

Beyond BMI: Losing Fat, Preserving Muscle

Michelle L. Look, MD, FAAFP, ABOM
Family Practice, Sports Medicine, Obesity Medicine
San Diego Sports Medicine Weight and Wellness Center
San Diego, CA

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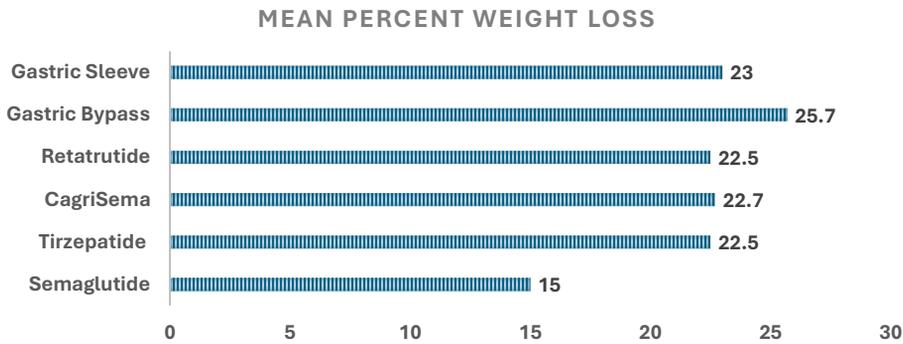
Disclosure

Advisory Board: Aadvark; Boehringer
Ingelheim; Eli Lilly; Novo Nordisk
Speaker's Bureau: Eli Lilly

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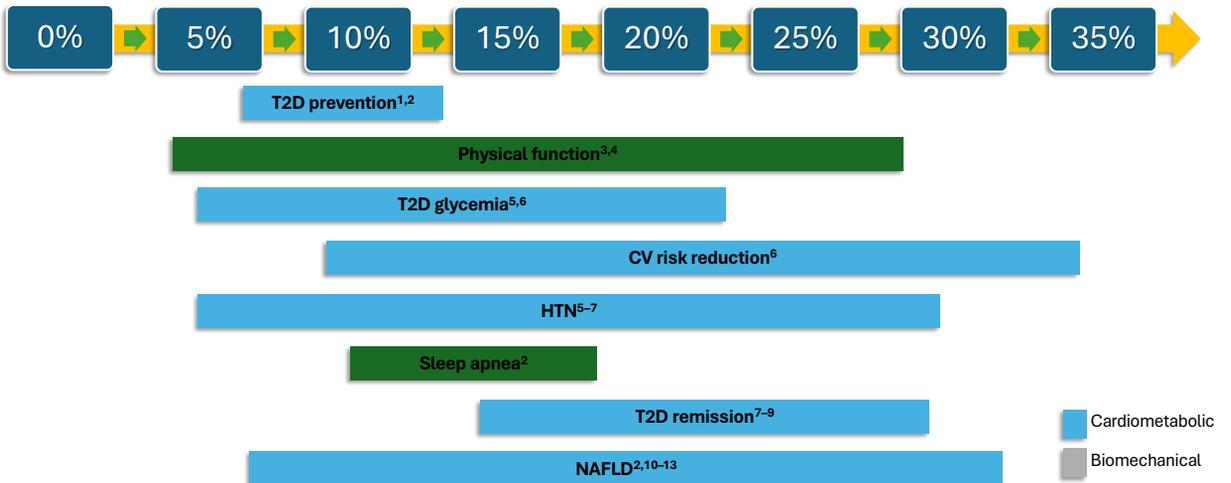
Make No Mistake: The New GLP-1 Medications Are GOOD! (for Weight Loss)



Arterburn DE, et al. *Ann Surg.* 2021 Dec 1;274(6):e1269-e1276. (Placebo-controlled, 1 year outcomes for surgery)
 CagriSema press release. Dec 20, 2024 <https://www.novonordisk.com/news-and-media/news-and-ir-materials/news-details.html?id=915082>
 Jastreboff A, et al. *N Engl J Med.* 2022;387(3):205-216 [SURMOUNT1].
 Wilding JPH, et al. *N Engl J Med.* 2021;384(11):989-1002 [STEP 1].

3

How Much Weight Loss Is Needed?

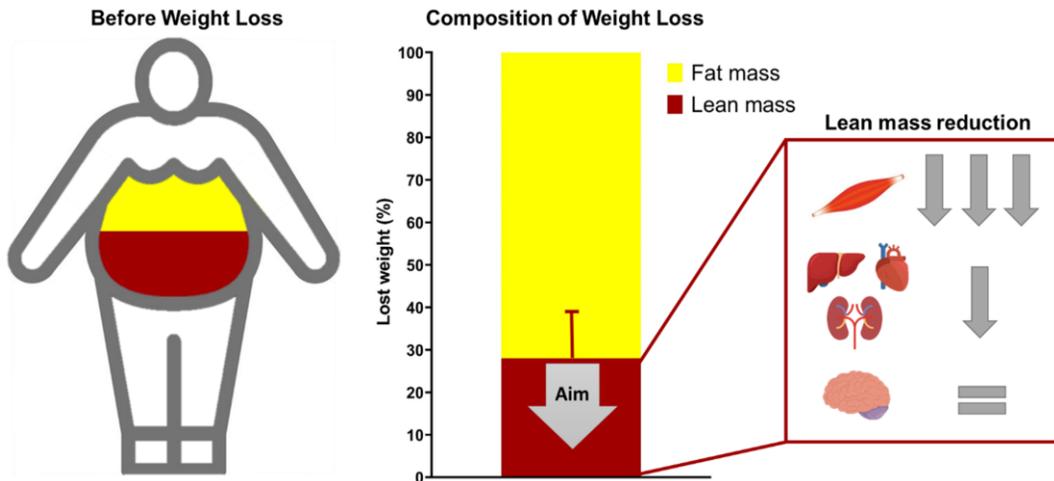


Slide courtesy of Tim Garvey MD

1. Knowler WC, et al. *N Engl J Med* 2002;346:393-403. 2. Cefalu WT, et al. *Diabetes Care* 2015;38:1567-82. 3. Christensen R, et al. *Osteoarthritis Cartilage* 2005;13:20-7.
 4. Bliddal H, et al. *Obes Revs* 2014;15:578-86. 5. Wing RR, et al. *Diabetes Care* 2011;34:1481-6. 6. Ooi GJ, et al. *Int J Obes* 2017;41:902-8. 7. Courcoulas AP, et al. *JAMA Surg* 2018;153:427-34. 8. Lean ME, et al. *Lancet* 2018;391:541-51. 9. Dambha-Miller H, et al. *Diabet Med.* 2020;37:681-8. 10. Vilar Gomez E, et al. *Gastroenterology* 2015;149:367-78.
 11. Koutoukidis DA, et al. *Metabolism* 2021;115:154455. 12. Promrat K, et al. *Hepatology* 2010;51:121-9. 13. Liu X, et al. *Obesity Surgery* 2007;17:486-92.

