Preserving Muscle Mass with Weight Loss with High Protein Diet

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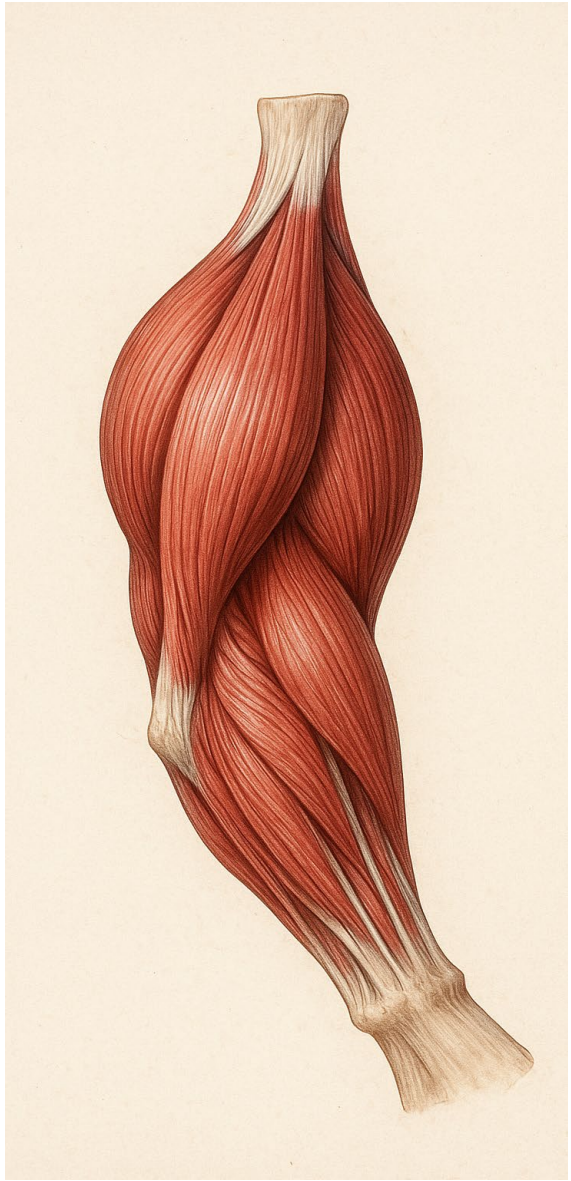
Disclosures

- Principal Investigator – Novo Nordisk Clinical Trial

What’s your take on high protein for muscle health?

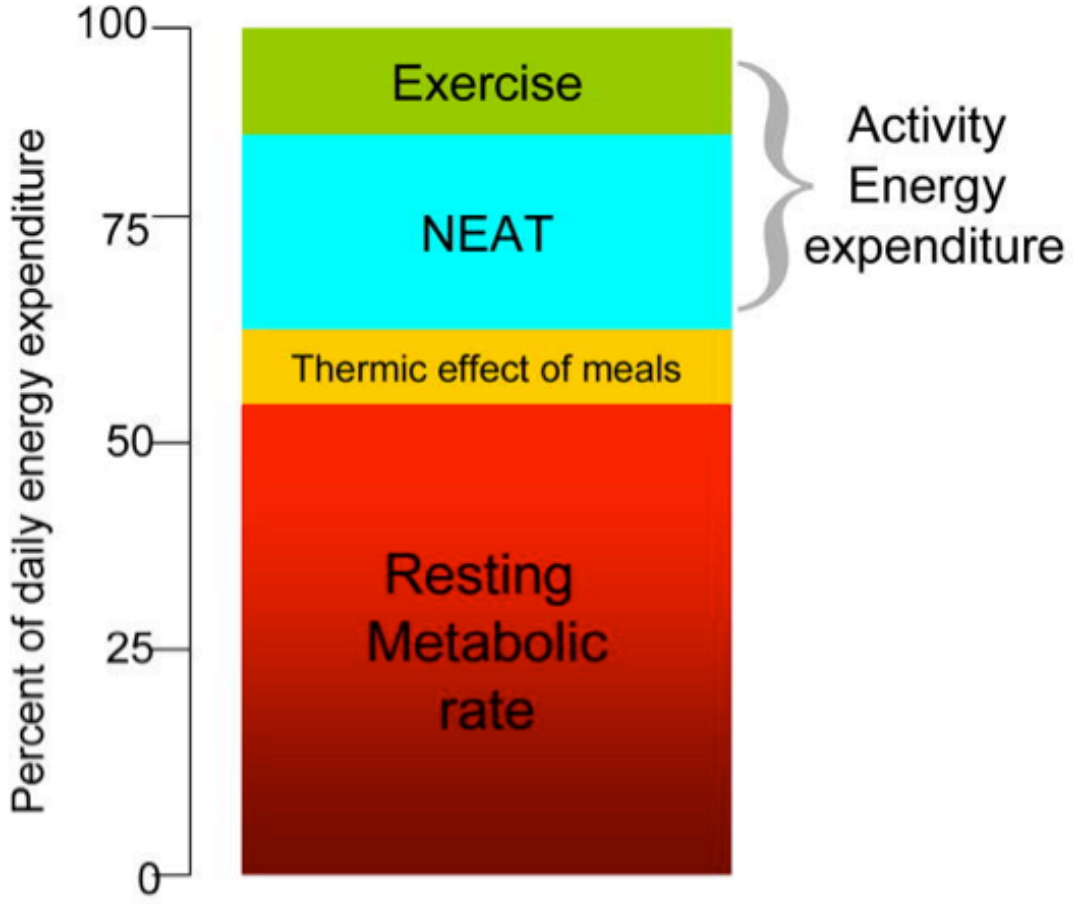
- Absolutely! I’m basically 90% chicken breast at this point
- Show me the evidence… otherwise I’m sticking with carbs and vibes
- Doesn’t matter. Just eat your veggies and pray

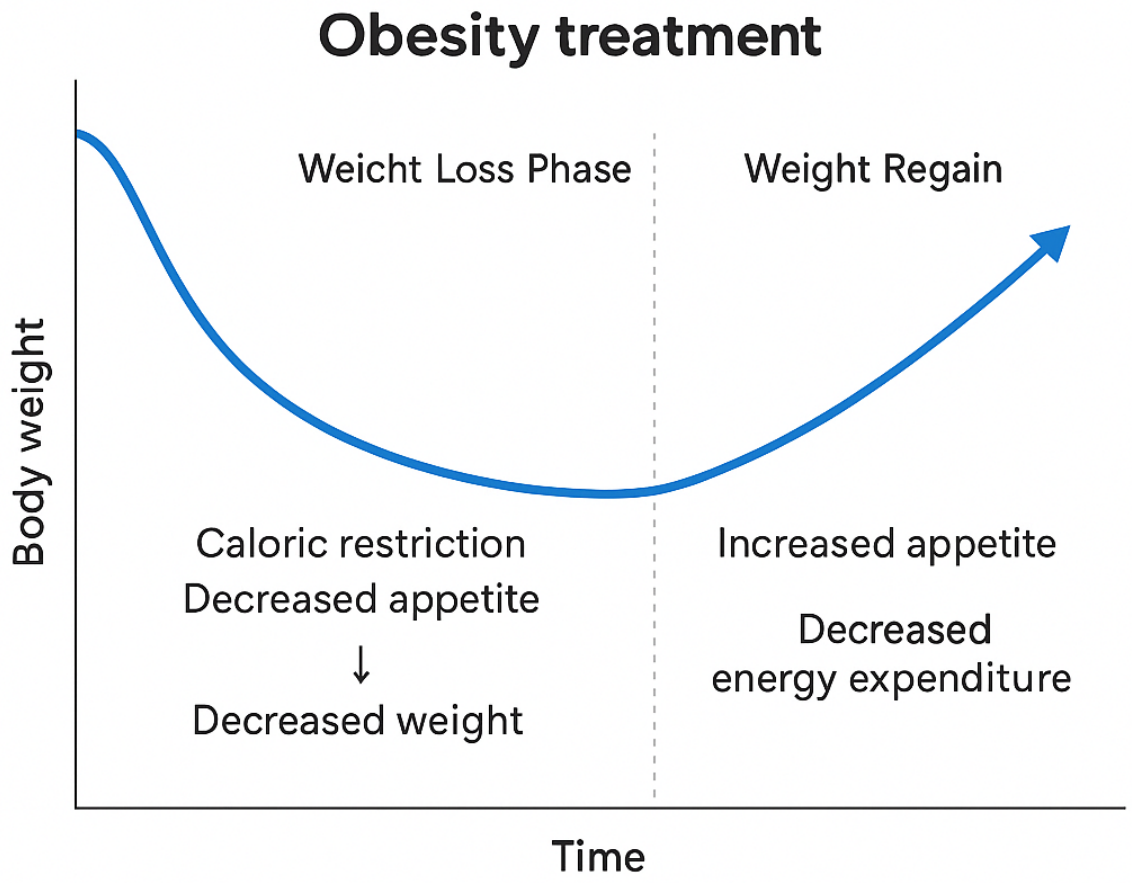
Why do we care?



