

Mitigating Bone and Muscle Loss

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The academic core of  **Atrium Health**

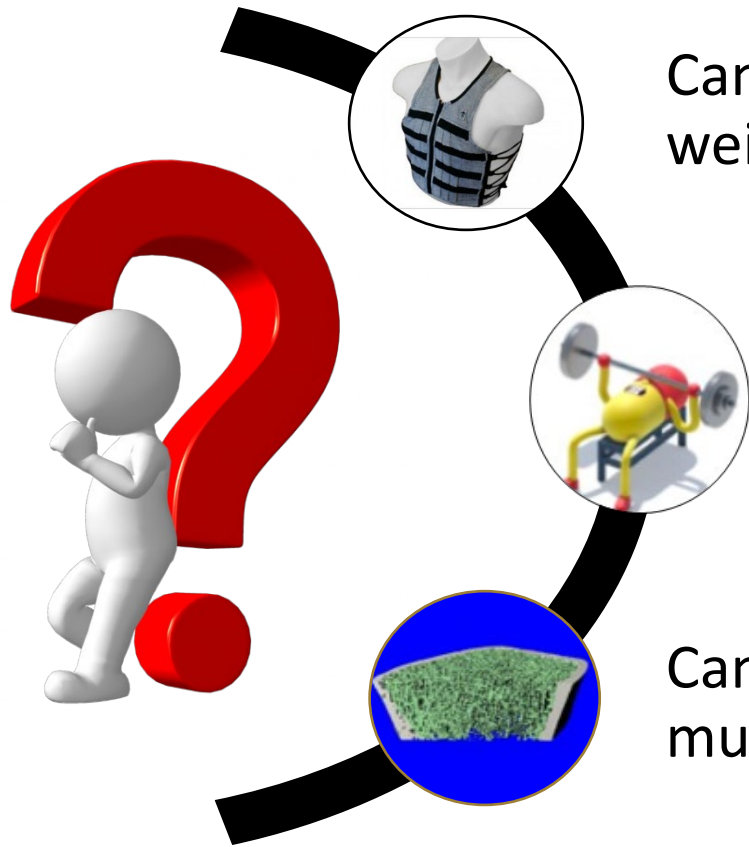
Presentation Overview

- Current recommendations to minimize weight loss associated bone and muscle loss in older adults
- Strategies under investigation to minimize weight loss associated bone and muscle loss and older adults
 - Lifestyle (exercise, nutrition)
 - Pharmacotherapy
 - Combination therapies
- Knowledge gaps in the field with opportunities for research

ASN/NAASO/TOS 2005 Joint Position Statement on Obesity in Older Adults

- “Weight-loss therapy that **minimizes muscle and bone losses** is recommended for older persons who are obese and who have functional impairments or metabolic complications that can benefit from weight loss.”
- “A modest **reduction in energy intake (500–750 kcal/d)** is recommended. The diet should contain **1.0 g/kg high quality protein/d** and multivitamin and mineral supplements to ensure that all daily recommended requirements are met, including **1500 mg Ca/d and 1000 IU vitamin D/d.**”
- “Regular physical activity is particularly important in obese older persons to improve physical function and help preserve muscle and bone mass. A **multicomponent exercise program** that includes stretching, aerobic activity, and strength exercises is recommended.”

Knowing This, What other Questions are Worth Asking?

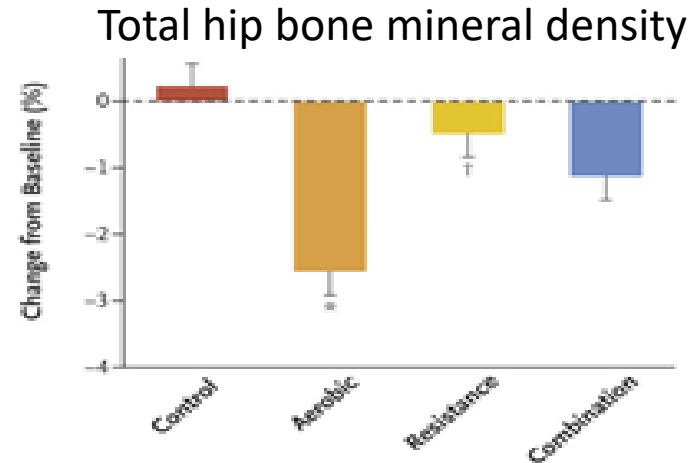
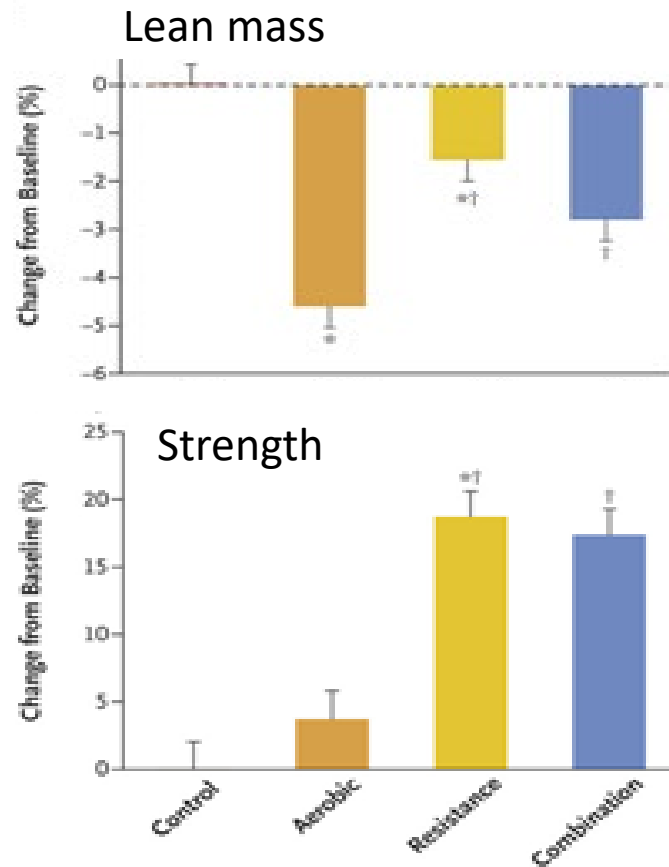


