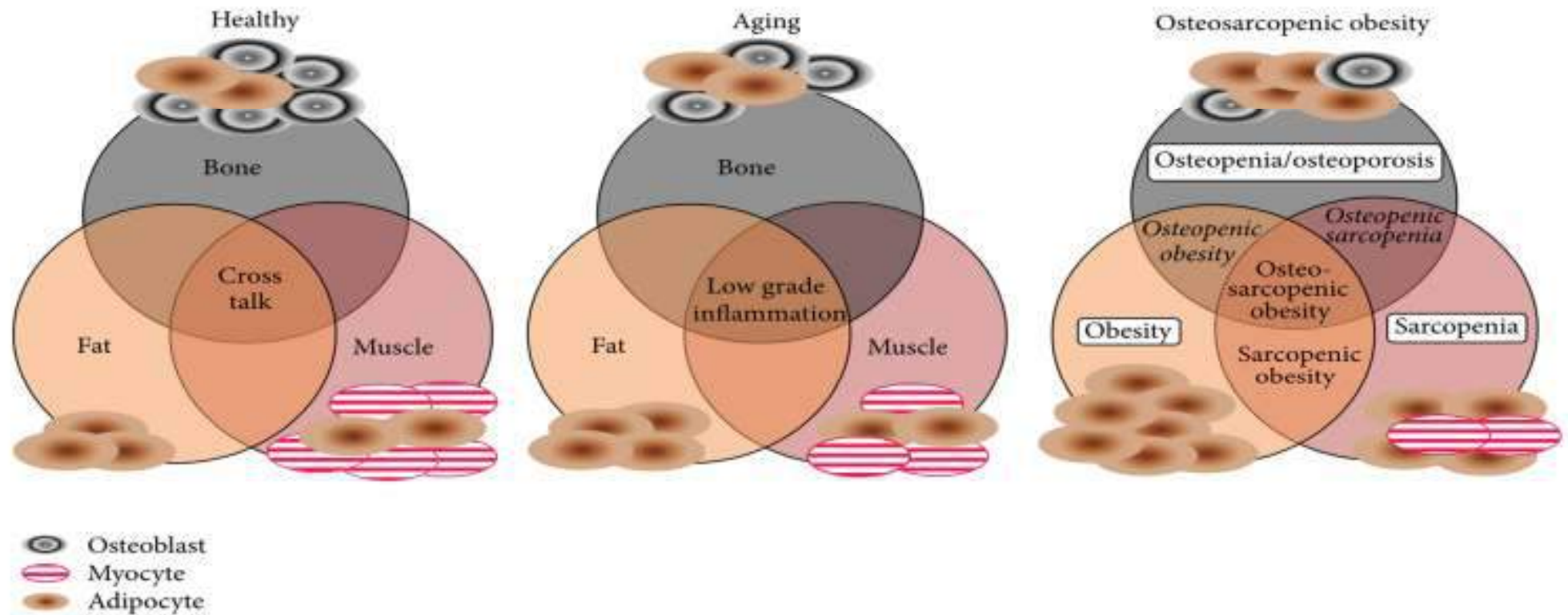
Isabella P. Carneiro<sup>1</sup> · Vera C. Mazurak<sup>1</sup> · Carla M. Prado<sup>1</sup>

- Mayor riesgo de toxicidad ala dosis.
- Complicaciones quirúrgicas.
- Discapacidad física.
- Supervivencia más corta





Conceptual model of bone, muscle, and fat tissues in healthy and diseased states: osteosarcopenic obesity is the most advanced stage resulting from aging or other compromised impairment in bone, muscle, and adipose tissue.