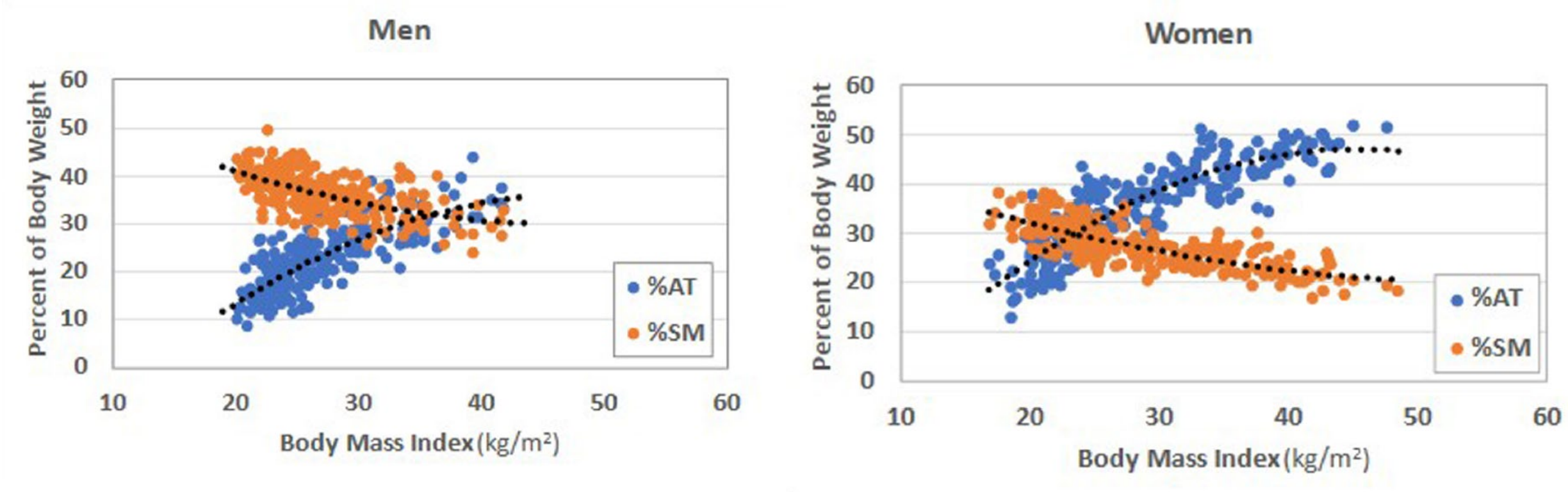
1. There are effective medications for obesity care
2. These medications will supress appetite and slow gastric emptying
3. Restricted caloric intake leads to weight loss usually followed by muscle mass loss
4. Muscle is metabolic active and its loss lead to reduced energy expenditure

Don’t fight physiology!





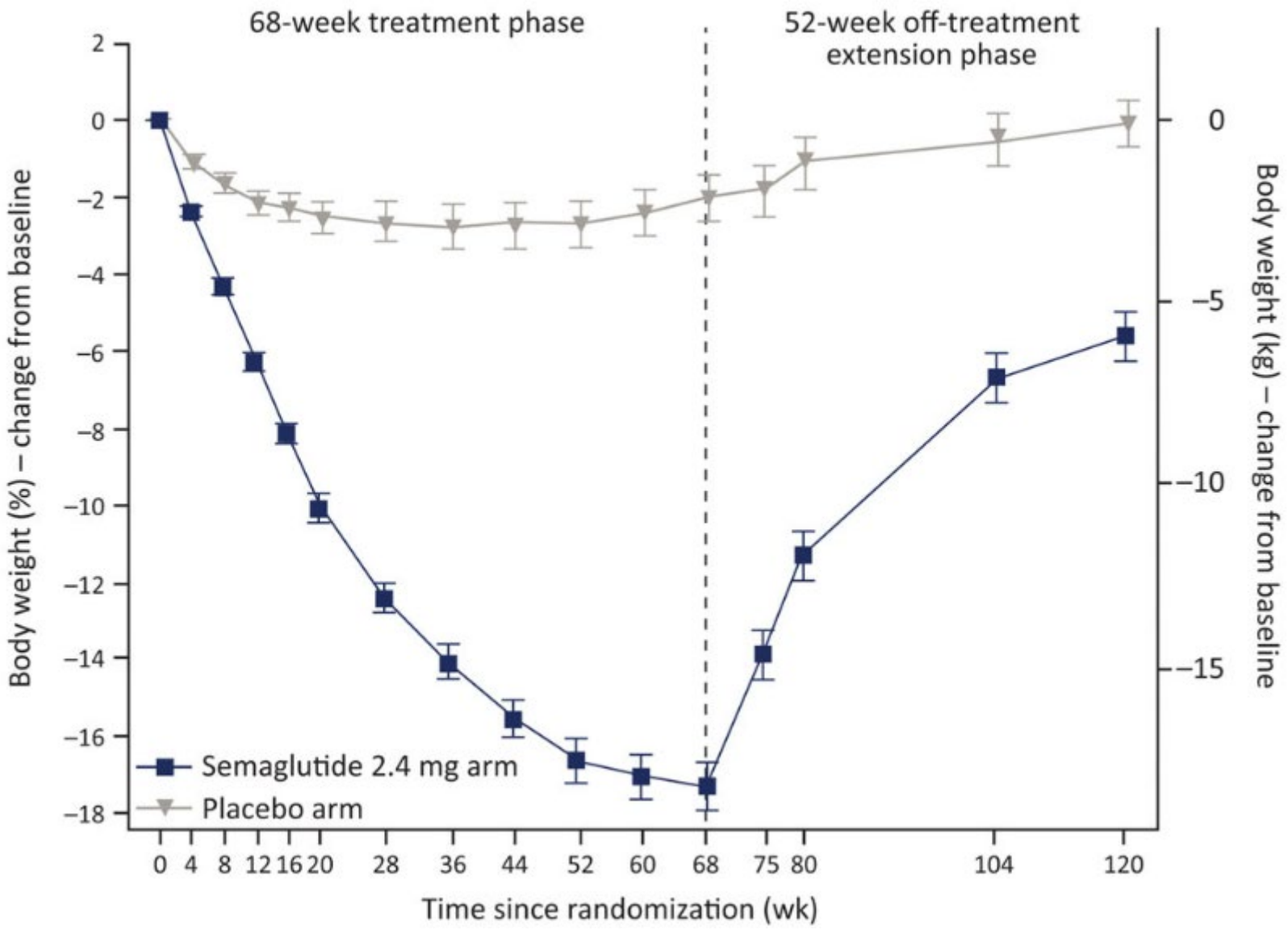
Muscle Mass and Obesity



Absolute Muscle is different than Relative Muscle/Fat

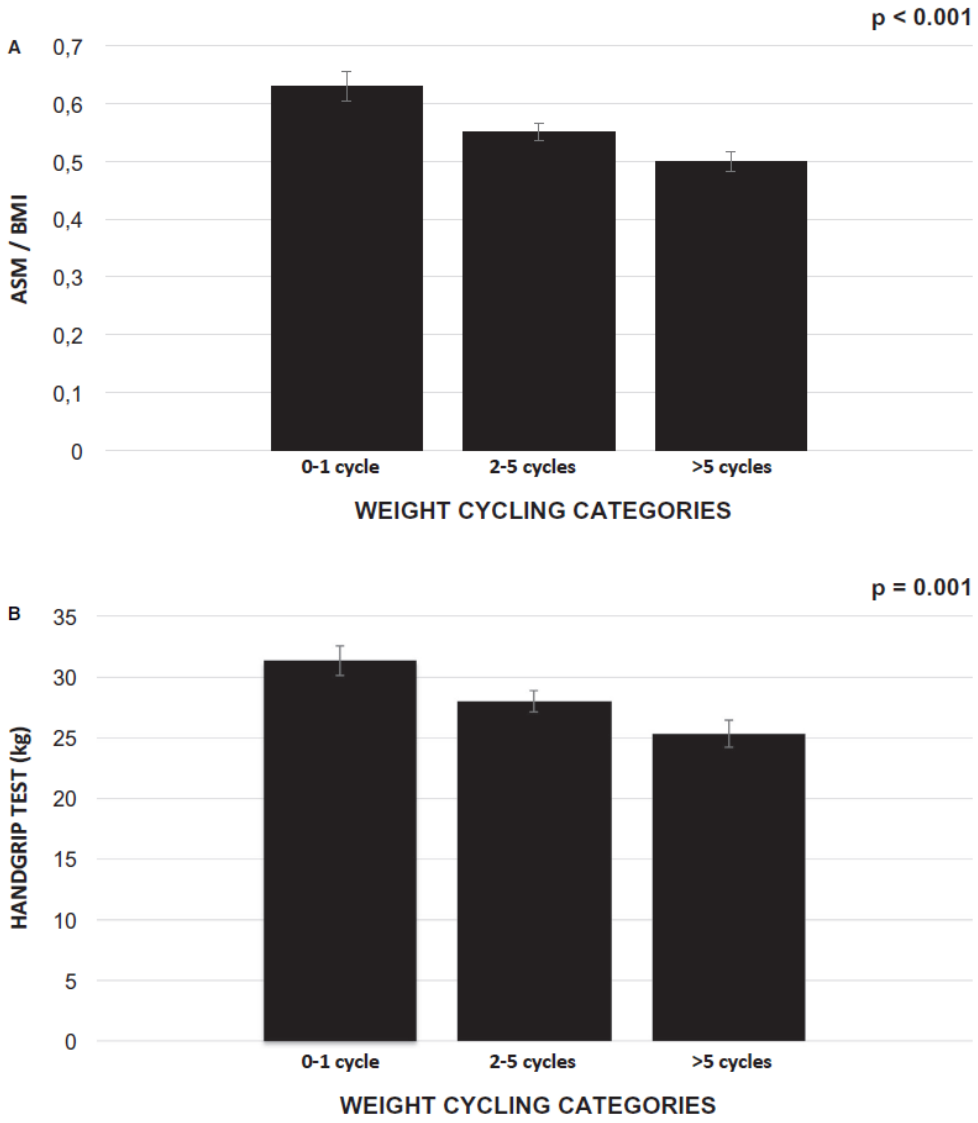
Phenotypic differences between people varying in muscularity. Heymsfield at al. Jounral of Cachexia and Muscle. 2022.