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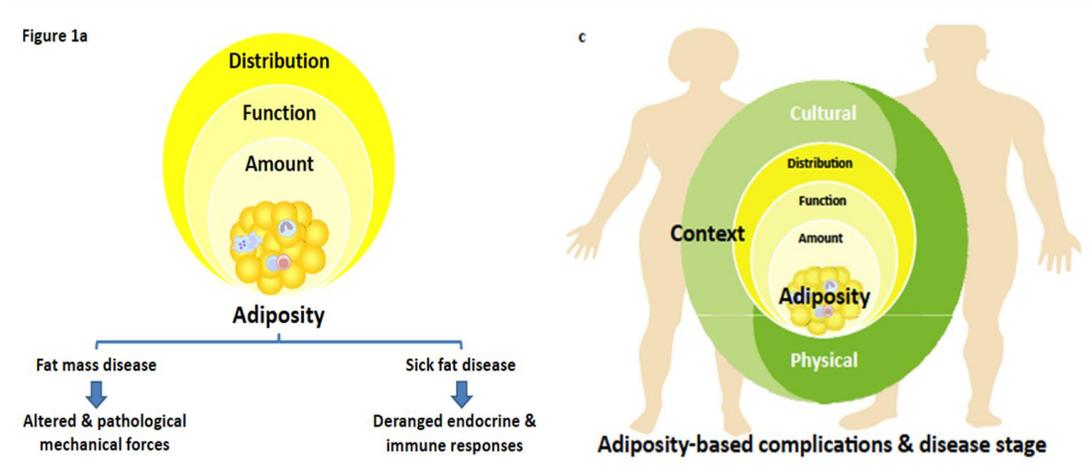
WHAT IS THE REAL GOAL?



Ostergaard B. et al. Beyond appetite regulation: Targeting energy expenditure, fat oxidation, and lean mass preservation for sustainable weight loss. Obesity. In press.

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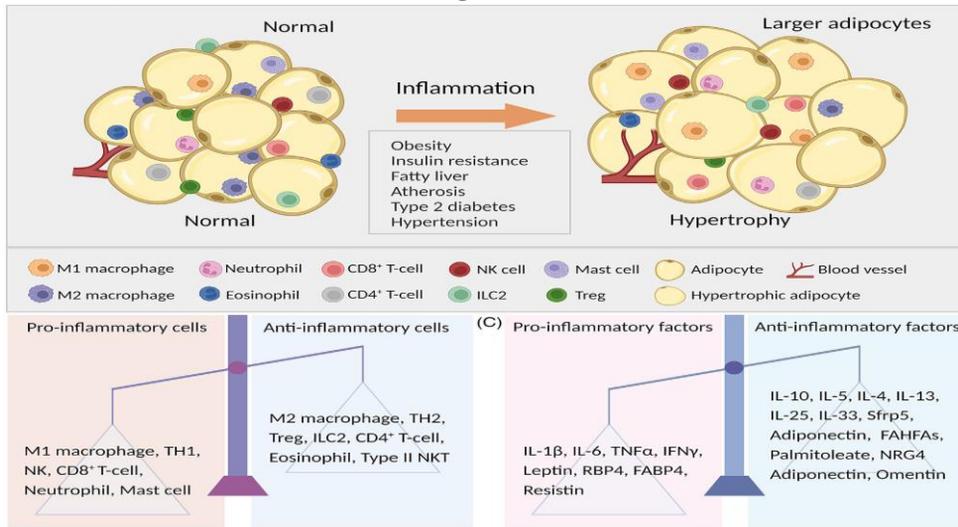
Adiposity Based Chronic Disease



Frühbeck G, Dicker D, et al. *Obes Facts*. 2019;.

6

Changes in Adipocytes and Immune Cells in Adipose Tissue During Chronic Inflammation



Xu S, Obesity Reviews. 2024

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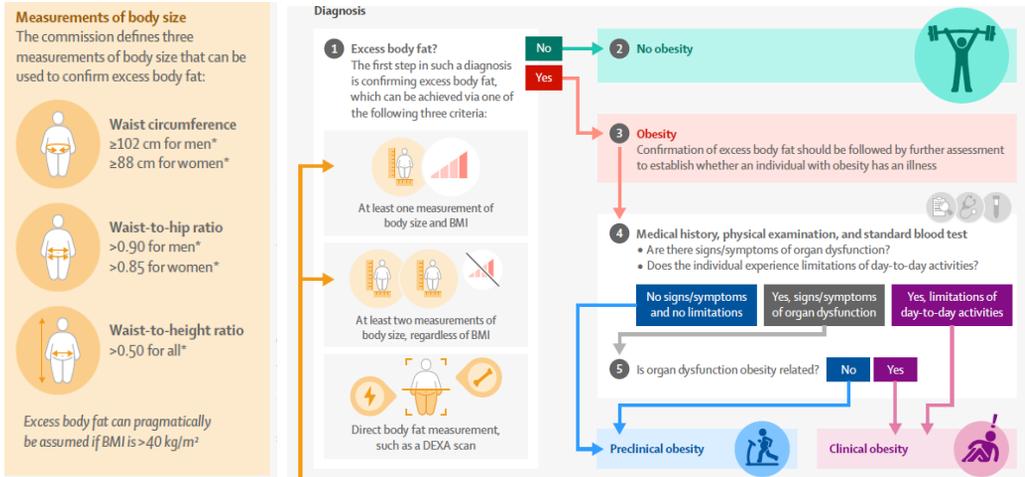
Use of BMI Alone Is an Imperfect Clinical Measure



- The newly adopted AMA policy also states that:
- BMI is significantly correlated with the amount of fat mass in the general population but loses predictability when applied on the individual level.
- Relative body shape and composition heterogeneity across race and ethnic groups, sexes, genders and age-span is essential to consider when applying BMI as a measure of adiposity.
- **The primary limitation is that it does not distinguish between FM and FFM, and therefore may cause misclassification of obesity and cannot identify individuals with sarcopenic obesity**

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Diagnosing Clinical Obesity



Rubino F et al. *Lancet Diabetes Endocrinol* 2025

Rubino F, et al. *Lancet Diabetes Endocrinol.* 2025; Published online January 14, 2025. doi:10.1016/S2213-8587(24)00316-4

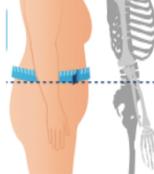
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Men	Women
≥ 40 inches	≥ 35 inches
≥ 35 inches for Asian men	≥ 31.5 inches for Asian women

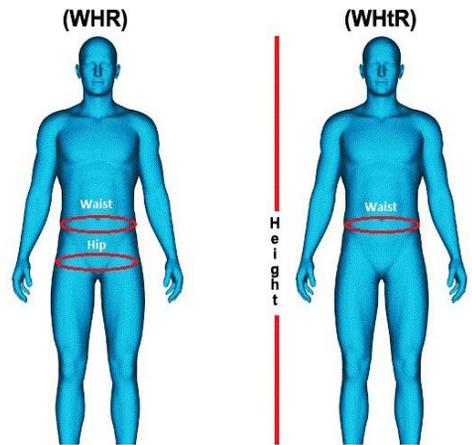
Measuring waist circumference in 3 steps

1. Place the tape measure horizontally around the patient's middle, at the level of the upper hip bone (iliac crest)



2. Keep the tape measure around the waist without compressing the skin

3. Measure after the patient exhales.



>0.9 for Men
>0.85 for Women

>0.5 for All

Rubino F, et al. *Lancet Diabetes Endocrinol.* 2025; Published online January 14, 2025. doi:10.1016/S2213-8587(24)00316-4

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Prediction of VAT Mass (Log) from Anthropometric Measures

Our main finding is that from five anthropometric variables (BMI, WC and WHR, WHtR, and WHT.5R) the WHtR is the best predictor of DXA-derived whole body fat percentage and VAT mass, in both men and women

	AIC Difference (Inference)	Adjusted R ²	Standard Error of the Estimate \times/\div factor (95% CI)
Males (n = 41)			
BMI	13 (weak support)	0.60	2.0 (1.8 to 2.4)
WC	4 (plausible)	0.68	1.8 (1.6 to 2.1)
WHR	41 (unsupported)	0.21	2.6 (2.2 to 3.3)
WHtR	0 (best)	0.71	1.8 (1.6 to 2.1)
WHT.5R	<1 (equivalent)	0.71	1.8 (1.6 to 2.1)
Females (n = 32*)			
BMI	6 (plausible)	0.58	2.8 (2.3 to 4.1)
WC	3 (plausible)	0.61	2.7 (2.2 to 3.7)
WHR	25 (unsupported)	0.22	4.1 (3.0 to 6.7)
WHtR	0 (best)	0.65	2.6 (2.2 to 3.7)
WHT.5R	<1 (equivalent)	0.64	2.6 (2.2 to 3.7)