Can we develop more scalable exercise protocols to offset weight loss associated bone and muscle loss in older adults?

Can we couple countermeasures to prevent weight loss associated bone and muscle loss in older adults?

Can we improve our ability to measure of bone and muscle outcomes in geriatric weight loss trials?

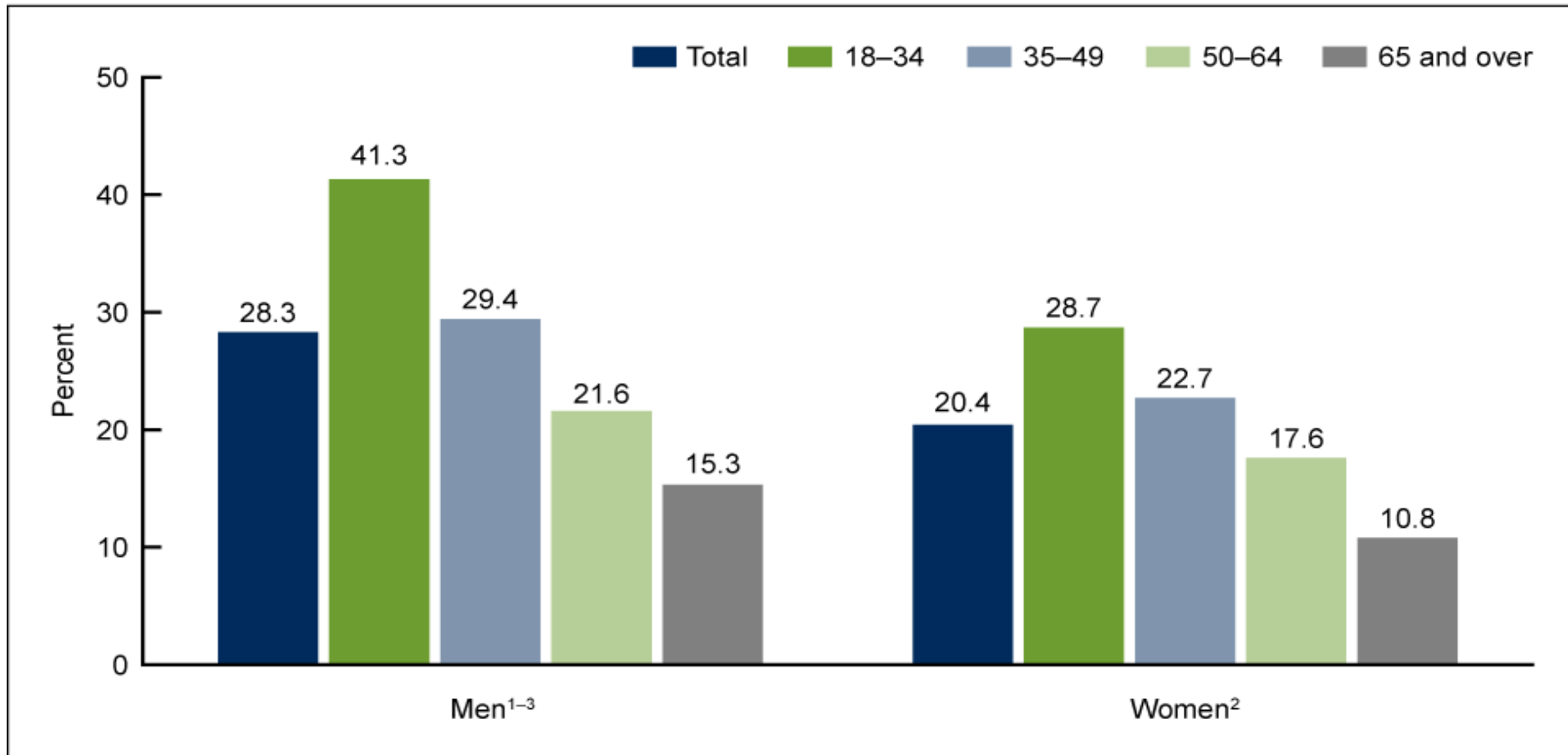
Exercise can Mitigate Loss of Lean Mass, Strength, and Bone during Weight Loss



Both resistance training and a combination of resistance and aerobic training attenuated the loss of lean mass and bone mineral density during caloric restriction in frail older adults

* $p < 0.05$ for the comparison with the control group; † $p < 0.05$ for the comparison with the aerobic group