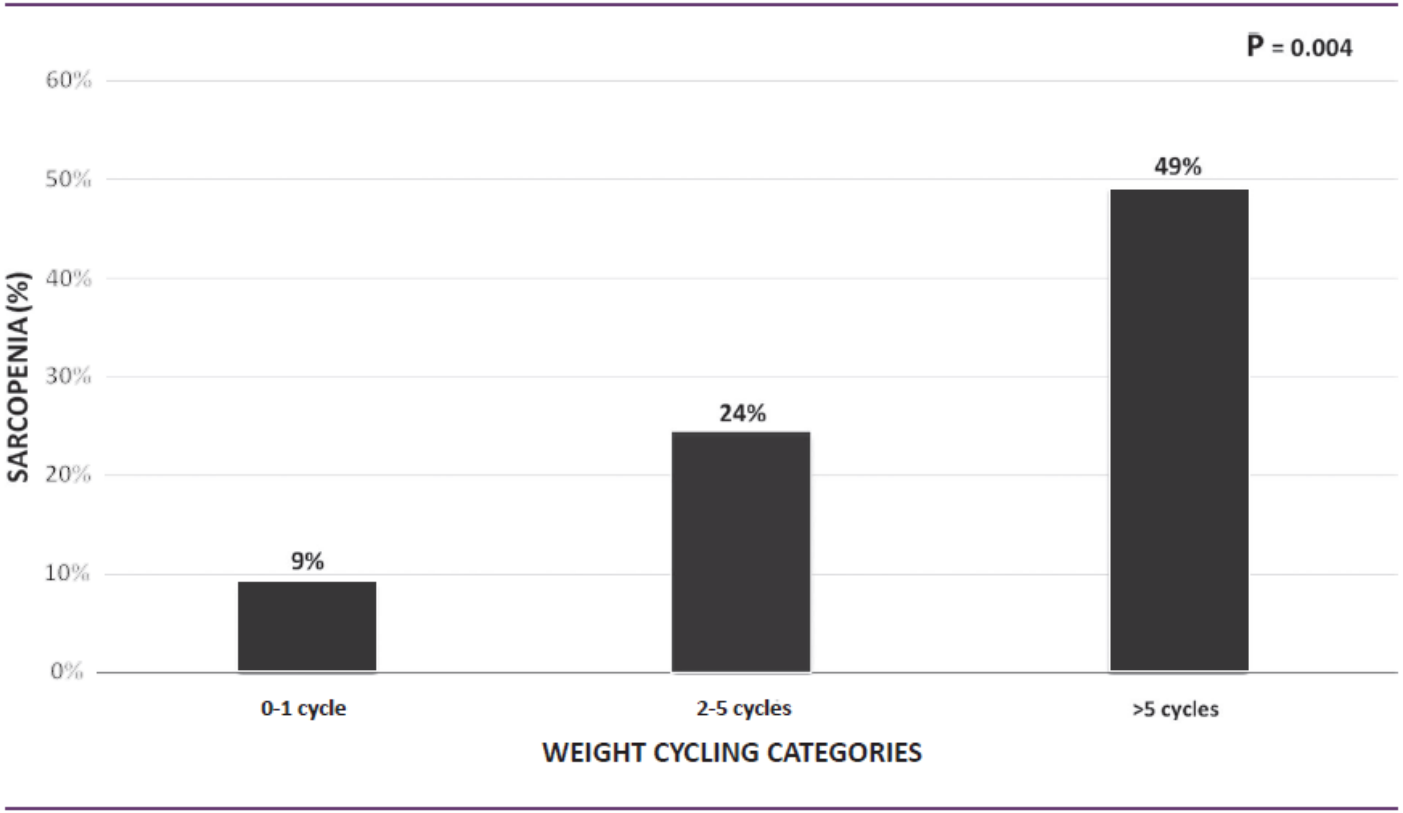
Weight Regain



Weight regain and cardiometabolic effects after withdrawal of semaglutide: The STEP 1 trial extension Wilding at all. Obesity. 2022.

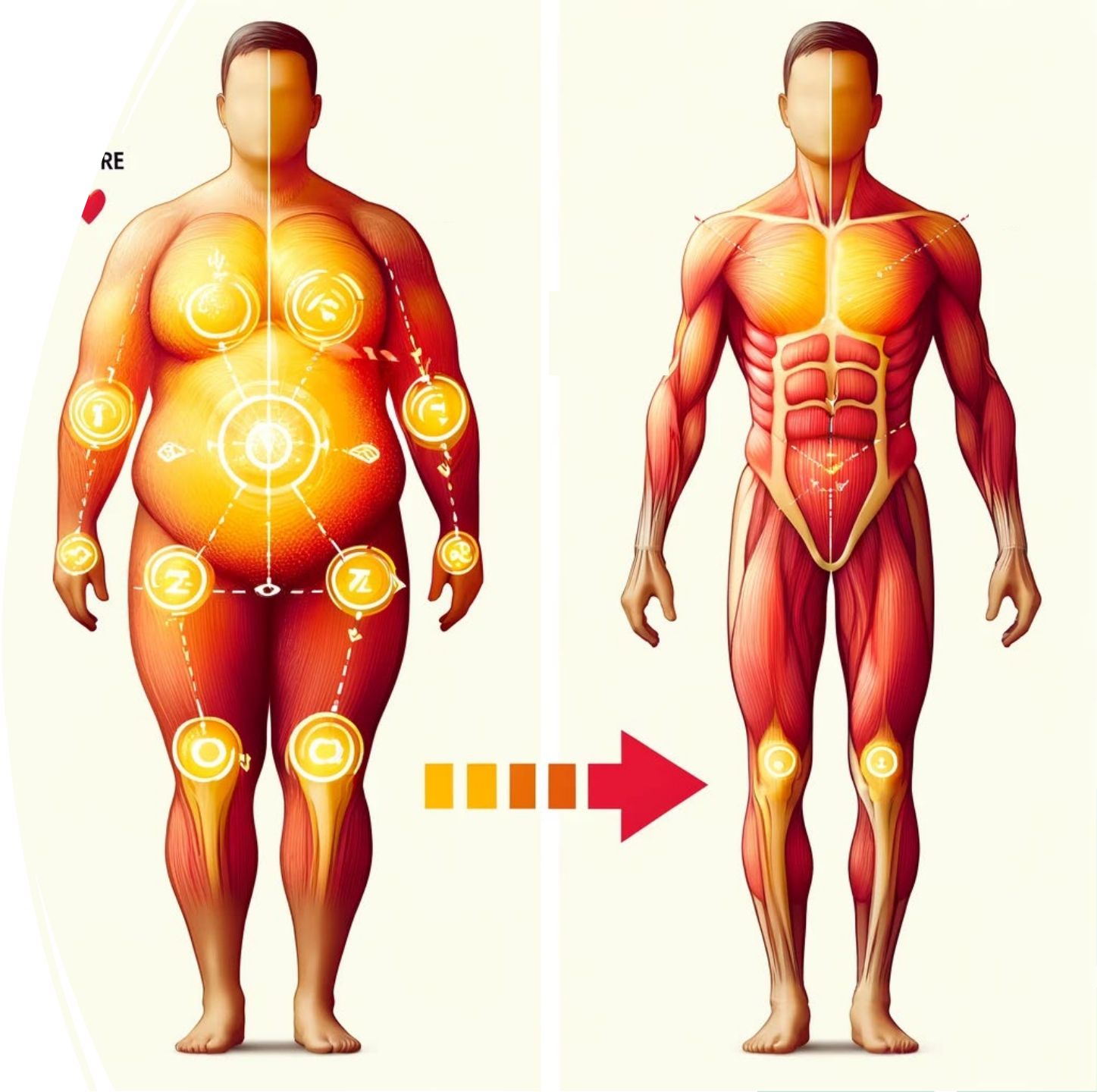
Weight Cycling and Muscle Mass





Weight Cycling as a Risk Factor for Low Muscle Mass and Strength in a Population of Males and Females with Obesity. Rossi at al. Obesity. 2019

Let’s break down fat and muscle loss



DEXA Changes – fat and muscle

Body composition (DEXA)	DEXA subpopulation: Semaglutide 2.4 mg once weekly (N=95)	DEXA subpopulation: Placebo once weekly (N=45)	DEXA subpopulation: Total (N=140)	Overall study population (N=1961)*
Total fat mass‡	42.1 ± 10.1	43.3 ± 9.2	42.5 ± 9.8	
Kg	43.4 ± 7.5	44.6 ± 8.1	43.8 ± 7.7	
%				
Total lean body mass‡	52.4 ± 11.6	51.5 ± 10.8	52.1 ± 11.3	
Kg	53.9 ± 7.4	52.7 ± 7.7	53.5 ± 7.5	
%				
Total fat mass				
Kg change	−10.40	−1.17	ETD: −9.23 [−12.72; −5.74]	
Total lean body mass				
Kg change	−6.92	−1.48	ETD: −5.44 [−7.07; −3.81]	