Swainson MG, PLOS ONE 2017

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Methods for Evaluating Body Composition

Assessment Method	Overview of Methodology	Speed (<10 min)	Cost	No Radiation Exposure	Portable	Validated in Obesity and Weight Loss	Minimal Technical Expertise Required
Bioelectrical Impedance Analysis (BIA) ^{1,2,3}	Low-level electrical current passes through the body to measure impedance, enabling estimation of total body water, fat mass, and fat-free mass	●	\$	●	●	●	●
Dual-Energy X-Ray Absorptiometry (DXA) ¹⁻⁴	DXA machine, multi-compartment assessment, considered as the gold standard technique for assessing bone mineral content	●	\$\$\$	●	●	●	●
Computed Tomography (CT) ¹⁻³	It can be used for volumetric measurement of lean mass, adipose tissue, and ectopic fat	●	\$\$\$	●	●	●	●
Magnetic Resonance Imaging (MRI) ¹⁻³	Considered the gold standard for assessing regional body composition, including measurement of VAT and ectopic fat	●	\$\$\$	●	●	●	●
Air Displacement Plethysmography (ADP) ^{1,3}	BOD POD measures body volume by air displacement. This can be used to estimate fat mass and fat-free mass	●	\$\$	●	●	●	●
3D Optical Imaging ⁵	The technology captures a 3D mesh representing a person's entire shape, which is then used to predict body composition	●	\$	●	●	●	●
Visual Body Composition (VBC) ^{1,4}	Commercially available smartphone-based applications used to estimate percent fat, fat mass, and fat-free mass	●	\$	●	●	●	●

Additional methods include skin folds (calipers), waist and hip circumferences, and hydrostatic weighing¹
 ●=Presence of the Mentioned Trait; ●=Absence of the Mentioned Trait; \$\$\$=Expensive; \$\$=Moderate; \$=Comparatively Cheaper; VAT=Visceral Adipose Tissue.
 1. Holmes CJ, Racette SB. *Nutrients*. 2021;13(8):2493. 2. Cenicola GD, et al. *Nutrition*. 2019;62:25-31. 3. Burrige K, et al. *Obes Pillars*. 2022;1:100007. 4. Graybeal AJ, et al. *Clin Nutr*. 2022;41(11):2464-2472. 5. Garber AK, et al. *Am J Clin Nutr*. 2023;118(4):812-821
 VV-Field Medical-US-DEL-0066 © 2024 Lilly USA, LLC. All rights reserved.

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What Might Be Better? Clinically Applicable Body Composition Methods



DXA

Attenuation of 2 energy level x-ray transmissions (absorbed or scattered).
Measures bone and soft tissue



MF-BIA

Uses electrical properties of body to estimate TBW and from that the body fat mass.
Body is modeled as 5 cylindrical compartment



ADP

Assumes two compartment model (fat and lean) with different density. Volume of displaced air determined from changes in air pressure



DA

Smartphone app scans and quantifies body anthropometric dimensions and volume, estimates body fat by algorithm

DXA = Dual x-ray absorptiometry; MF-BIA = multiple frequency Bioimpedance analysis; ADP = Air displacement plethysmography
DA = Digital anthropometry

Digital Anthropometry



Courtesy of S Heymsfield

Body Measurements (in)	
Bicep Left Lower	12.12
Bicep Right Lower	12.53
Bicep Left	13.97
Bicep Right	15.19
Calf Left	14.68
Calf Right	14.67
Chest	44.33
Forearm Left	11.71
Forearm Right	12.04
High Hip	41.75
Hip	44.16
Neck	16.11
Thigh Left Lower	18.85
Thigh Right Lower	17.96
Mid-Thigh Left	25.42
Mid-Thigh Right	24.90
Thigh Left Upper	27.61
Thigh Right Upper	27.23
Waist (Abdominal)	41.52
Waist (Lower)	42.80
Waist (Narrowest)	38.81

SIZE3 STREAM Body F.A.T.™ Formulas of Adipose Tissue

Body F.A.T.%

Your Gender
 Male
 Female

Your Bicep (in):

Your Thigh (in):

Your Calf (in):

Your Max Stomach (in):

Your Body F.A.T.%
14.2 %

Disclaimer: Size Stream's Body F.A.T.™ was developed on input gathered from adults 18 years and older. The calculated percentage above is based on the "Lower Mean Formula" found in the "Size Stream Body Fat Formula" publication.

Body Visualizer | MeThreeSixty

Benefits of Body Composition Analysis

- Improved assessment of body fat and fat distribution
- Assessment of Sarcopenia prior to treatment
- Assistance of clinical decision making during treatment.
- Feedback on program for nutrition and physical activity program.

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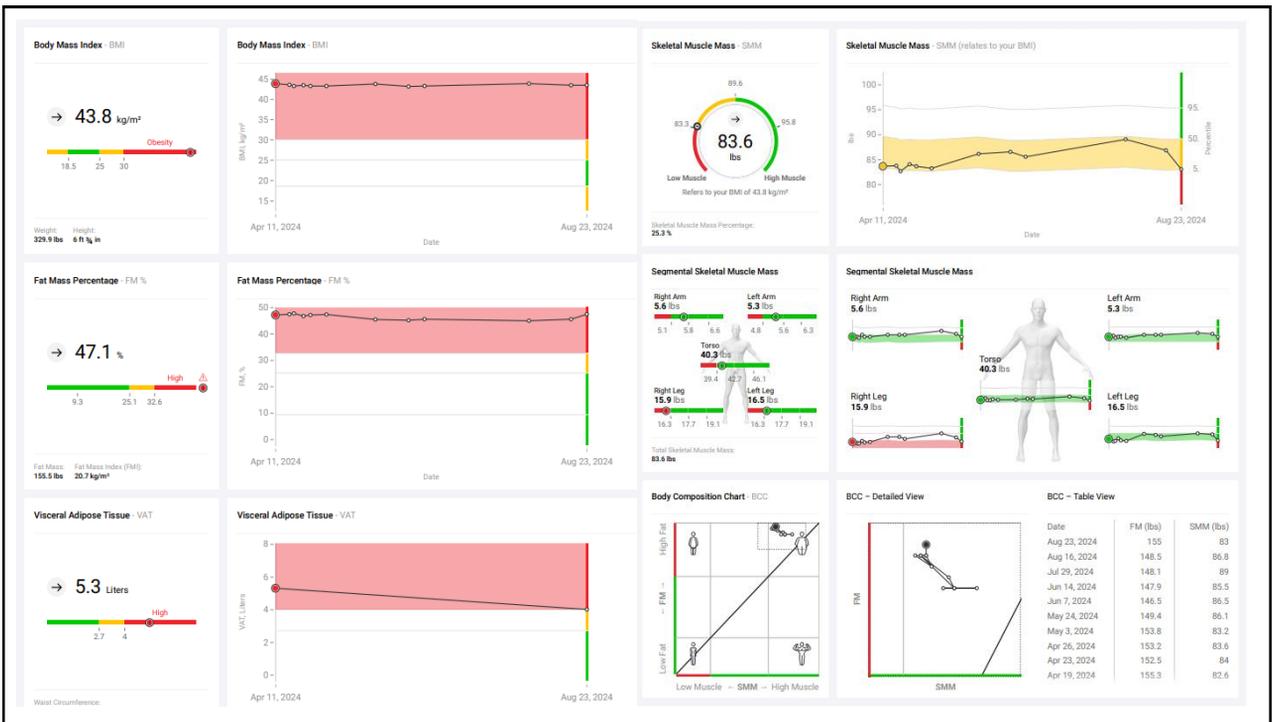
Case Jim