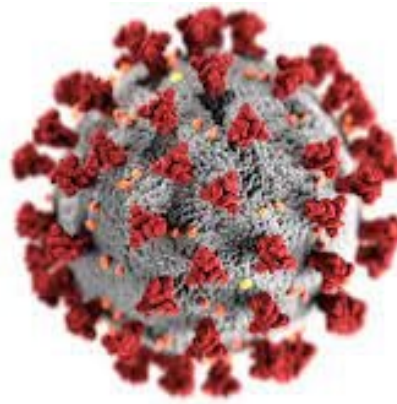
Less than 15% of Older Adults Meet the National Physical Activity Guidelines



**Exercise Can Preserve
Muscle and Bone
during Weight Loss in
Older Adults**



**Less than 15% of Older
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National Physical
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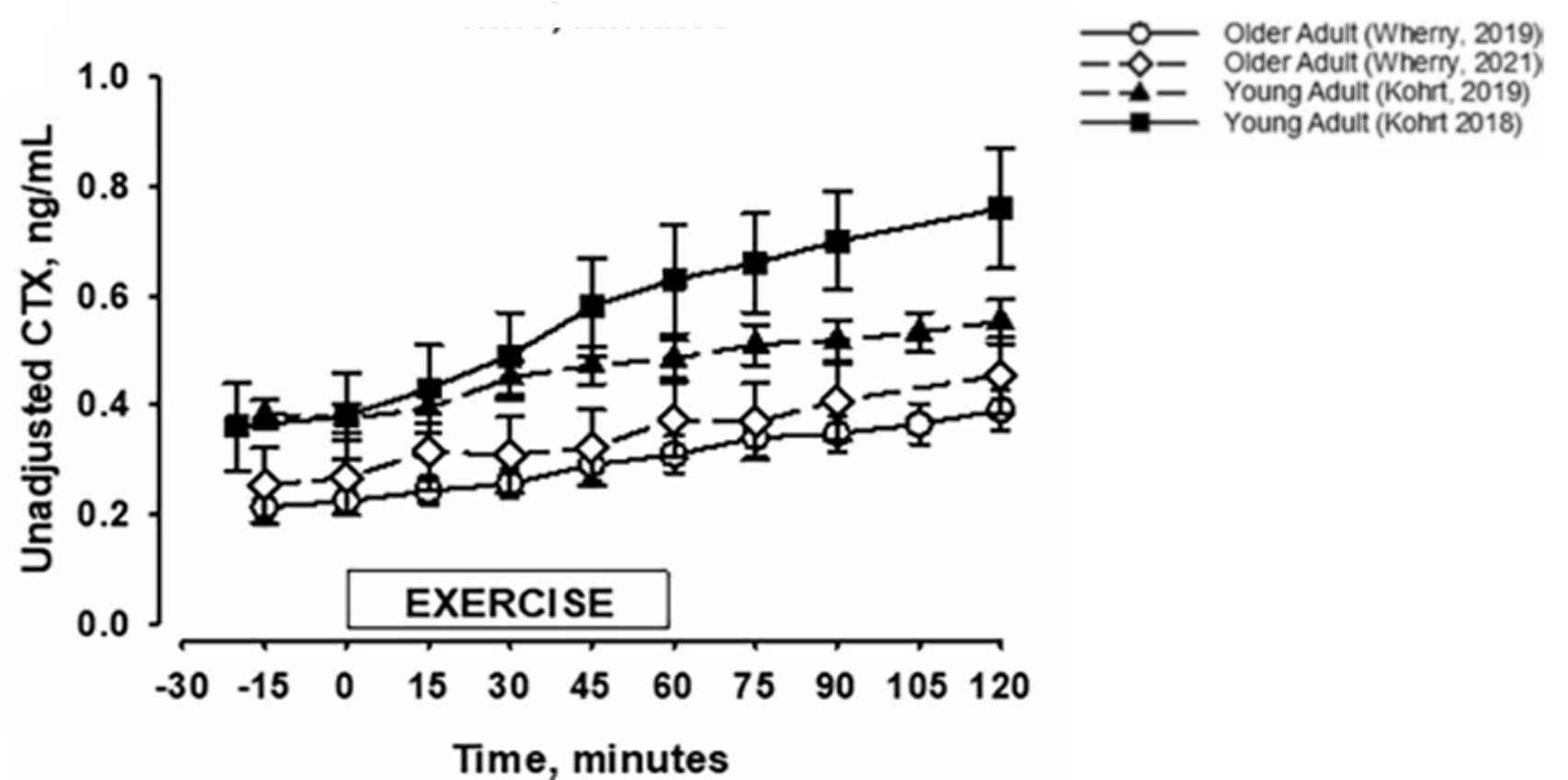


INVEST in Bone Health (R01 AG059186)