Baseline

Intervention

24% fat loss

13% muscle loss

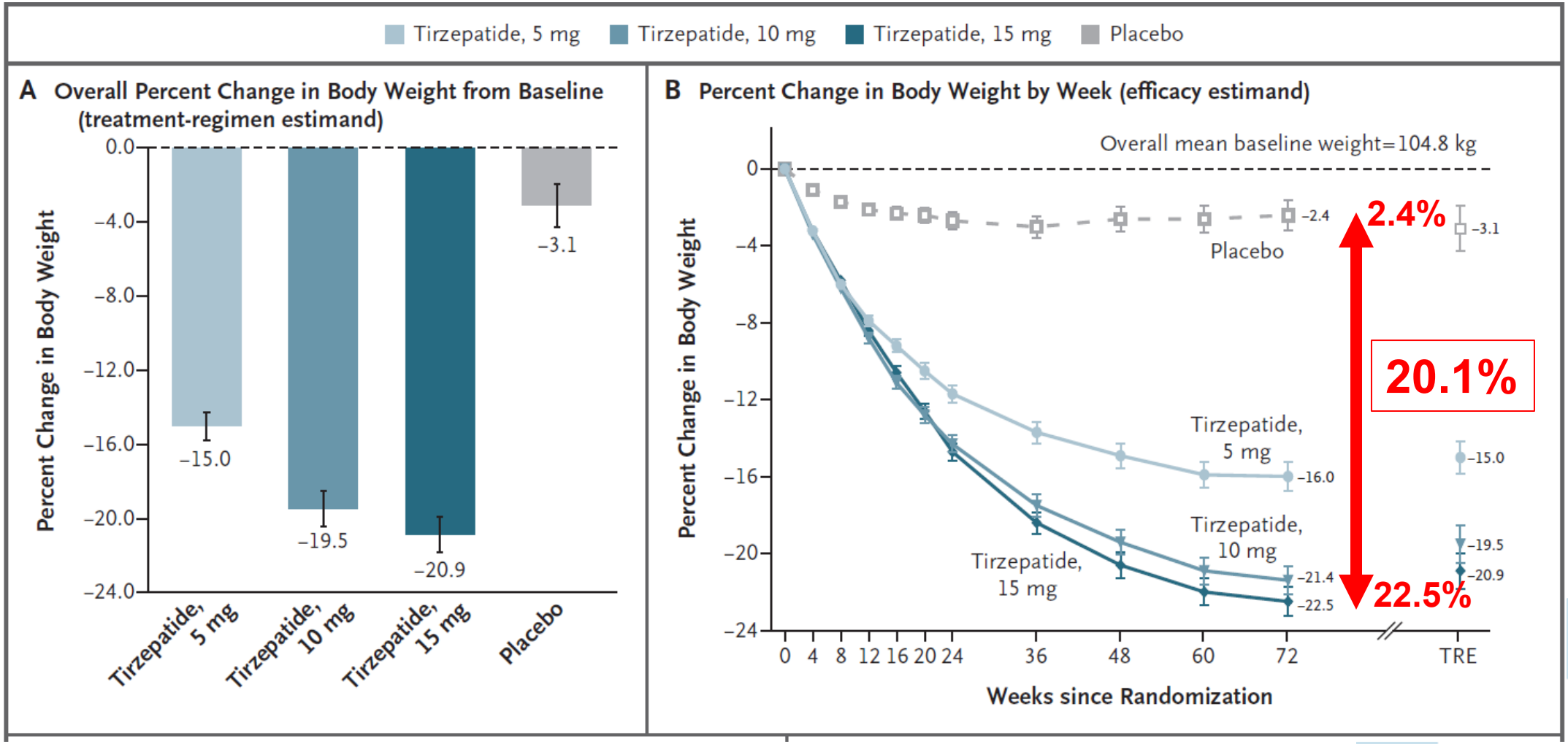
17.2 kg fat and muscle loss

40% muscle loss

Muscle/Fat Ratio has improved!

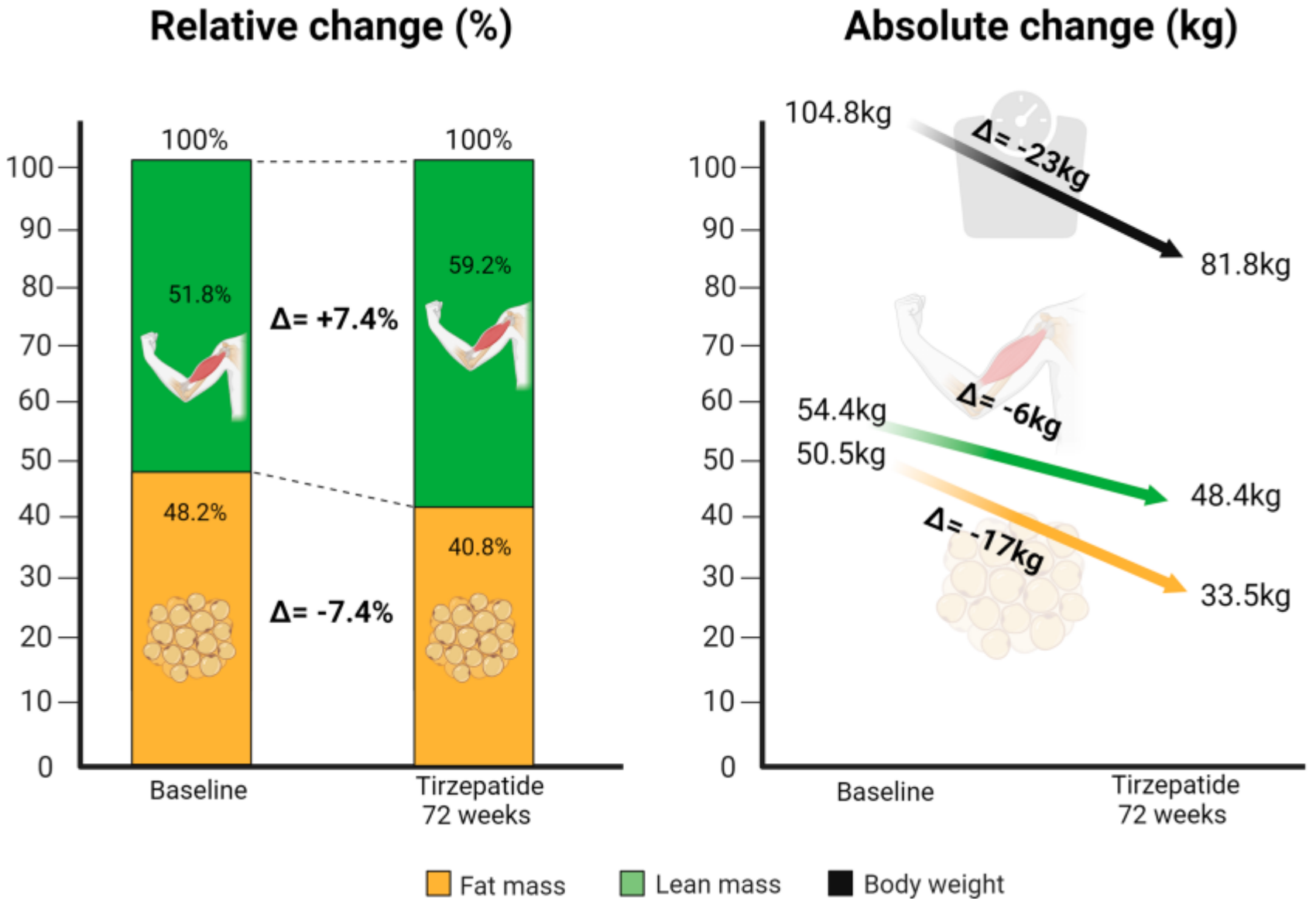
Once-Weekly Semaglutide in Adults with Overweight or Obesity. Wilding et al. NEJM. 2/2020

Tirzepatide for weight loss (SURMOUNT-1)



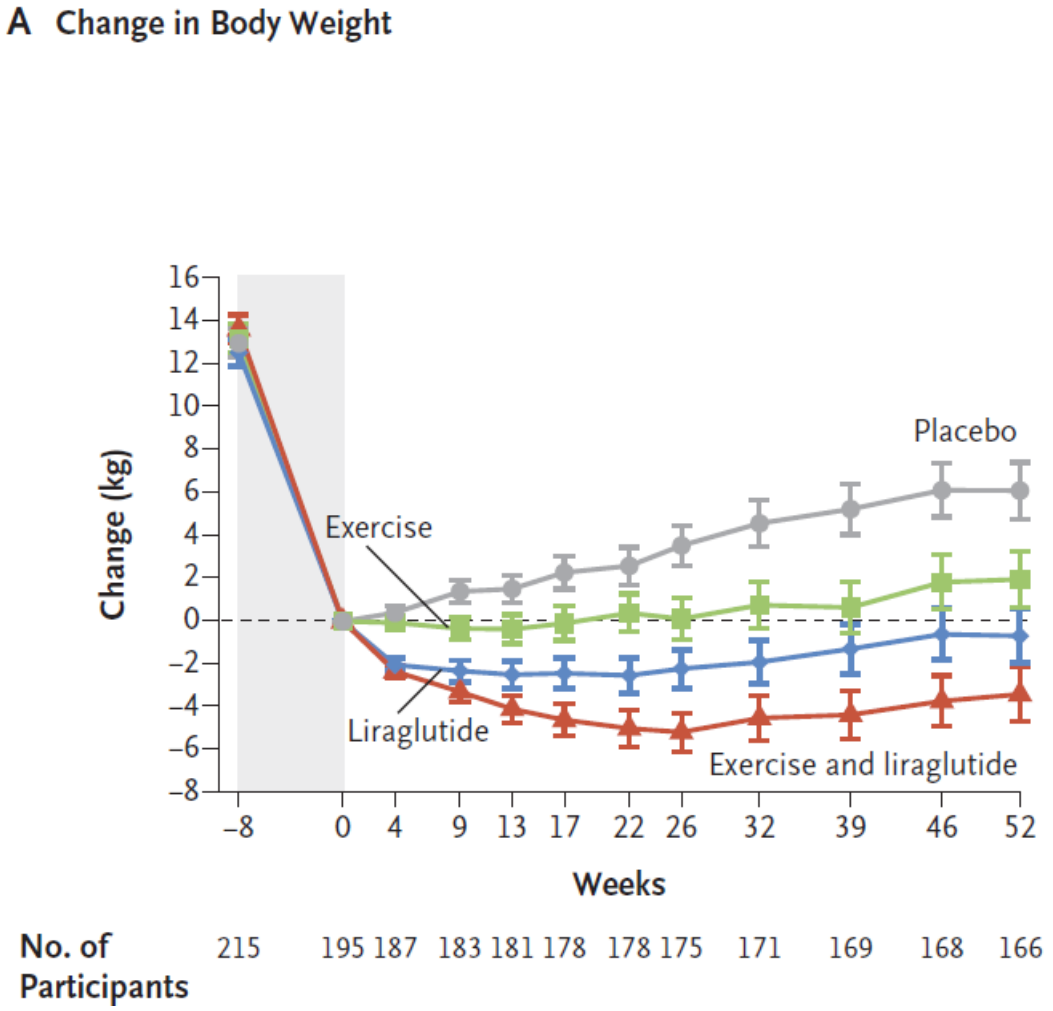
TIRZEPATIDE Once Weekly for the Treatment of Obesity. Jastreboff et al. NEJM. 6/2022