- 62 yo 5'9", weight 345lb, bmi 51 severe hip OA, FBS 114. WC 48"
- Retired UPS driver. Sedentary due to hip pain
- Awaiting THA surgery, but Ortho declines.
- Treated with Semaglutide 0.25mg SQ weekly for obesity and titrated up 1.7mg
- 4 month follow up visit: lost 30 lbs total but on review of body comp analysis by BIA

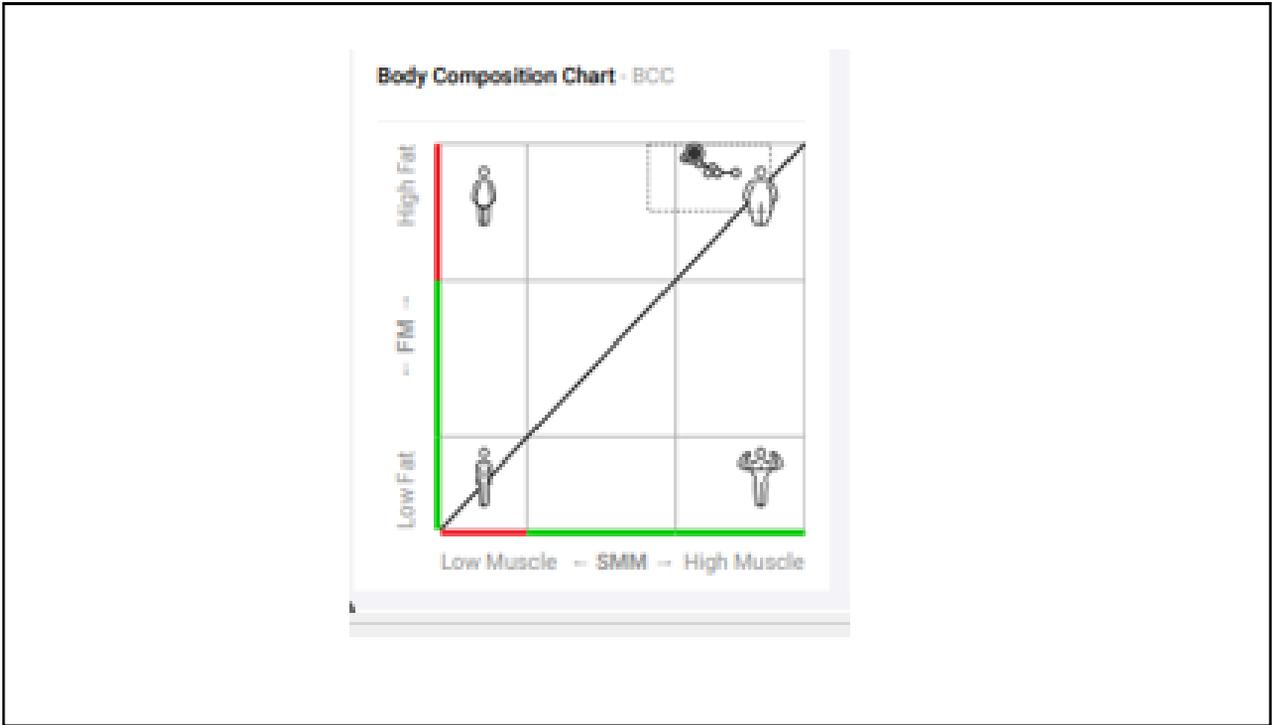
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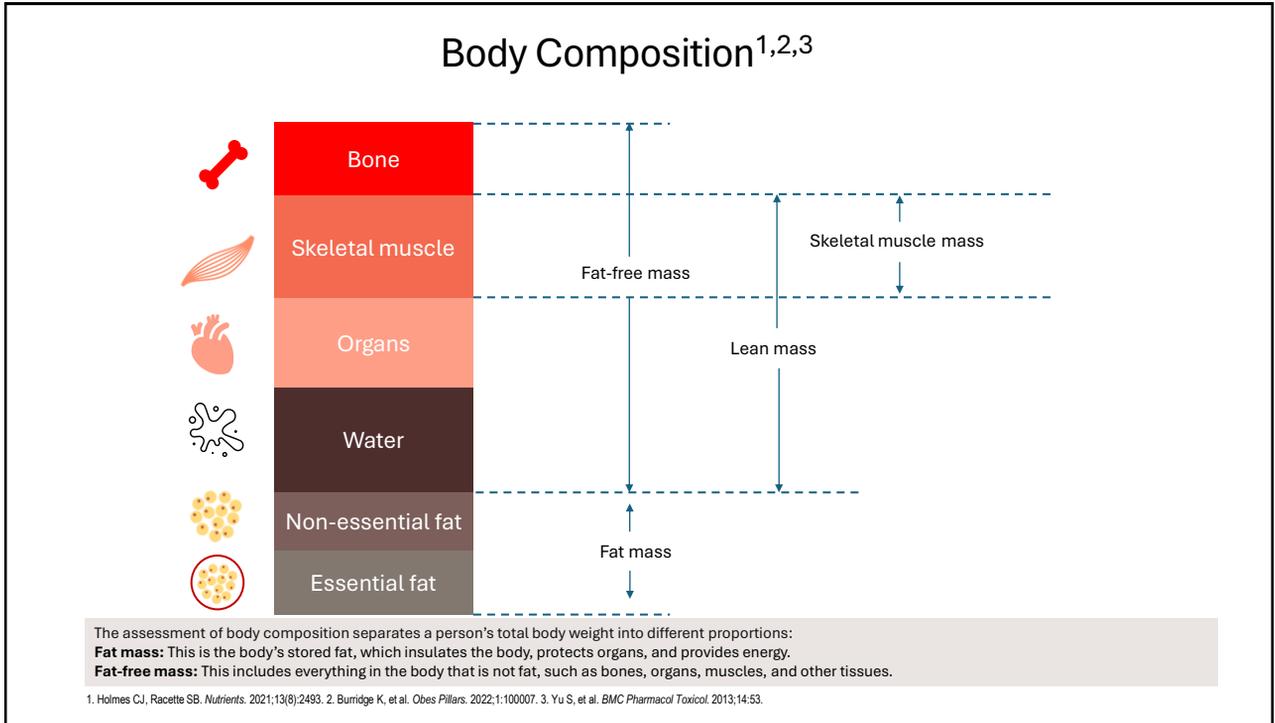


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Too Much?

- Is this too much weight loss?
- Is this too rapid weight loss?
- Is the Lean Mass loss as expected?

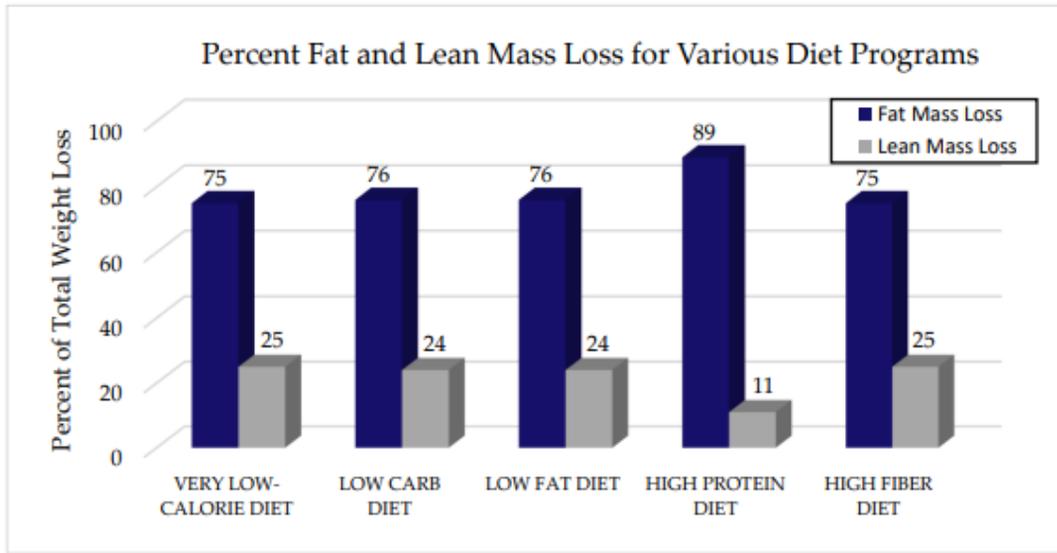
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What Are the Effects of Different Weight Loss Methods on Body Composition?