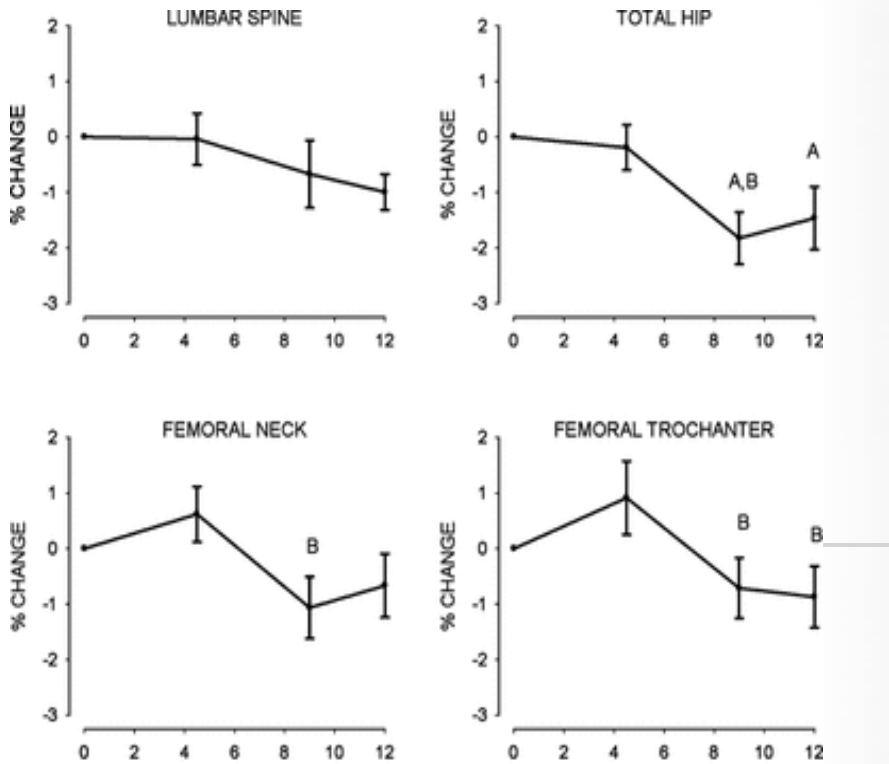


Exercise Can Acutely Activate Bone Resorption

“Despite mechanical loading generating an anabolic signal, metabolic factors during exercise can generate catabolic signals in bone.”

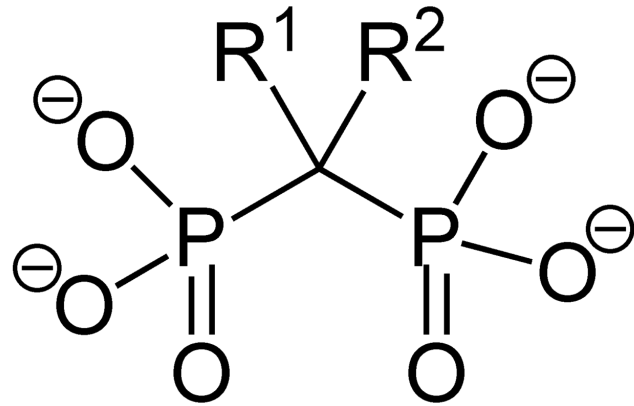


BMD decreases by ~1.5% over the course of a year in competitive male cyclists

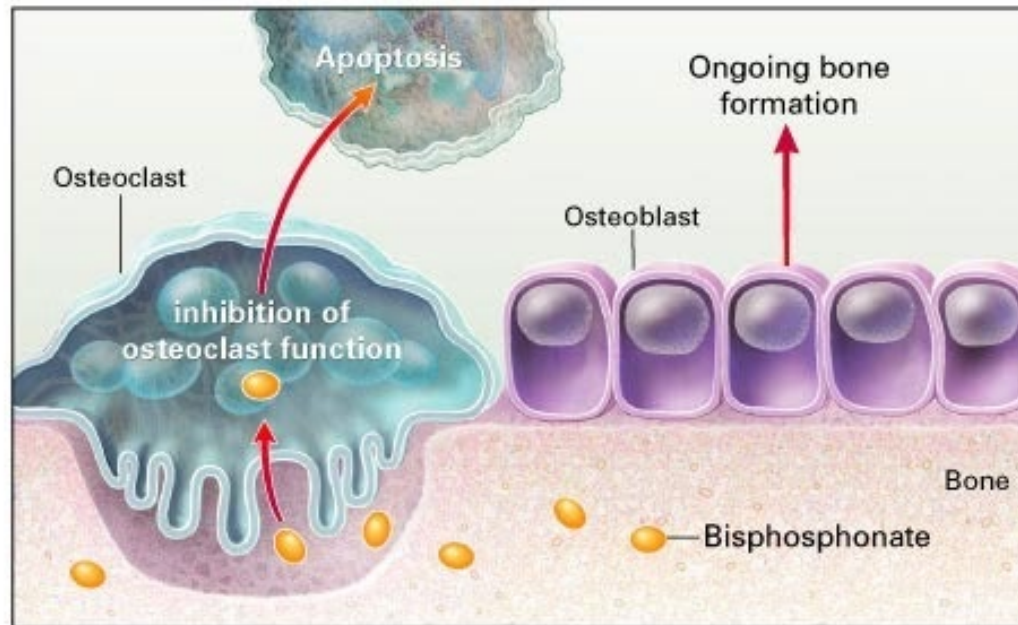


Barry DW, Kohrt WM. BMD decreases over the course of a year in competitive male cyclists. *J Bone Miner Res.* 2008 Apr;23(4):484-91. PMID: 18072875.





Bisphosphonate General Chemical Structure



Additive effects of antiresorptive agents and exercise on lumbar spine bone mineral density in adults with low bone mass: a meta-analysis

J. Zhang · R. Gao · P. Cao · W. Yuan



RESEARCH ARTICLE

Antiresorptive Agents Increase the Effects of Exercise on Preventing Postmenopausal Bone Loss in Women: A Meta-Analysis

Renqing Zhao*, Zhengang Xu, Meihua Zhao

College of Physical Education and Health Sciences, Zhejiang Normal University, Jinhua, Zhejiang, China

What are the independent and combined effects of exercise and bisphosphonate use on weight loss associated bone loss in older adults?