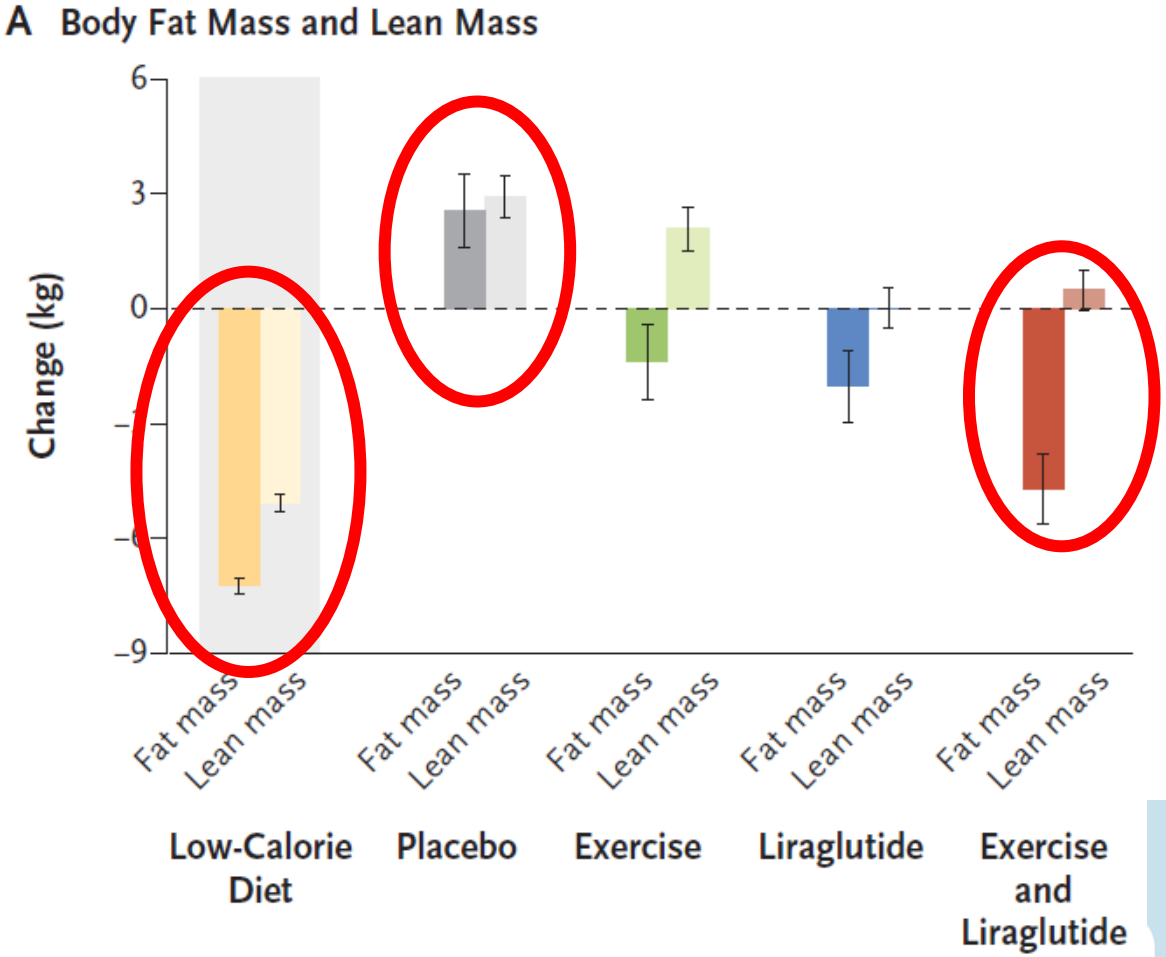
Absolute is different than relative muscle loss



Locatelli et al. Diabetes Care 2024; 47(10):1718-1730

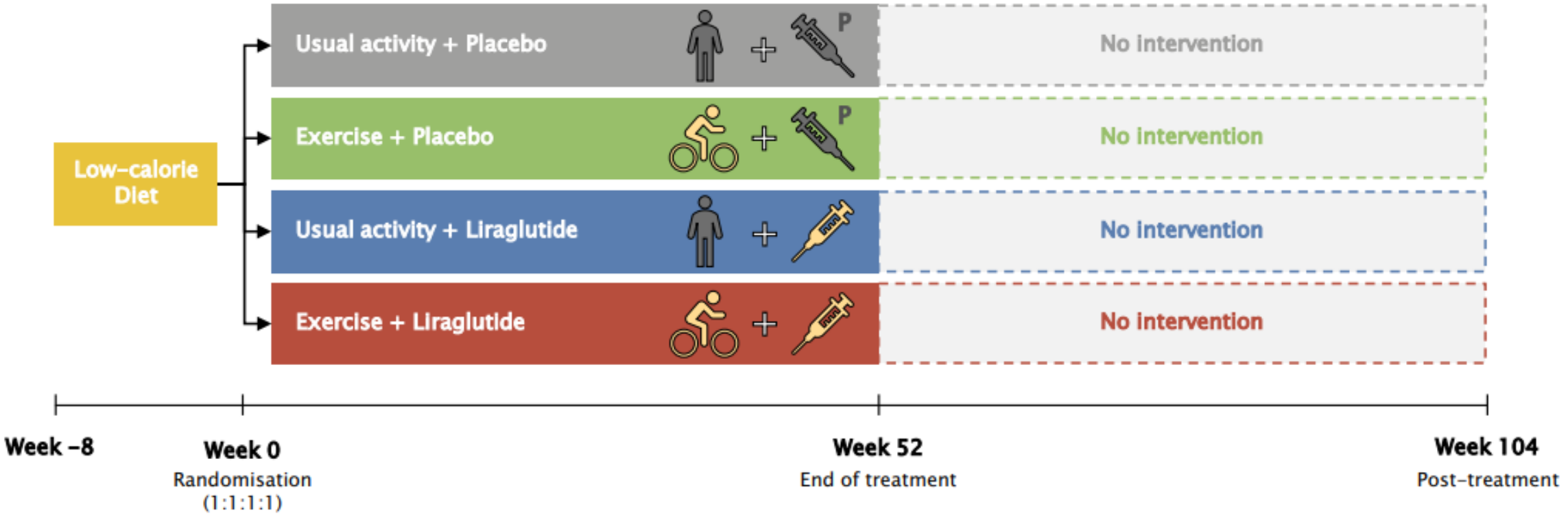
Weight Loss, Fat and Muscle





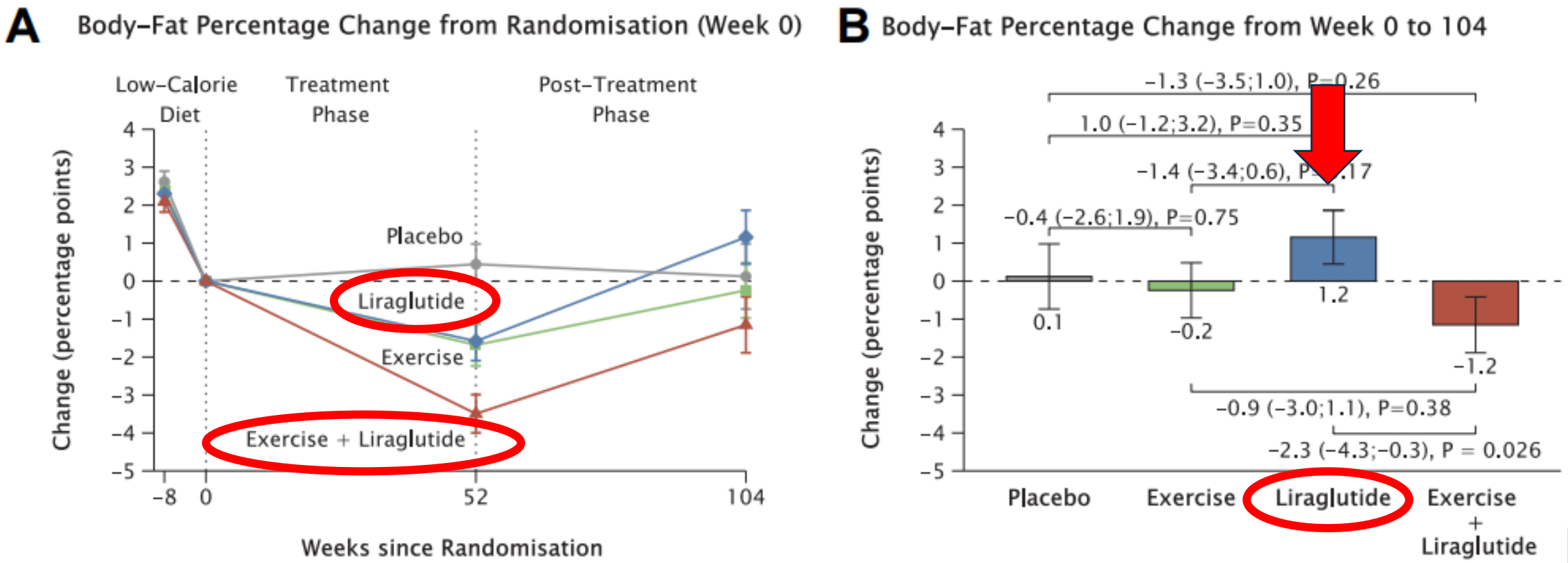
Healthy Weight Loss Maintenance with Exercise, Liraglutide, or Both Combined. Lundgren et al. NEJM. 2021

What happens after?