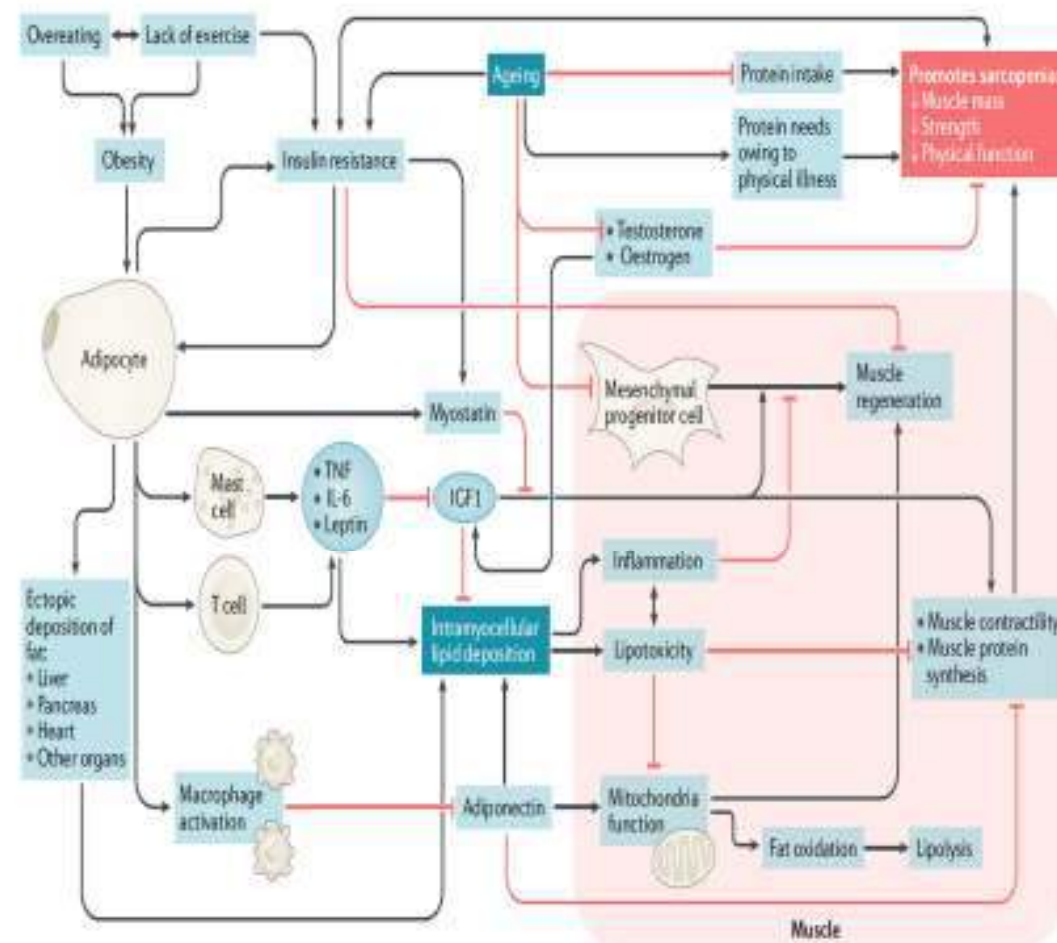
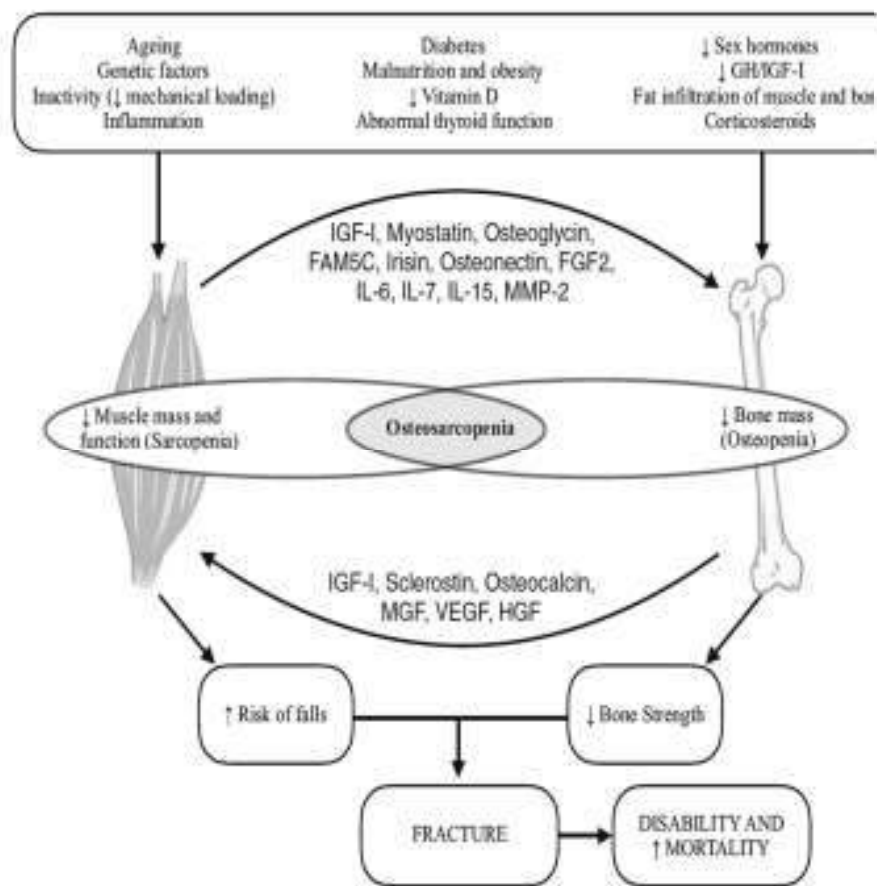