THE BONE, EXERCISE, ALENDRONATE, AND CALORIC RESTRICTION TRIAL

INTERVENTION COMPONENTS BY TREATMENT GROUP

Dietary Weight Loss plus Bisphosphonate

Bisphosphonate

No Bisphosphonate

**Dietary Weight Loss plus
Progressive Resistance
Training (RT) and Bone-
Loading Exercises**

RT⁺

Progressive RT and Bone-
Loading Exercise
+ 70 mg/weekly dose
alendronate
(RT⁺+BIS)

Progressive RT and
Bone-Loading Exercise +
Weekly Placebo
(RT⁺+PL)

No RT

No Resistance Training
+ 70 mg/weekly dose
alendronate
(NoRT+BIS)

No Resistance Training
+ Weekly Placebo
(NoRT+PL)



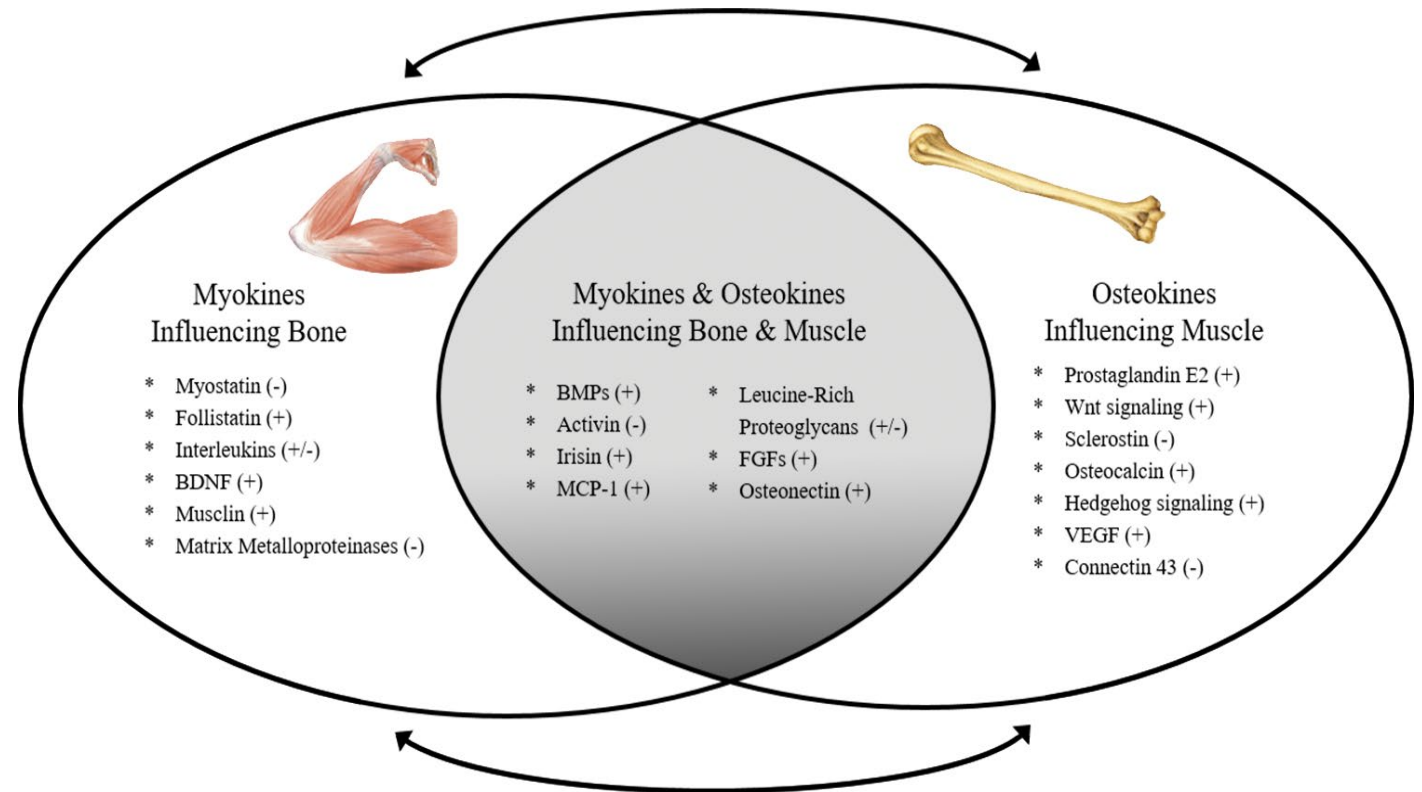
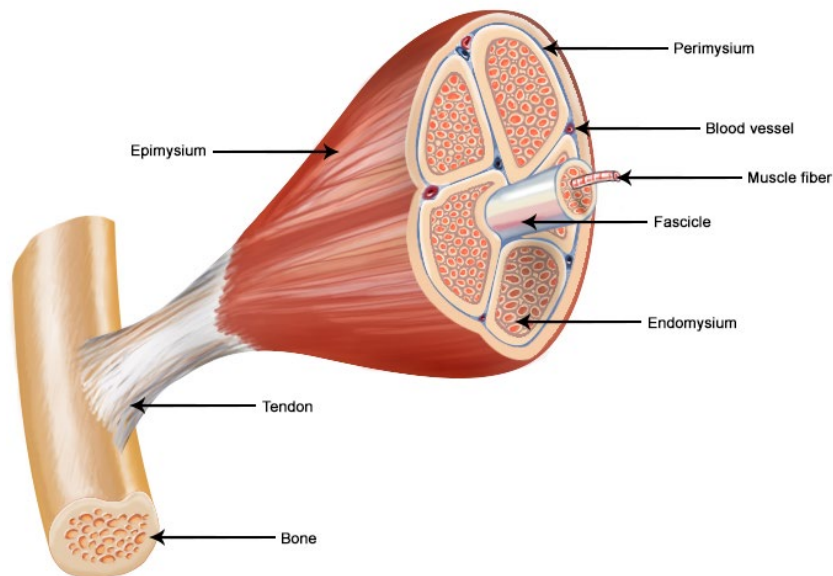
BEACON