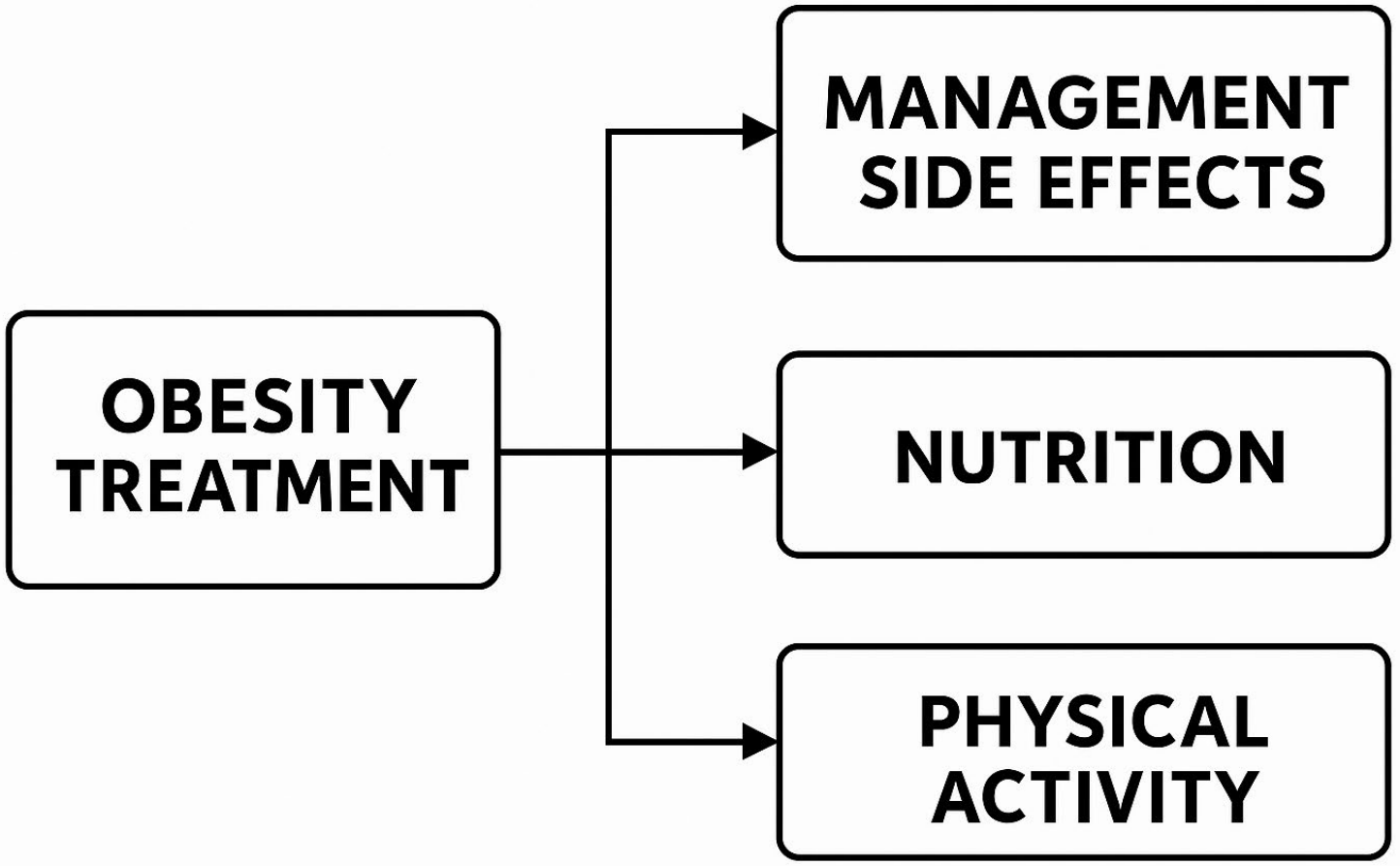
Healthy Weight Loss Maintenance with exercise, GLP-1RA, or both combined followed by one year without treatment: a post-treatment analysis of a randomized placebo-controlled trial. Jensen at al. The Lancet. 2024.

Body-Fat Changes



Healthy Weight Loss Maintenance with exercise, GLP-1RA, or both combined followed by one year without treatment: a post-treatment analysis of a randomized placebo-controlled trial. Jensen at al. The Lancet. 2024.

Obesity treatment aimed at Muscle Preservation



Acceptable Macronutrient Distribution

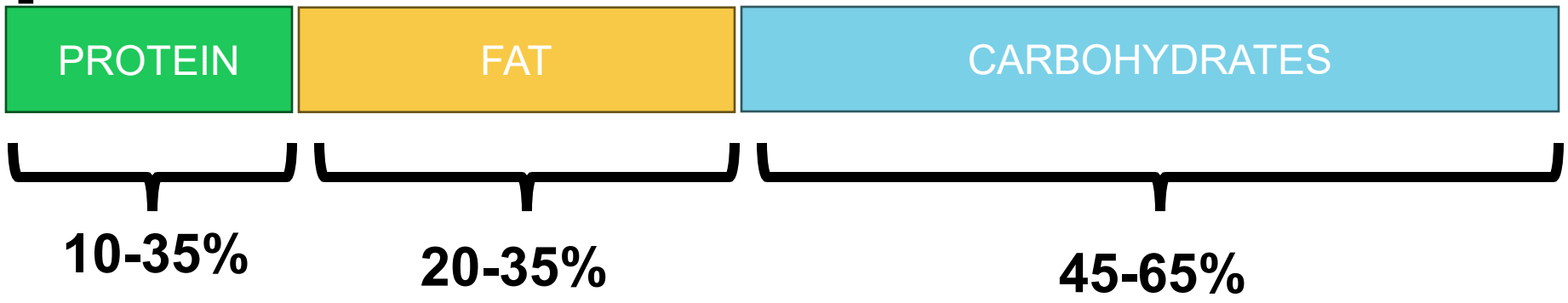
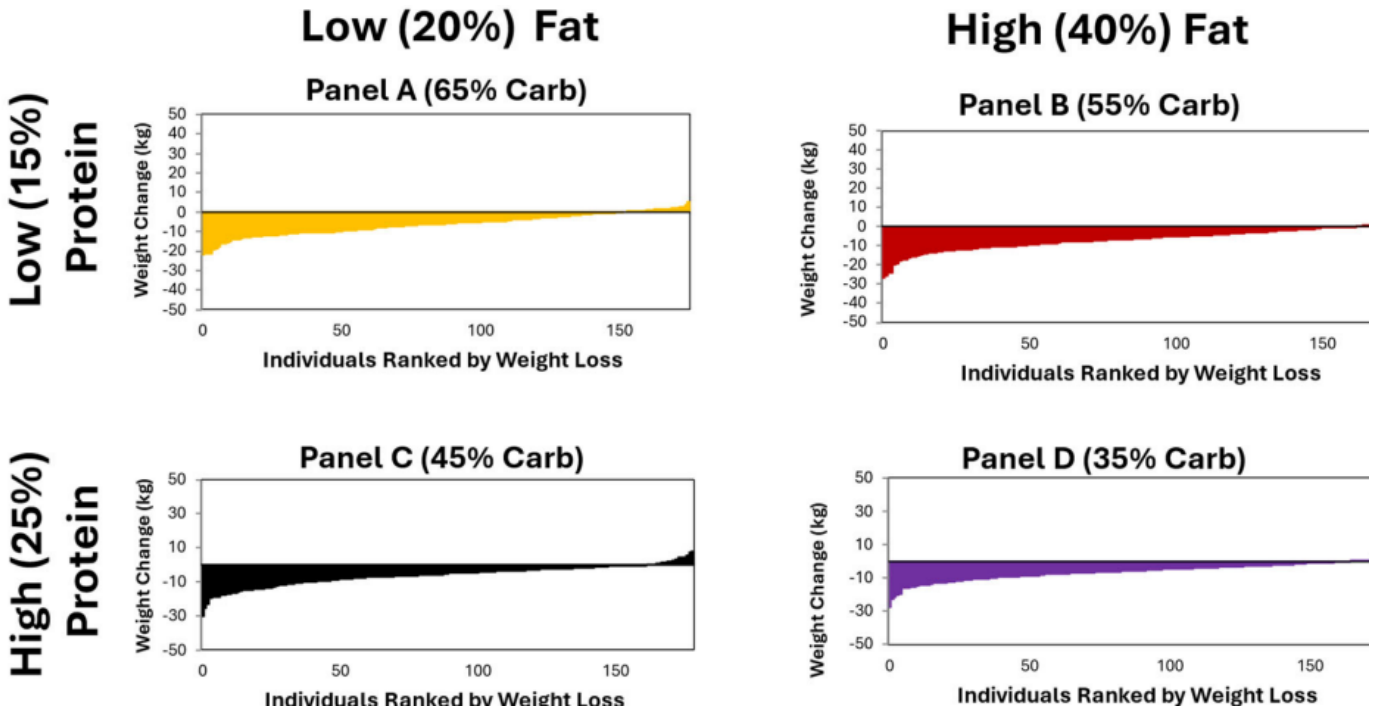