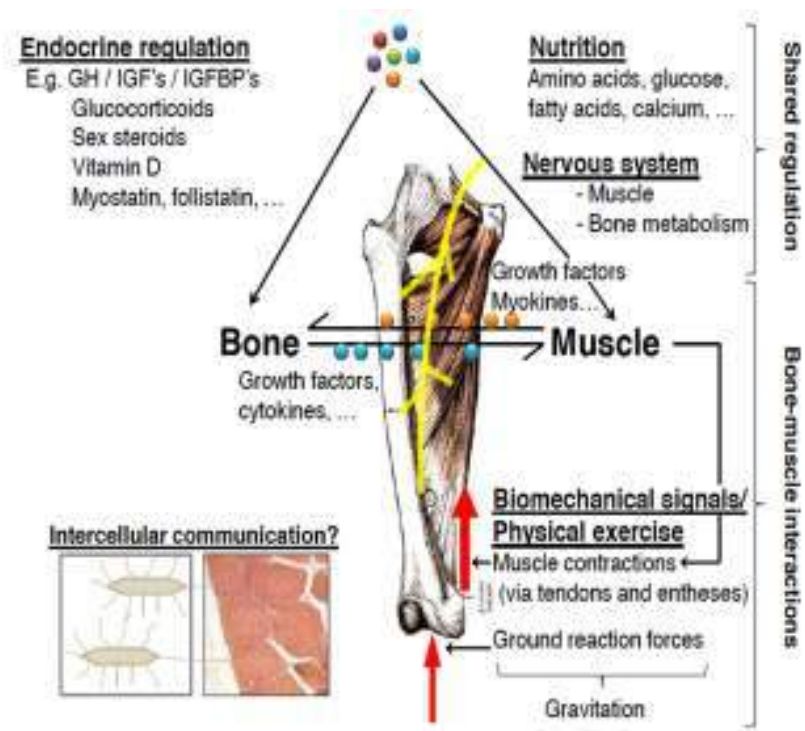