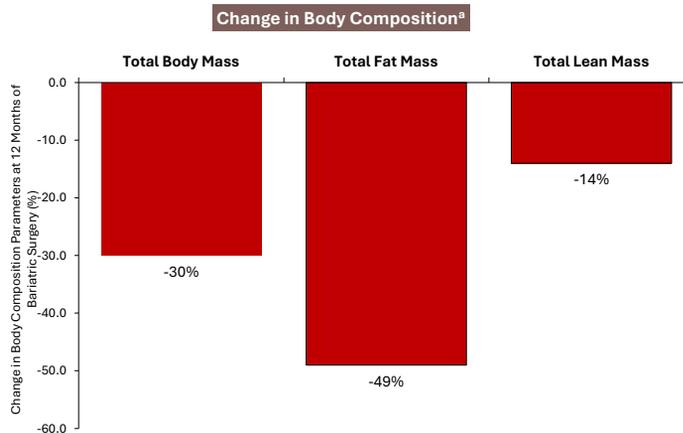
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Willoughby D, Hewlings S, Kalman D. Body composition changes in weight loss: strategies and supplementation for maintaining lean body mass, a brief review. *Nutrients*. 2018;10(12):1876.

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Change in Body Composition with Gastric Bypass Surgery at 12 Months

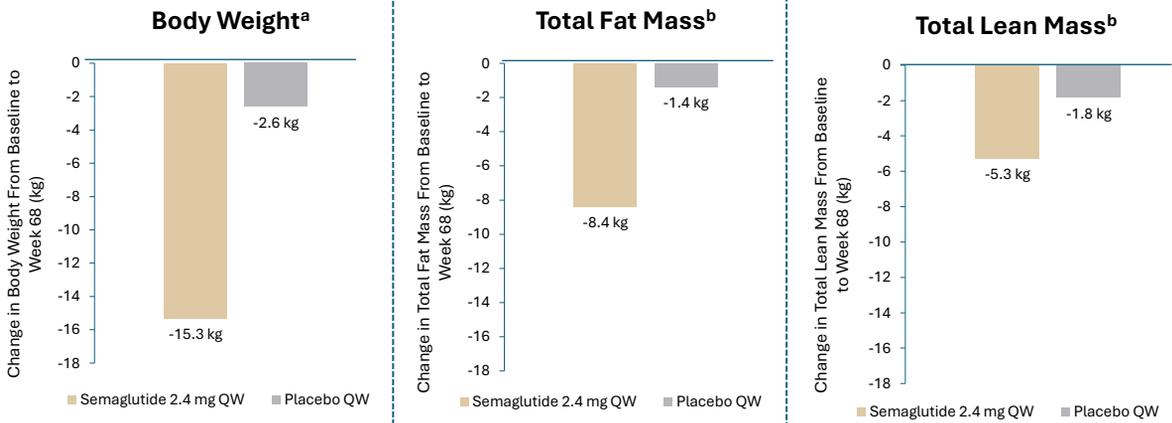


- The weight loss comprised a 49% ± 12% decrease in fat mass and a 14% ± 6% decrease in lean mass at 12 months
- Body composition was measured by DXA in 44 participants with obesity

Data are mean ± SD.
 *P < 0.05 compared with baseline by paired t test.
 DXA=Dual-Energy X-Ray Absorptiometry.
 Alba DL, et al. *J Clin Endocrinol Metab*. 2019;104(3):711-720.

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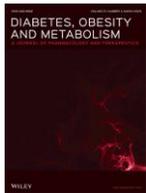
Change in Body Composition With Semaglutide at Week 68



- Phase 3 STEP1 68 week study Semaglutide vs Placebo
- 1961 participants , 140 participants in subgroup analysis
- Mean BMI 35

^aAll enrolled participants with BMI ≥30 kg/m² (N=1961).
^bSubgroup of participants with a BMI of ≤40 kg/m² (N=140).
 DXA=Dual-Energy X-Ray Absorptiometry; QW=Once Weekly.
 Wilding JPH, et al. *N Engl J Med.* 2021;384(11):989-1002.

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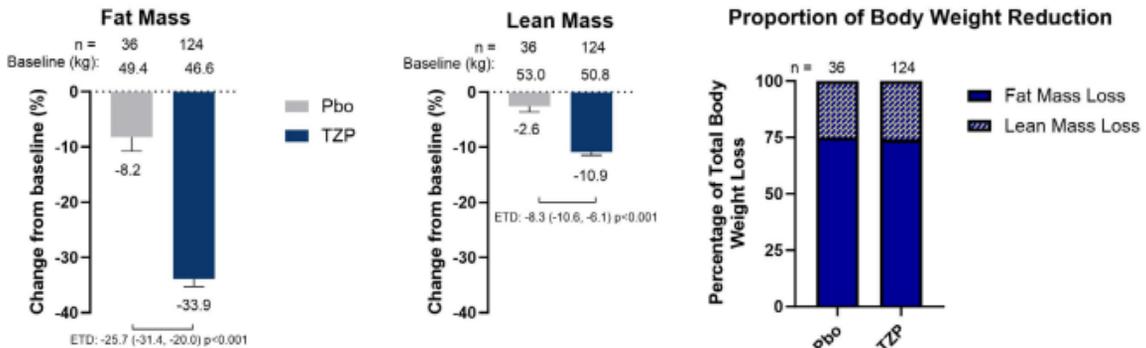
Received 7 November 2024 | Revised 28 January 2025 | Accepted 4 February 2025
 DOI: 10.1111/dom.16275

ORIGINAL ARTICLE

WILEY

Body composition changes during weight reduction with tirzepatide in the SURMOUNT-1 study of adults with obesity or overweight

Michelle Look MD¹ | Julia P. Dunn MD² | Robert F. Kushner MD³ |
 Dachuang Cao PhD² | Charles Harris MD² | Theresa Hunter Gibble PhD² |
 Adam Stefanski MD² | Ryan Griffin Pharm. D.²



Phase 3 Surmount 1 72 week study Tirzepatide vs Placebo
 2539 participants total, 160 participants in subgroup analysis
 Average BMI 38

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What Are the Effects of Different Weight Loss Methods on Body Composition?