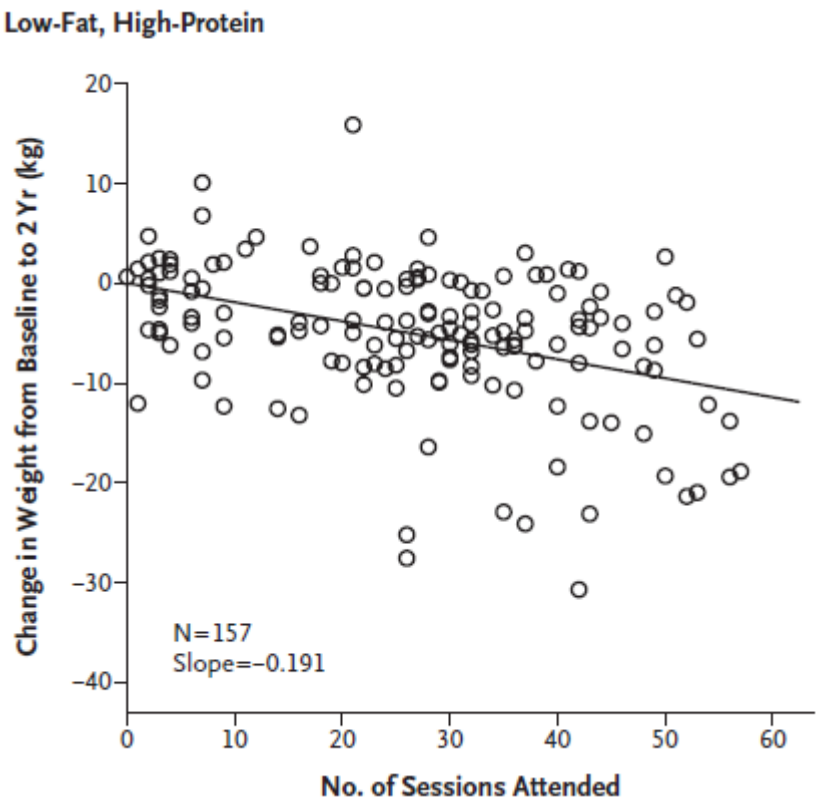
Table 1. Dietary Reference Intakes for Total Dietary Protein, Fat, Carbohydrates, Fiber, and Water.*

Life Stage	Protein		Fat		Carbohydrates		Total Fiber	Water		
	RDA	AMDR	RDA	AMDR	RDA	AMDR	RDA	Overall	Males	Females
	g/kg/day	%	*g/kg/day*	%	*g/day*	%	*g/1000 kcal/day*		*liters/day*	
0 to 6 mo	1.52	ND	31		60	ND	ND	0.7		
7 mo to <1 yr	**1.2**	ND	30		95	ND	ND	0.8		
≥1 to 3 yr	**1.05**	5–20	ND	30–40	**130**	45–65	14	1.3		
4 to 8 yr	**0.95**	10–30	ND	25–35	**130**	45–65	14	1.7		
9 to 13 yr	**0.95**	10–30	ND	25–35	**130**	45–65	14		2.4	2.1
14 to 18 yr	**0.85**	10–30	ND	25–35	**130**	45–65	14		3.3	2.3
≥19 yr	**0.80**	10–35	ND	20–35	**130**	45–65	14		3.7	2.7
Pregnancy	**1.1**	10–35	ND	20–35	**175**	45–65	14			3.0
Lactation	**1.3**	10–35	ND	20–35	**210**	45–65	14			3.8

Institute of Medicine. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids,… National A

POUNDS Study – Best Diet!





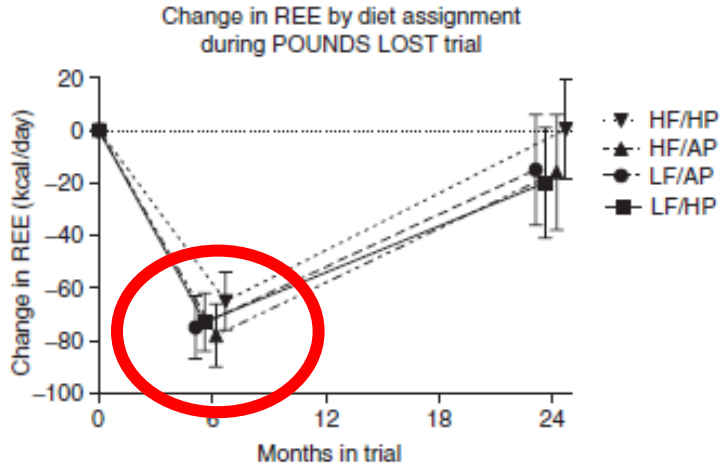
Comparison of Weight-Loss Diets with Different Compositions of Fat, Protein, and Carbohydrates. Sacks et al. NEJM. 2009

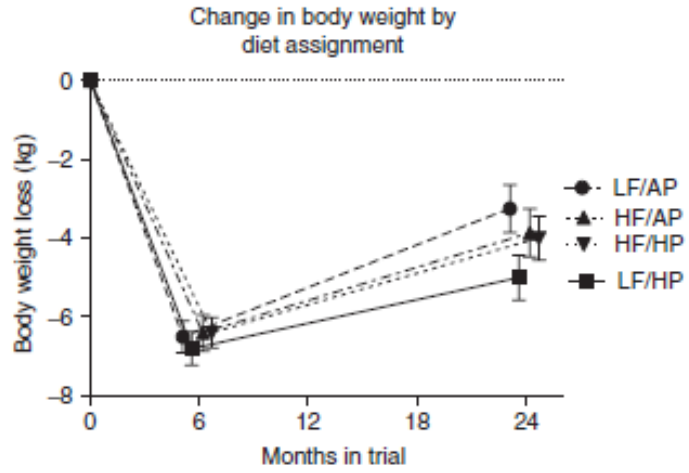
POUNDS STUDY – Energy Expenditure

In this sub-study, 99 participants had their total energy expenditure (TEE) and resting energy expenditure (REE) measured at baseline and after 6 months.

Findings: There was no significant difference in REE between high- and low-protein or fat diets.

The study concluded that **adaptive thermogenesis** occurred early but resolved over time, and **macronutrient composition had no meaningful effect** on REE.



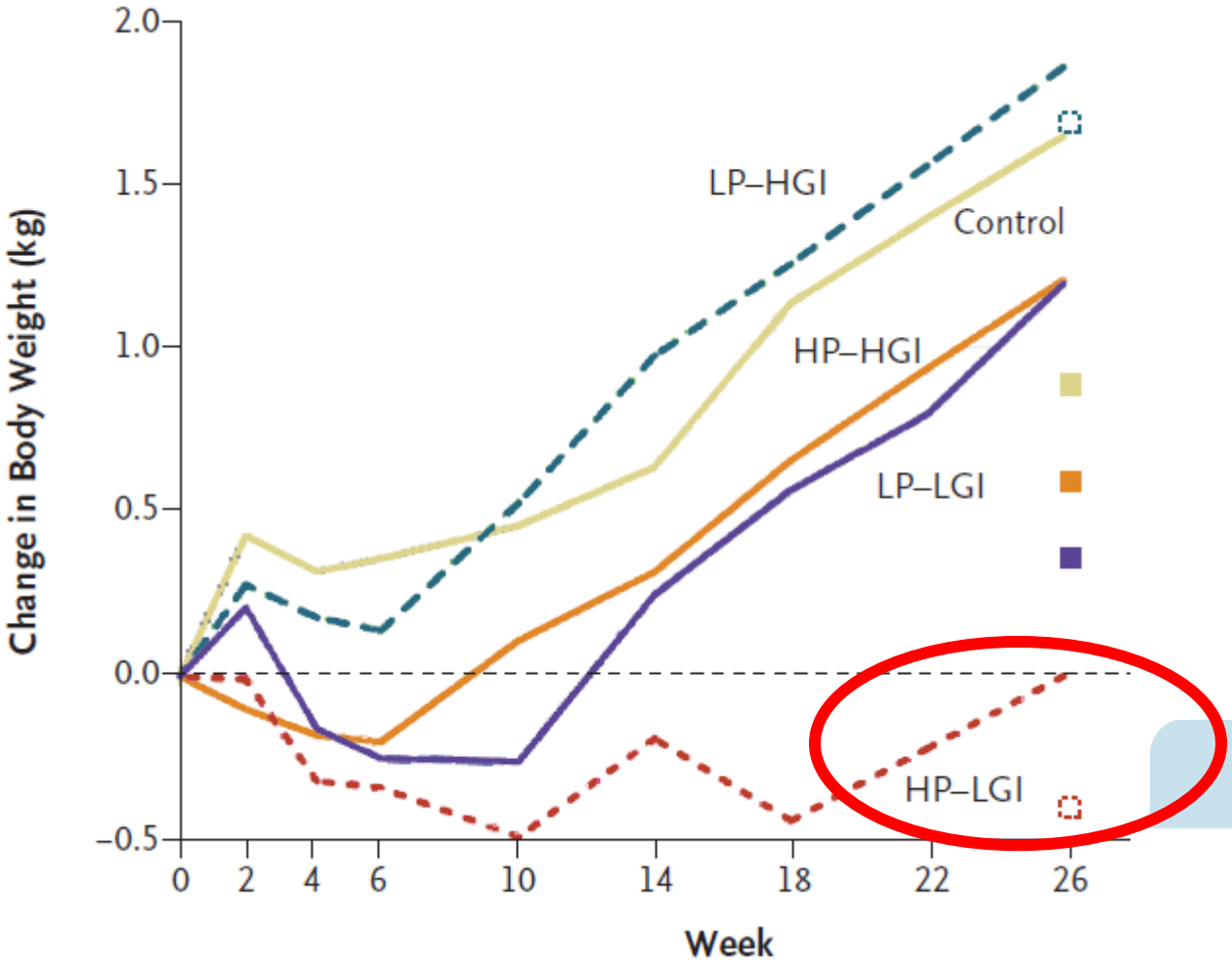


Effect of Diet Composition and Weight Loss on Resting Energy Expenditure in the POUNDS LOST Study. De Jonge et al. Obesity. 2012

DIOGENES – High/Low Protein

Study Design: After an initial 8-week low-calorie diet leading to significant weight loss, 773 overweight adults were randomized to one of five ad libitum diets for 26 weeks, varying in protein content (high vs. low) and glycemic index (GI) (high vs. low)

Weight Maintenance: The high-protein, low-GI diet group experienced the least weight regain, effectively maintaining the initial weight loss.