R01 AG074979

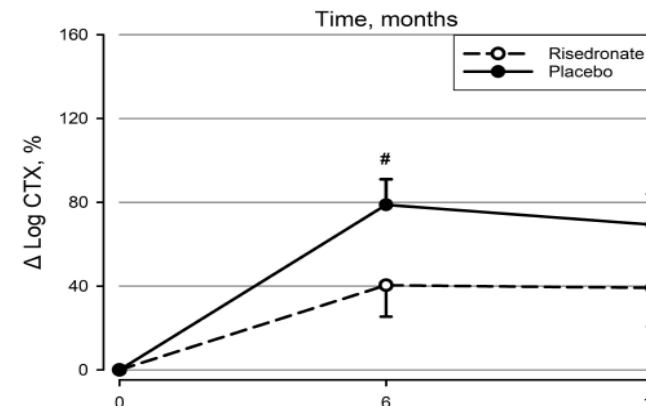
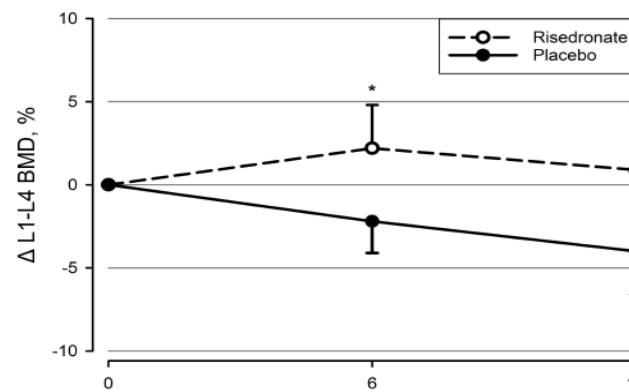
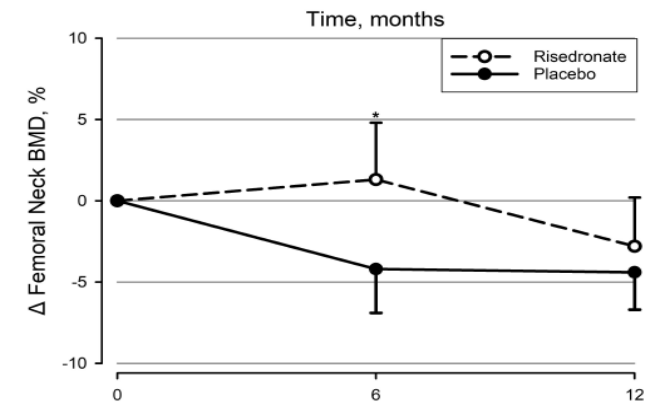
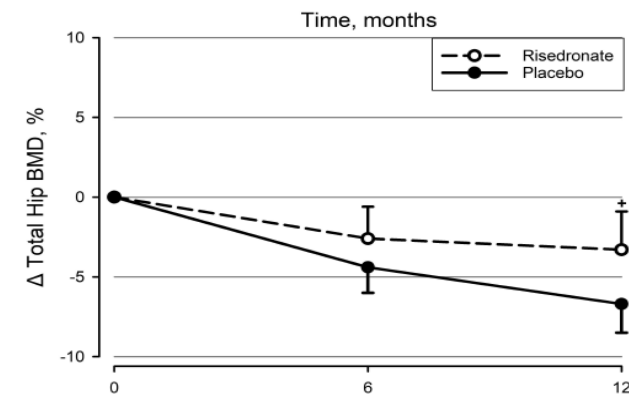
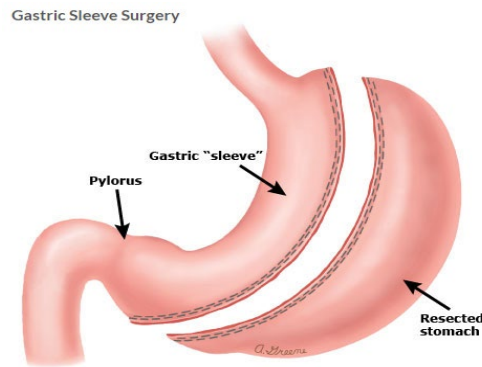
Primary Endpoint: 12 month Δ total hip aBMD