Changes in Body Composition with Weight Loss

	<u>Total Wt Loss</u>	<u>Fat loss</u>	<u>Lean loss</u>	<u>Lean/fat ratio</u>
RYGB ¹	34.1 kg	22.8 kg	7.9 kg	0.3
Sleeve	30.5 kg	19.2 kg	8.2 kg	0.4
Medical ²	20.6 kg	16.7 kg	4.9 kg	0.3
Surgery (RYGB)	23.3 kg	17.8 kg	5.5 kg	0.3
Semaglutide ³	16.9 kg	10.4 kg	6.9 kg	0.7 ★
Tirzepatide ⁴	18.4 kg	15.0 kg	3.3 kg	0.2

1. Sylviris A et al. *Ob Rev* 2022; 23:e13442. Data are from 4 studies
2. Kulovitz MG et al. *Nutrition* 2014; 30:49. Weight losses >15% in both arms, n=48
3. Wilding JPH et al. *NEJM* 2021; 384:989
4. Jastreboff AM et al. *NEJM* 2022; 387:205

Milken Institute School of Public Health
THE GEORGE WASHINGTON UNIVERSITY

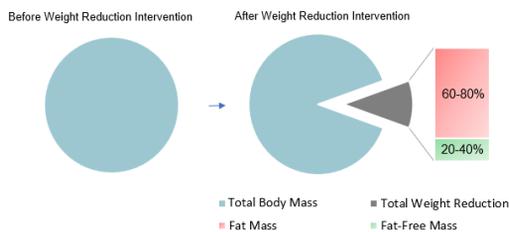
Sumner M. Redstone
Global Center for Prevention & Wellness

Slide Courtesy Bill Dietz, STOP Obesity Alliance

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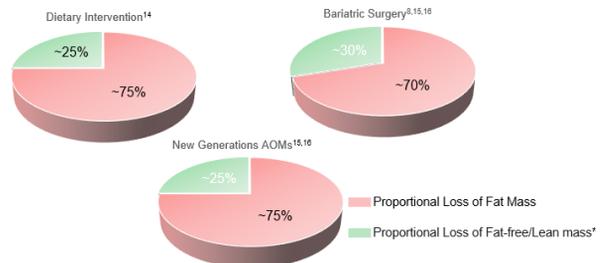
Weight Reduction Is Accompanied by the Loss of Both Fat Mass and Fat-free Mass¹

Weight Reduction With Most Obesity Interventions^{12,13}



The image above illustrates the contribution of fat mass and fat-free mass to total weight reduction

Weight Reduction With Different Interventions



*Lean mass, a component of fat-free mass excluding bone mass, is typically assessed using Dual-Energy X-Ray Absorptiometry (DXA).⁶

5. Garvey WT. *J Clin Endocrinol Metab*. 2022;107(4):e1339-e1347. 6. Holmes CJ, Racette SB. *Nutrients*. 2021;13(8):2493. 8. Nuijten MAH, et al. *Obes Rev*. 2022;23(1):e13370. 12. McCarthy D, Berg A. *Nutrients*. 2021;13(7):2473. 13. Heymsfield, S. *Obesity Reviews*. 2014;15(4):310-321. 14. Willoughby, D. *Nutrients*. 2016;10(12):1876. 15. Wadden TA, et al. *Curr Obes Rep*. 2023;12(4):453-473. 16. Chaston, T. *Int J Obes (Lond)*. 2007;31(5):743-750. 17. Alba, D. *The Journal of Clinical Endocrinology & Metabolism*. 2019;104(3):711-720.

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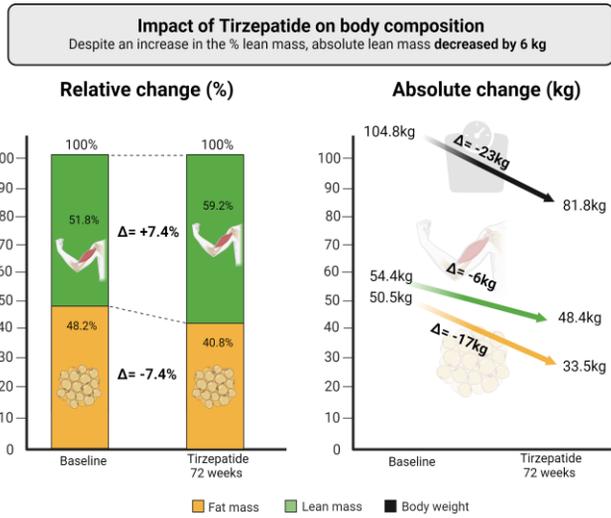


Figure Legend:
Impact of Tz on body composition: relative versus absolute change. Despite an increase in the percent LM, absolute LM decreased by 6 kg.

Diabetes Care. 2024;47(10):1718-1730. doi:10.2337/doi23-0100

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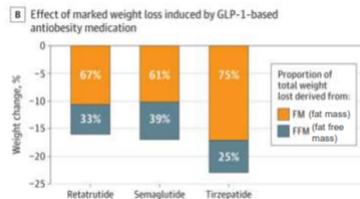
Key Question for Muscle Preservation Drugs: Do They Matter?

No. When you weigh less you need less muscle. Losing some muscle mass is not clinically relevant.

From: Conte C, Hall KD, Klein S. Is Weight Loss-Induced Muscle Mass Loss Clinically Relevant? *JAMA*. Jun 3, 2024

The loss of fat free mass (FFM) is not clinically relevant and is normal. Weight loss helps muscle function and there is little evidence that Activin II receptor blockade matters.

"The marked weight loss induced by GLP-1-based antiobesity medications and the results from several trials that found 25% to 40% of the weight lost was composed of FFM/lean body mass (Figure, B) have led to concerns regarding adverse effects of GLP-1-based antiobesity medications on physical function... However, none of these studies reported the effects of weight loss on SMM (skeletal muscle mass) or objective measures of physical function. It is unlikely that the decline in SMM that occurs with even large amounts of weight loss impairs physical function. People with obesity generally have greater amounts of FFM (fat-free mass) and SMM than lean people, so the decrease in SMM induced by weight loss represents a small fraction of total body SMM. Moreover, even though the decrease in SMM can sometimes cause a decrease in muscle strength, it does not necessarily have an adverse effect on physical function. Intentional weight loss causes a greater relative decrease in body fat than FFM or SMM, so the ratio of FFM/SMM to fat mass increases. Accordingly, physical function and mobility improve after weight loss despite the decrease in FFM/SMM, even in older adults with decreased FFM and SMM at baseline. In addition, weight loss improves the "quality" of remaining muscle



by decreasing intramyocellular and intermuscular triglycerides and increasing muscle insulin sensitivity. Nonetheless, the effect of GLP-1-based antiobesity medications on FFM has led to an interest in developing concomitant pharmacotherapy to mitigate the decrease in FFM/SMM. A 2024 study in mice found that stimulating muscle growth by blocking the activin II receptor prevented the decrease in FFM during weight loss induced by GLP-1 agonism, but did not result in greater benefits in exercise performance or glucose homeostasis than weight loss induced by GLP-1 agonism alone."

The stories told about having worse body composition after weight rebound are not accurate.

"It has been proposed that weight loss and subsequent regain in people with obesity could have detrimental effects on body composition, based on short-term studies that found a greater relative increase in fat mass than FFM in regained weight than in lost weight, suggesting repeated cycles of weight loss and regain will increase whole-body adiposity. However, these studies involved refeeding following experimental weight loss in lean individuals (eg, the Minnesota Starvation Experiment) or illness-induced cachexia (eg, tuberculosis, cancer). Such data do not accurately reflect weight regain after intentional weight loss in people with obesity, where the composition of weight regained is nearly identical to the composition of weight lost. GLP-1-based pharmacotherapy and bariatric surgery can achieve marked weight loss in people with obesity. Even though the absolute decrease in FFM/SMM is related to total weight loss, the decrease in FFM/SMM in relation to baseline is usually small and the relative reduction in FFM/SMM is less than the relative reduction in fat mass, resulting in an improvement in physical function.