Fig. 1 | A proposed model of mechanisms leading to sarcopenic obesity. The proposed interplay between adipose and muscle tissue, which is believed to contribute to the development of sarcopenic obesity, is shown. The black lines are stimulatory, while red lines with flat ends indicate inhibition. IGF1, insulin-like growth factor 1; TNF, tumour necrosis factor.

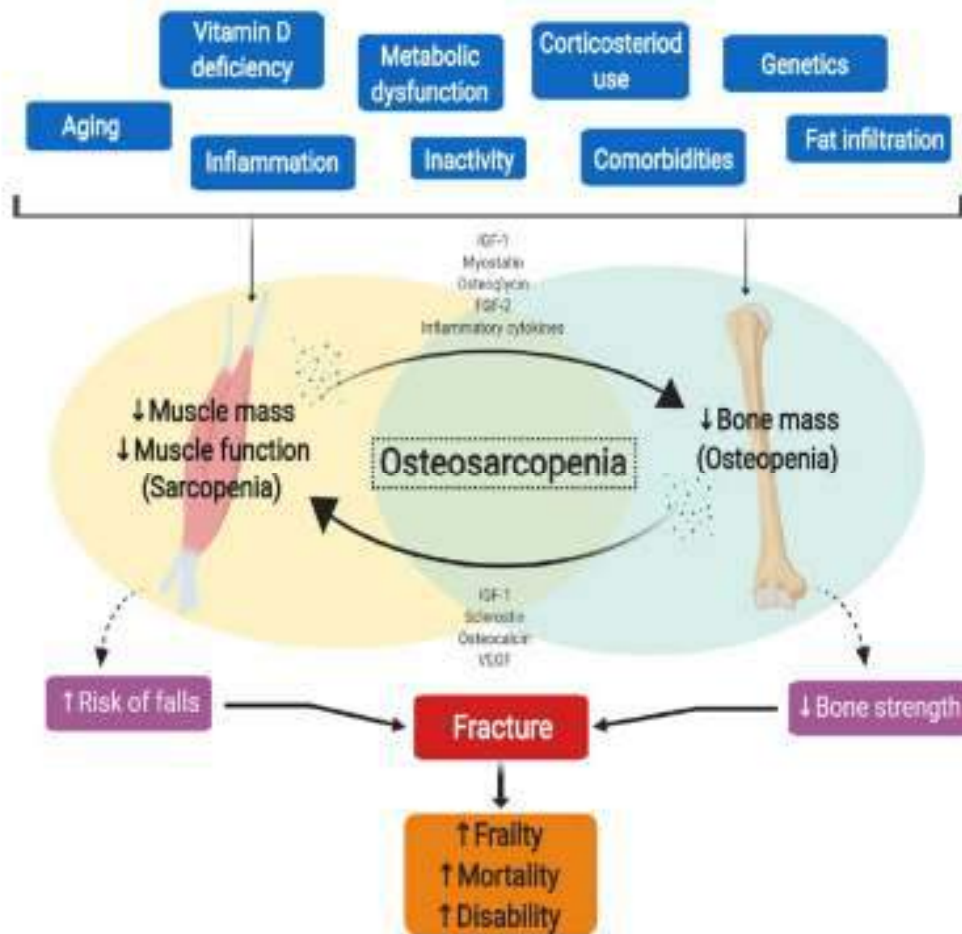
# Mecanismos involucrados en las interacciones musculares óseas



Aging Medicine. 2019;2:147–156.



Molecular and Cellular Endocrinology (2015), doi: 10.1016/j.mce.2015.10.017.



### Loss of lean body mass

### Associated complications

-10%



- Decreased immunity
- Increased risk of infection

-20%



- Decreased wound healing
- Increased muscle weakness
- Increased risk of infection

-30%



- Difficulty sitting
- Pressure ulcers
- Pneumonia
- Inability to heal

-40%

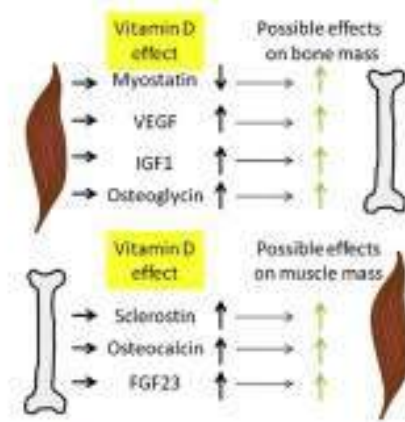
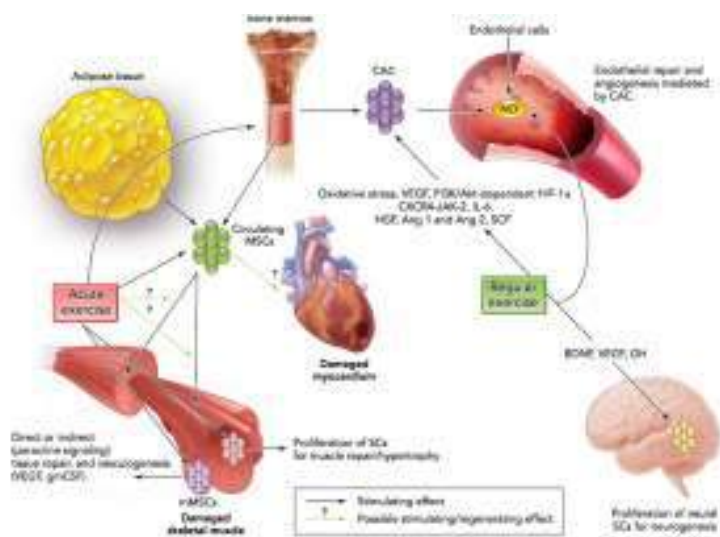


- Increased risk of death, usually from pneumonia

Fig. 3. Complications of lean body mass (muscle) loss.