Muscle and Bone are Tightly Coupled Tissues – Mechanically and Biochemically

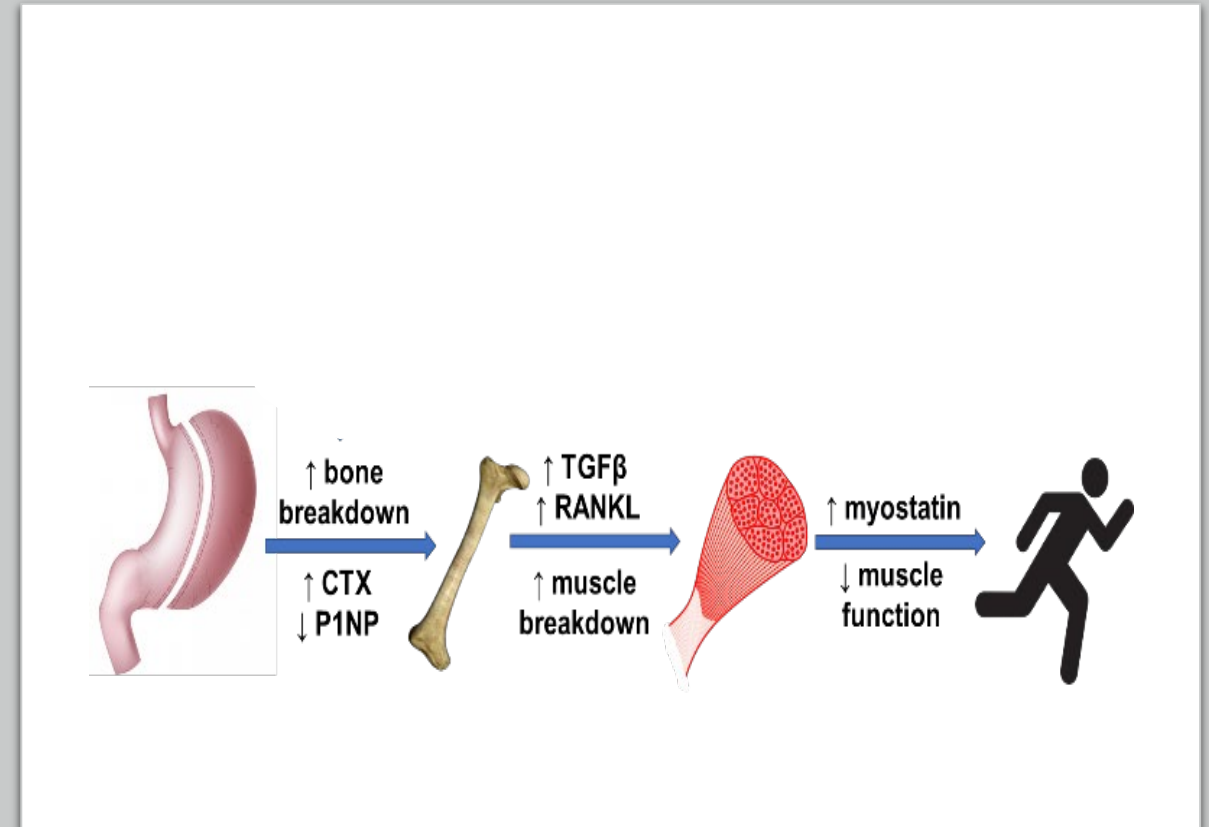
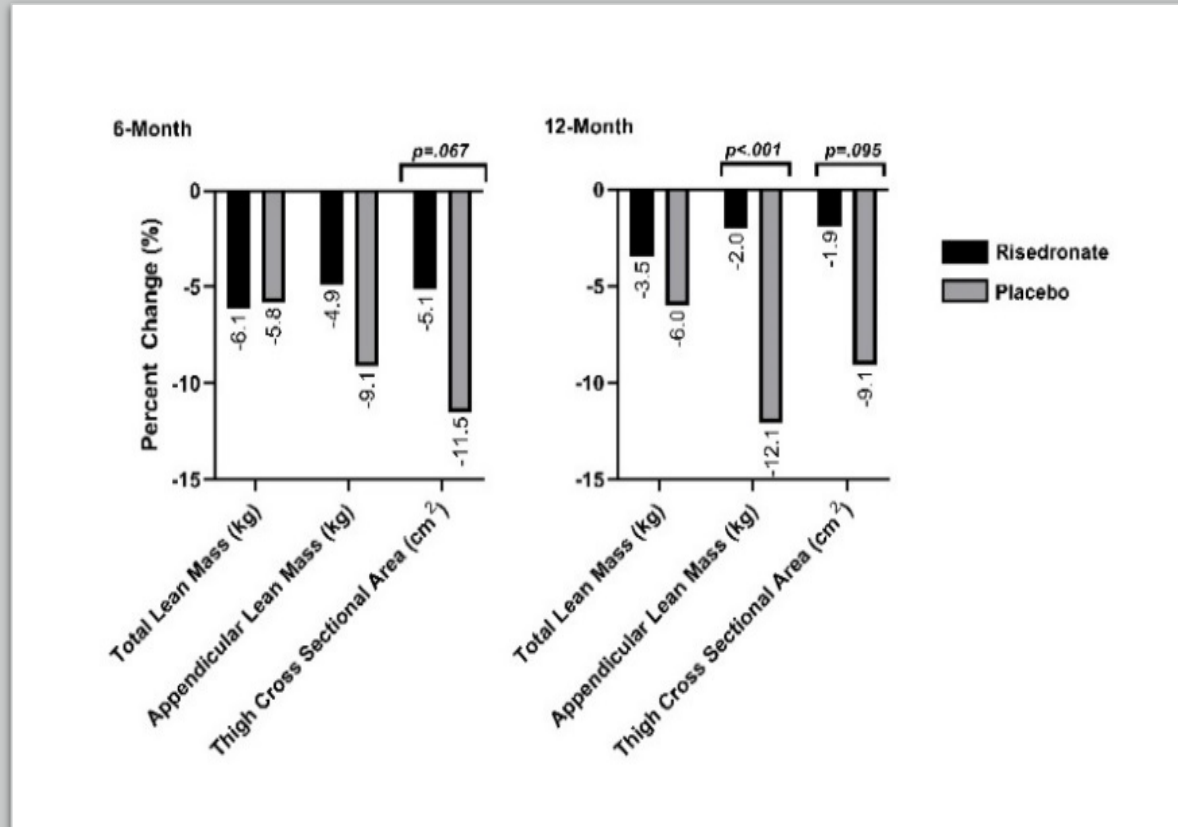
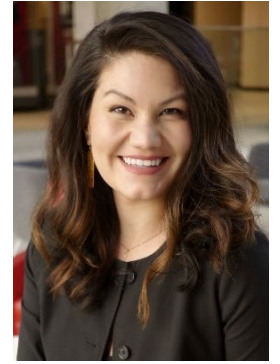
Structure of a Skeletal Muscle