Source: <https://jamanetwork.com/journals/jama/article-abstract/2819410> 79

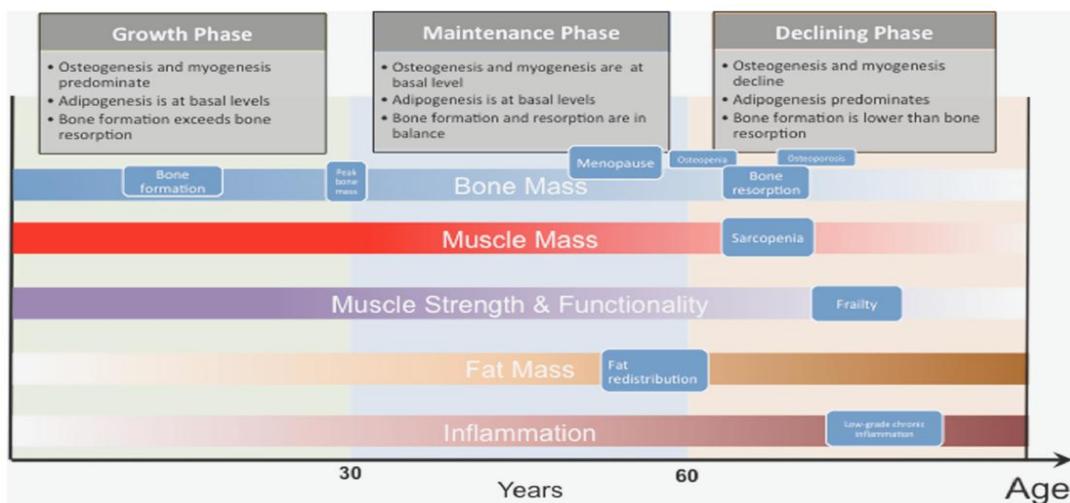
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Who Is at Risk for Too Much Weight Loss?

- Lower BMI (<35)
- Older individuals (because they start with lower lean mass)
- Sarcopenic Obesity
- Older women (because of the higher risk of osteoporosis)
- Women (because of the cultural drive for slimness driving unrealistic body image)

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Body Composition Across the Lifespan

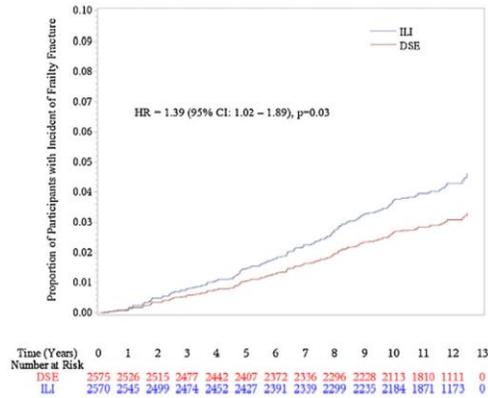


JafariNasabian P, et al. Journal of Endocrinology. <http://joe.endocrinology-journals.org> DOI: 10.1530/JOE-16-0603

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Frailty Fractures in Weight Loss

Increased Risk of Frailty Fractures in Look AHEAD Intensive Lifestyle Intervention



Increased Risk of Fractures in SELECT Cardiovascular Outcome Trial

- SELECT study hip and pelvic fractures from SAE reports
- Average age 61.5 years at start
- Average weight loss 9.3%
- Female patients
 - 1.0% (24/2448) vs 0.2% (5/2424)
- Patients age 75+
 - 2.4% (17/703) vs. 0.6% (4/663)

Johnson KC, et al. *J Bone Miner Res* 2017;32:2278-2287.

Kushner RK et al. *Obesity* (Silver Spring). 2025 Feb 13. doi:10.1002/oby.24222.

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Is More Always Better?
No, Better Is Better!



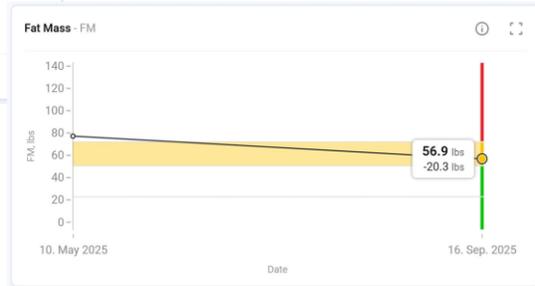
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Body Composition Over Time

Initial report



4-month follow-up



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Reviewing Skeletal Muscle Mass

Initial scan



Trend



4-month follow-up



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Advice for Jim

- Minimal change in VAT reduction in liters.
- Ratio of fat to sk mm mass loss close to 2:1, abnormal.
- Slow down the weight loss
- Lower the dose of Semaglutide or hold on up titration
- Focus on Nutrition and Resistance training

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Supporting a Healthier Lifestyle During Weight Reduction¹

HEALTHY DIET



PHYSICAL ACTIVITY



CONSIDERATIONS

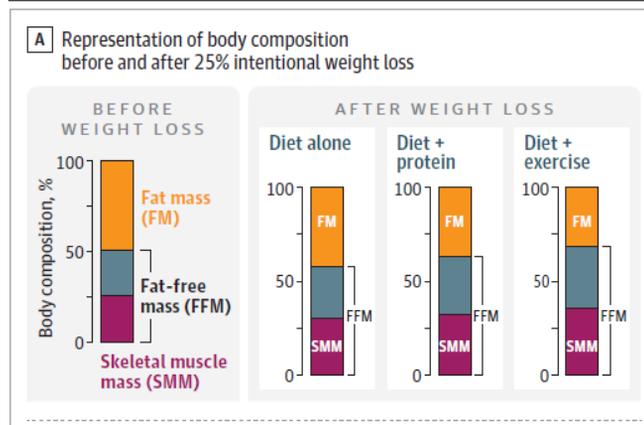
- Nutritional completeness should be monitored¹
- Diets rich in high-quality protein sources can support muscle maintenance and overall metabolic health during weight loss efforts¹
- Physical activity is defined by any bodily movement produced by skeletal muscles that results in energy expenditure²
- Incorporate resistance training and aerobic training¹⁻⁴

1. Almandoz JP, et al. Obesity (Silver Spring) 2024 Jun 10. Online Ahead of print. 2. WHO guidelines on physical activity and sedentary behaviour <https://www.who.int/news-room/fact-sheets/detail/physical-activity>, accessed 10th of September 2024. 3. Wadden TA, et al. Am Psychol. 2020;75(2):235-251. 4. Wharton S, et al. Obesity (Silver Spring). 2023;31(3):703-715.

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Weight Loss–induced Reduction in Fat-free Mass (FFM) and Skeletal Muscle Mass (SMM) Is Attenuated Through Dietary Protein and Exercise

Figure. Body Composition Before and After Weight Loss



Conte C, et al. JAMA. 2024;332(1):9-10

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Nutritional Assessment

Assess	Assess risk factors for nutrient deficiencies
Evaluate	Evaluate nutrient intake (e.g., 24-hour dietary recall)
Perform	Perform nutrition-focused history and physical assessment
Assess	Assess body composition

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Advise on Recommended Intakes

- Fluids:** $\geq 2-3$ L/day
- Protein:** >60 g/day (up to 1.5 g/kg body weight/day)
- Fiber:** >21 g/day (women); >30 g/day (men)
- Energy:** 1200–1500 kcal/day (women); 1500–1800 kcal/day (men)
- Micronutrients:** correct deficiencies; consider vitamin D, calcium, multivitamin

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Monitor Treatment Response

- Assess response monthly during dose escalation, then every 3 months
- Adjust concomitant medications as needed
- Address gastrointestinal symptoms
- Ensure adequate social and emotional support
- Monitor for mood disorders

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Risk Factors for Malnutrition

- Obesity
- History of GI or bariatric surgery
- Advanced age
- Chronic diseases (e.g., CKD, heart failure, liver disease)
- Eating, mood, or substance use disorders
- GI symptoms
- Unintended weight loss >5% in 1 month or >10% in 6 months
- Food insecurity or monotonous diet
- Poor dentition

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Management of AOM-Associated Adverse GI Events

- Eat smaller, nutrient-dense meals more frequently
- Limit high-fat, spicy foods, alcohol, and carbonated beverages
- Reduce dose, slow titration, or switch therapy
- Use OTC medications for short-term symptom relief if needed
- Ensure adequate intake of protein, fiber, fluids, and micronutrients
- Use short-term supplements if oral intake is inadequate

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Timing of Protein Matters

<p>Post-Workout</p>	<p>The post-exercise “anabolic window” is crucial for recovery.</p> <p>Aim to consume 20–30 grams of protein with carbohydrates within 30–60 minutes after training. This helps stimulate muscle protein synthesis (MPS) and aids in recovery.</p>
<p>Even Distribution Throughout the Day</p>	<p>Distributing protein intake evenly throughout the day can further enhance MPS.</p> <p>Aim for 20–30 grams of protein per meal and 4–5 protein feedings a day (breakfast, lunch, pre-training, post-training/dinner, snacks) to ensure a steady supply of amino acids for muscle repair and growth.</p>

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EVERY MOVE COUNTS

Being active has significant health benefits for hearts, bodies and minds, whether you're walking, wheeling or cycling, dancing, doing sport or playing with your kids.