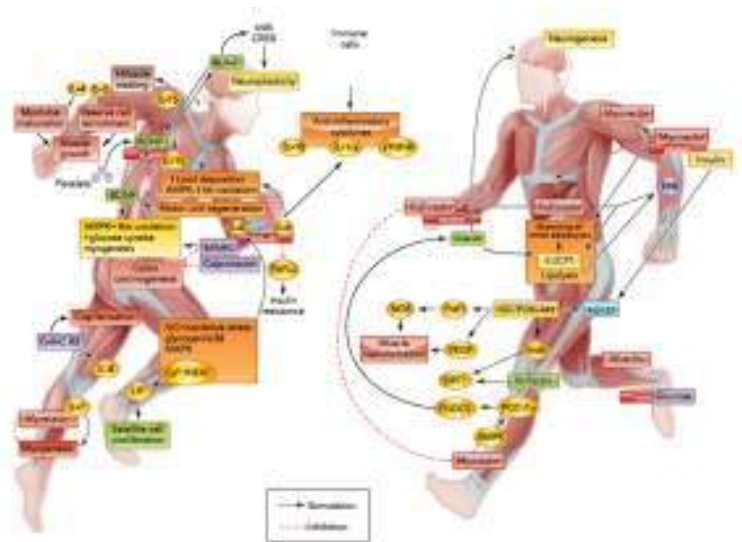


**Figure 3.** Vitamin D mediates several mechanisms of the bone-muscle cross-talk (adapted from Gurtin et al.<sup>50</sup>). IGF1, insulin-like growth factor 1; FGF23, fibroblast growth factor 23; VEGF, vascular endothelial growth factor.

**Table 7.** Summary of the evidence regarding the effect of pharmacological agents in osteoporosis and sarcopenia related outcomes.

Pharmacological agent	Osteoporosis	Sarcopenia
Denosumab	Meta-analysis of 5 RCTs, investigating the effect of denosumab on BMD reported significant improvement in BMD at lumbar spine, hip, and radius. <sup>71</sup>	Reduction in falls in the Denosumab treatment group of the FREEDOM Study. No evidence of effect on muscle function. <sup>72</sup> Improves muscle strength and muscle sensitivity to atrophic fibers. <sup>73</sup>
Testosterone	Intramuscular testosterone increased lumbar spine bone density in men. <sup>74</sup>	Testosterone in older men with decreased testosterone levels and muscle weakness can improve muscle mass, strength and physical performance. <sup>75</sup>
Growth hormone	Meta-analysis of 7 RCTs and one extension trial concluded that growth hormone may not improve bone density but did reduce fracture risk in women with age-related bone loss. <sup>76</sup>	Low growth hormone levels with age contribute to decrease in lean body mass and increase adipose tissue. <sup>77</sup>
Anti-inflammatories	Anti-inflammatory antibody in combination with resist/anaerobic exercise improved bone health in rats. <sup>78</sup>	(1) Anti-inflammatory antibodies increased muscle mass and strength in mice. <sup>79</sup> (2) Anti-inflammatory antibodies increased lean mass and may improve functional measures of muscle power. <sup>80</sup>

BMD, bone mineral density; RCT, randomized controlled trial.



**FIGURE 2.** Summary of the main myokines, their cellular effects, and the molecular signals/cytokines involved.

# Intervenciones

- Programa de Ejercicio Físico Multicomponente ViviFrail,
- Programa de Educación Nutricional y Actividad Física en el Anciano
- R+ACTIVA
- Programa de ejercicios Otago.

# Conclusiones

- Poco se sabe sobre el impacto a largo plazo de estas condiciones combinadas de osteoporosis, sarcopenia y obesidad en ancianos.
- Muchos ancianos pueden no ser diagnosticados y progresar sin tratamiento.
- La medición de los cambios funcionales puede ser útil en el escenario de la vida real para las personas y son lo suficientemente simple como para realizarse a bajo costo en cualquier centro de salud.



# Conclusiones

- Se requiere de una detección más temprana.
- Un diagnóstico no es el punto final.
- Estandarizar las herramientas de detección.
- La inactividad física es uno de los principales factores para una mala calidad muscular y capacidad funcional.
- Se debe considerar que las enfermedades tienen un impacto en el tejido osteo-muscular y adiposo
- Aumento de costos sanitarios.

Gracias...

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