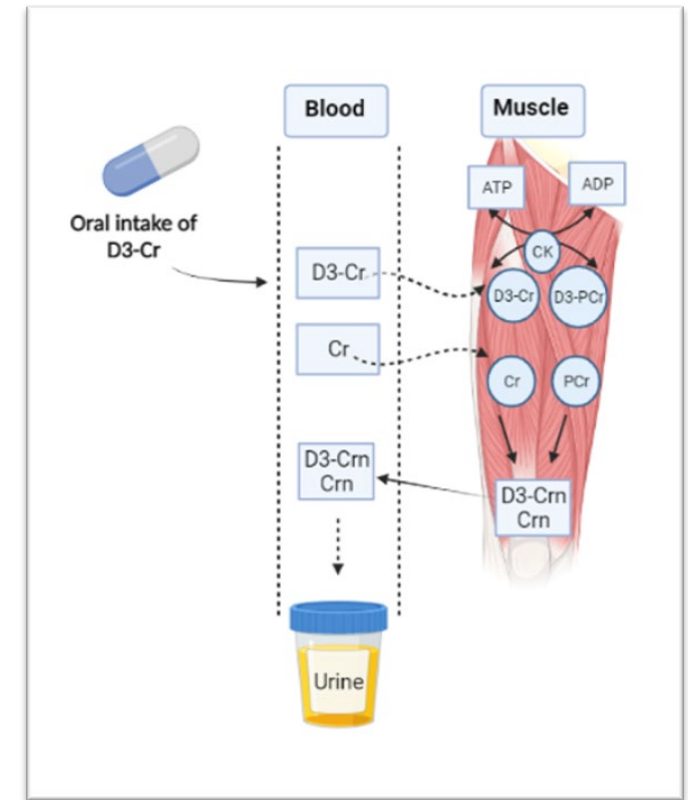
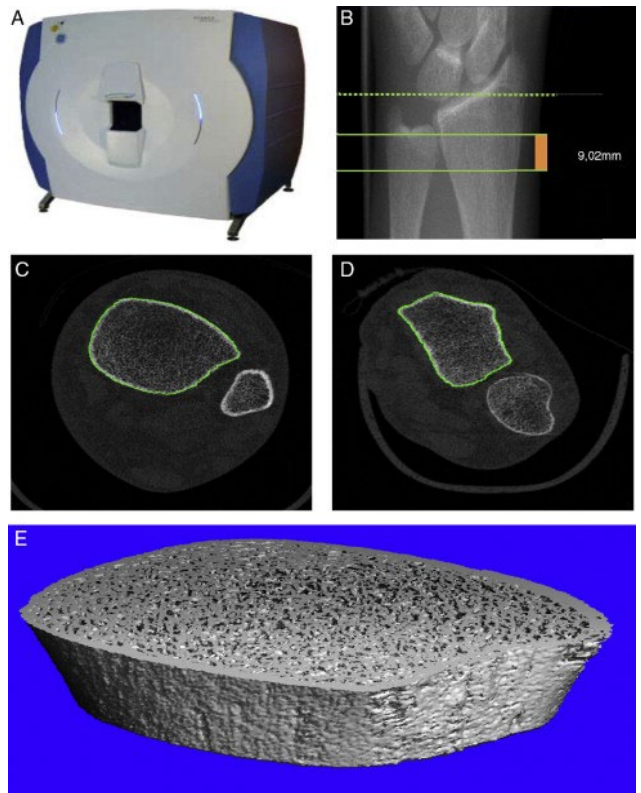
Risedronate Use Appears to Mitigate Bone Loss Following Sleeve Gastrectomy



Risedronate May also Mitigate SG-induced Lean Mass Loss...



DXA has known limitations when assessing musculoskeletal tissue



Grateful Acknowledgement



National Institute
on Aging



National Institute of
Arthritis and Musculoskeletal
and Skin Diseases



National Heart, Lung,
and Blood Institute