LIMIT sedentary time

REPLACE with some physical activity

ANY IS BETTER THAN NONE

150 minutes PER WEEK

150 to 300 minutes PER WEEK

60 minutes PER DAY

On at least 2 days a week muscle strengthening activities

On at least 3 days a week multicomponent activities for balance and strength

more than 300 minutes PER WEEK

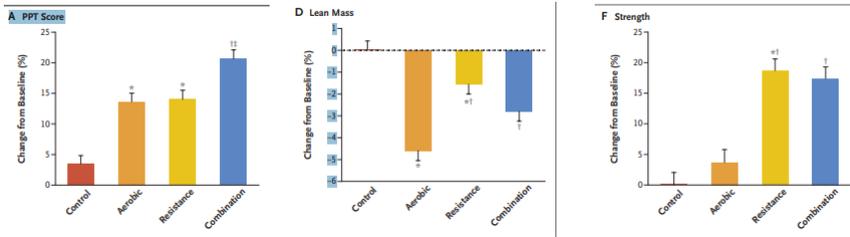
MORE IS BETTER

PREGNANT & POSTPARTUM WOMEN | **ADULTS & OLDER ADULTS** | **CHILDREN & ADOLESCENTS** | **ADULTS** | **OLDER ADULTS** | **EVERYONE WHO CAN**

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Aerobic vs Resistance Training Physical Function, Lean Mass and Strength

Figure 2 (facing page). Mean Percentage Changes in Physical Function, Lean Mass, and BMD at the Total Hip during the Interventions. Measures of physical function included the Physical Performance Test (PPT; scores range from 0 to 36, with higher scores indicating better functional status), peak oxygen consumption, Functional Status Questionnaire (FSQ; scores range from 0 to 36, with higher scores indicating better functional status), and strength (measured as total one-repetition maximum [i.e., the total of the maximum weight a participant can lift, in one attempt, in the biceps curl, bench press, seated row, knee extension, knee flexion, and leg press]). Scores on the PPT were used as an objective measure of frailty (primary outcome), and scores on the FSQ were used as a subjective measure of frailty. The asterisk indicates $P < 0.05$ for the comparison with the control group, the dagger $P < 0.05$ for the comparison with the aerobic group, and the double dagger $P < 0.05$ for the comparison with the resistance group. Percentage changes are presented as least-squares–adjusted means; T bars indicate standard errors. BMD denotes bone mineral density.



Villareal et al., NEJM, 2017 376:1943

Seated Exercises

Ankle Pumps

Pump both ankles up and down 10 times.

Repeat: 10 times

Perform: 3 times daily



Glute Squeeze

Tighten your buttocks and hold for the count of 5. Relax.

Repeat: 5 times

Hold: 5 seconds

Perform: 3 times daily



Seated Exercises

Leg Extension

Press your lower back, firmly into the back of the chair while sitting up straight. Engage abdominals by pressing the belly button toward your spine. Extend one leg straight, tightening thigh muscles, and hold for a count of 10. Switch legs.

Repeat: 5 times each side

Hold: 10 seconds

Perform: 3 times daily



Pelvic Tilt

Tilt your pelvis backward and then forward. It will feel like you are pulling your stomach in and then sticking your stomach out. Hold each position for 5 seconds.

Repeat: 5 times each position

Hold: 5 seconds

Perform: 3 times daily



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Seated Exercises

Seated Marches

Start by sitting in a chair with an elastic band wrapped around your lower thighs. Next, move a knee upward, set it back down and then alternate to the other side.

Repeat: 10 times each side

Perform: 2 times daily



Seated Butterfly

While seated in a chair, place a looped elastic band around your thighs near your knees. Start by moving both knees out to the side to separate your legs. Return to starting position and repeat.

Repeat: 10 times

Perform: 2 times daily



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Resistance Training

Sit to Stand

Hold onto the band for stability. Sit towards the front edge of a sturdy chair. Place feet shoulder width apart with knees at a 90 degree angle. Leaning forward at the waist, push through your heels to a standing position, lower down.

Advanced Level: perform the same movement without the resistance band.

Repeat: 10 times

Perform: 2 times daily



Slider Cardio

Place a slider under one foot. Sit up tall and engage your core. Slide your foot horizontally back and forth as fast as you can. Use your arms for stability.

Perform this exercise for 30 seconds and switch feet.

Next, move your foot vertically, forward and backward.

Perform this exercise for 30 seconds and switch feet.

Repeat: 10 times each side/each direction

Perform: 2 times daily



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Resistance Band

Monster Walk

Place a looped elastic band around both thighs.

Bend your knees and step to the side while keeping tension on the band the entire time. Repeat the sidesteps to the side in one direction and then reverse the direction until you return to the starting position.

Repeat: 10 times each direction

Perform: 2 times daily



Standing Leg Lifts

While standing with an elastic band looped around your ankles, move the target leg low to the ground in three directions. For the right leg, move your leg in a 3-6-9 o'clock direction and for the left leg, move in a 6-7-9 o'clock direction.

Remember to stand tall and do not arch your back.

Repeat: 5 times each leg

Perform: 2 times daily



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Standing Strength Exercises

Single legged overhead march

Overhead March

Stand tall and suck your belly in. Stand on one foot for 3 seconds and then switch sides.

Advanced Level: add a 1-5lbs dumbbell over your head

Duration: 3 second

Repeat: 10 times each side

Perform: 3 times daily



Wall Sits

While standing, lean you back against a door or wall with a slick surface. Position your feet shoulder-width apart. Next, bend your knees as you slide your body downward, making sure your knees stay above your ankle(not your toes), and hold for 10 seconds.

Repeat: 5 times

Perform: 2 times daily



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Standing Strength Exercises

Modified Plank

Stand in front of a table and then take a step backward with both feet as you place your elbows on the table. Maintain a straight spine and pull in your belly to your back as you hold this position. Hold this position for about 30 seconds, building up the holding time each week.

Repeat: 2 times daily



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Lifestyle 5 P's



Planned Portions

- Regular consistent eating that is portion controlled

Plants and Protein-whole foods

- Vegetables, fruit and 1-1.5g/kg ideal body weight of protein

Power

- Strength training

Pillow

- Adequate sleep

Pause

- Avoid eating in the night

Dr. Angela Fitch, Past President Obesity Medicine Association, CMO Knownwell

Beyond BMI

-
- Assess Adiposity
 - Assess Lean Mass It Matters
 - Choose treatment based on Signs and Symptoms of Clinical Obesity
 - Even in the age of new Obesity Management Medications (OMM) lifestyle treatment is important
 - Nutrition(adequate protein) and Resistance Training are essential