Diets with High or Low Protein Content and Glycemic Index for Weight-Loss Maintenance. Larsen at al. NEJM. 2010

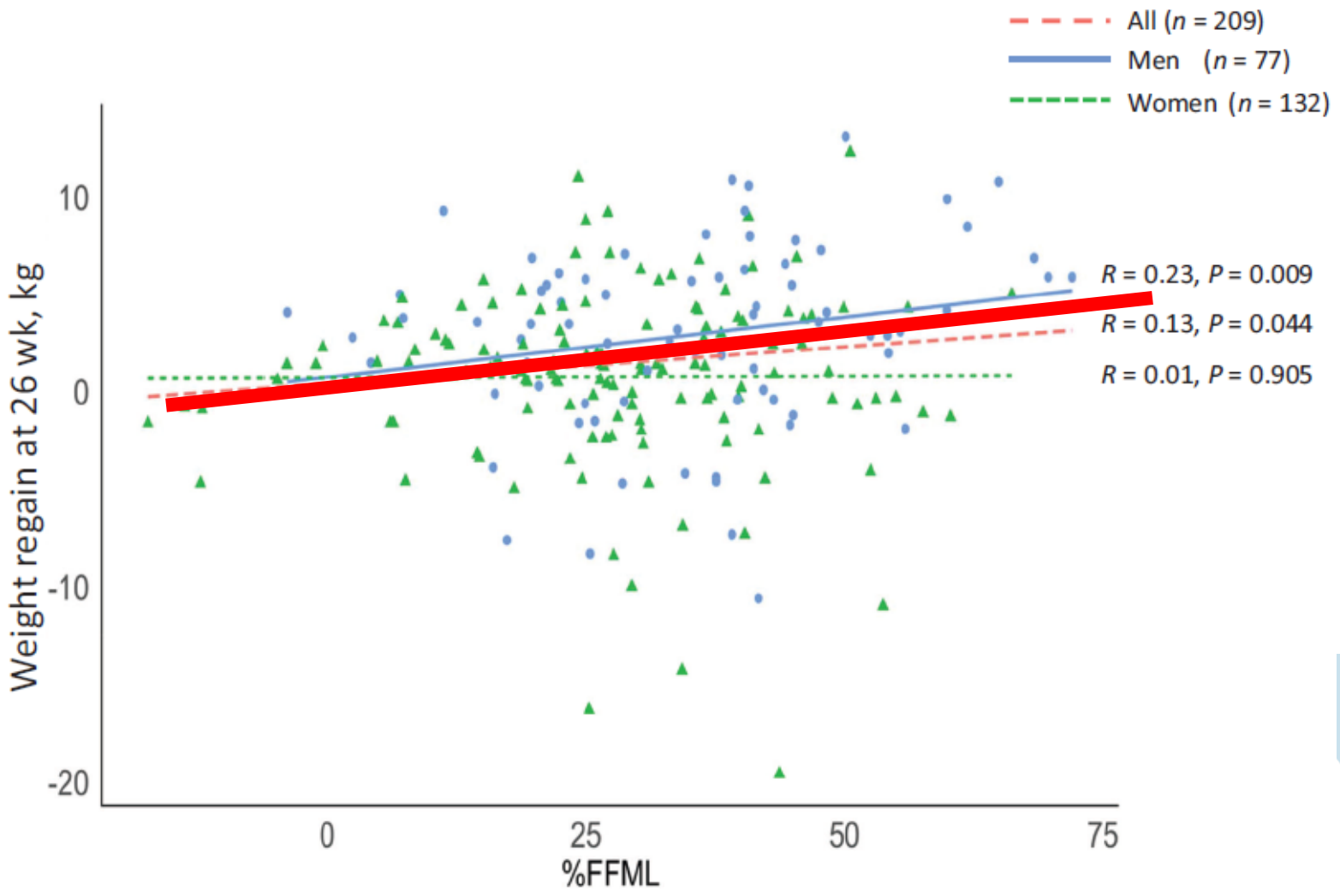
DIOGENES Follow Up

Lean Mass Preservation:

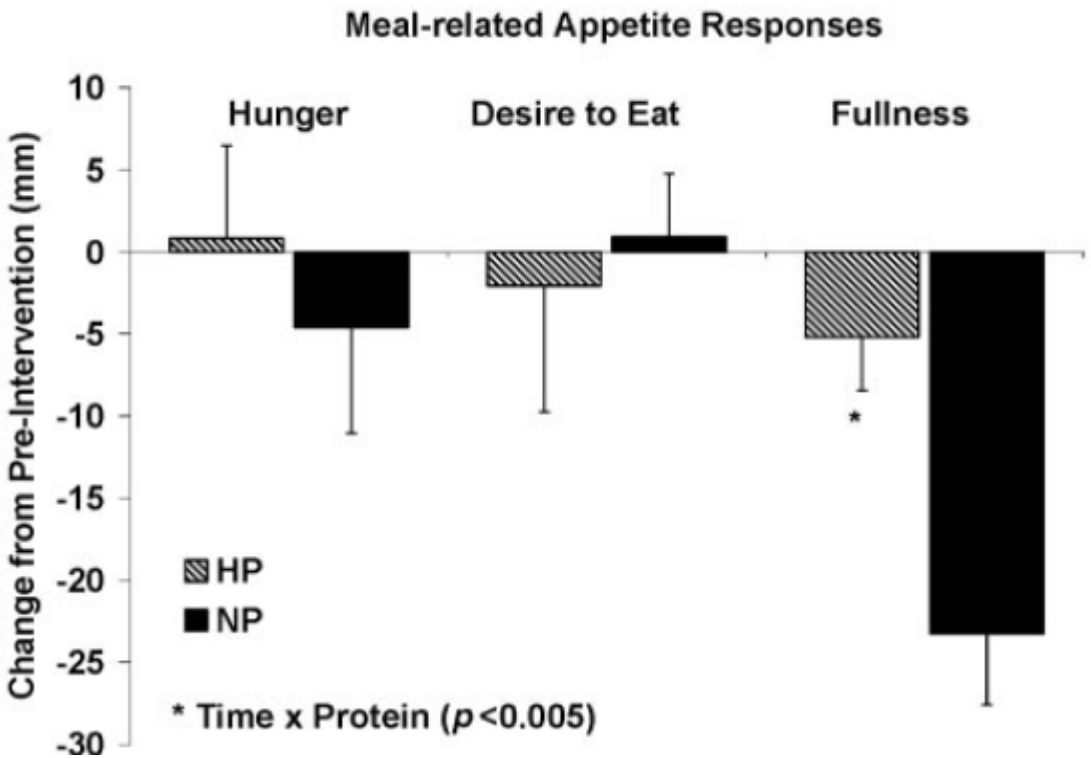
Subsequent analyses of the DIOGENES study data

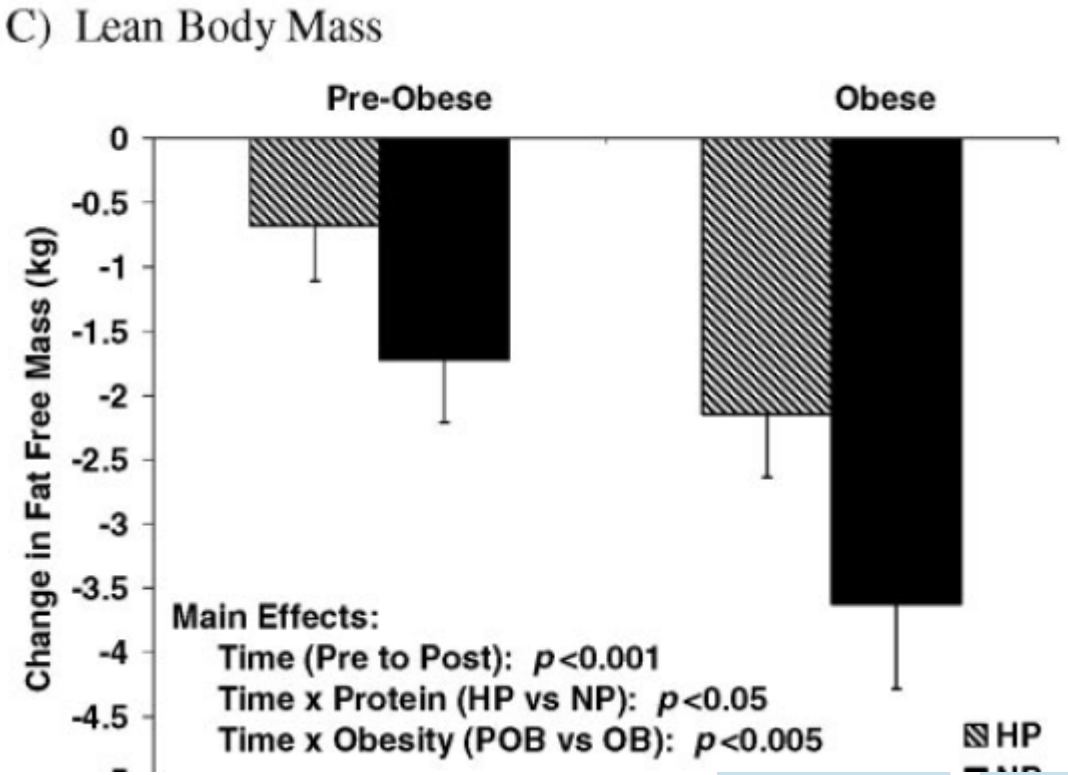
Participants who lost a higher proportion of FFM during an initial low-calorie diet phase were more likely to experience weight regain during the maintenance phase.

Preserving lean body mass during weight loss may be important for long-term weight maintenance



High Protein – Satiety & Muscle





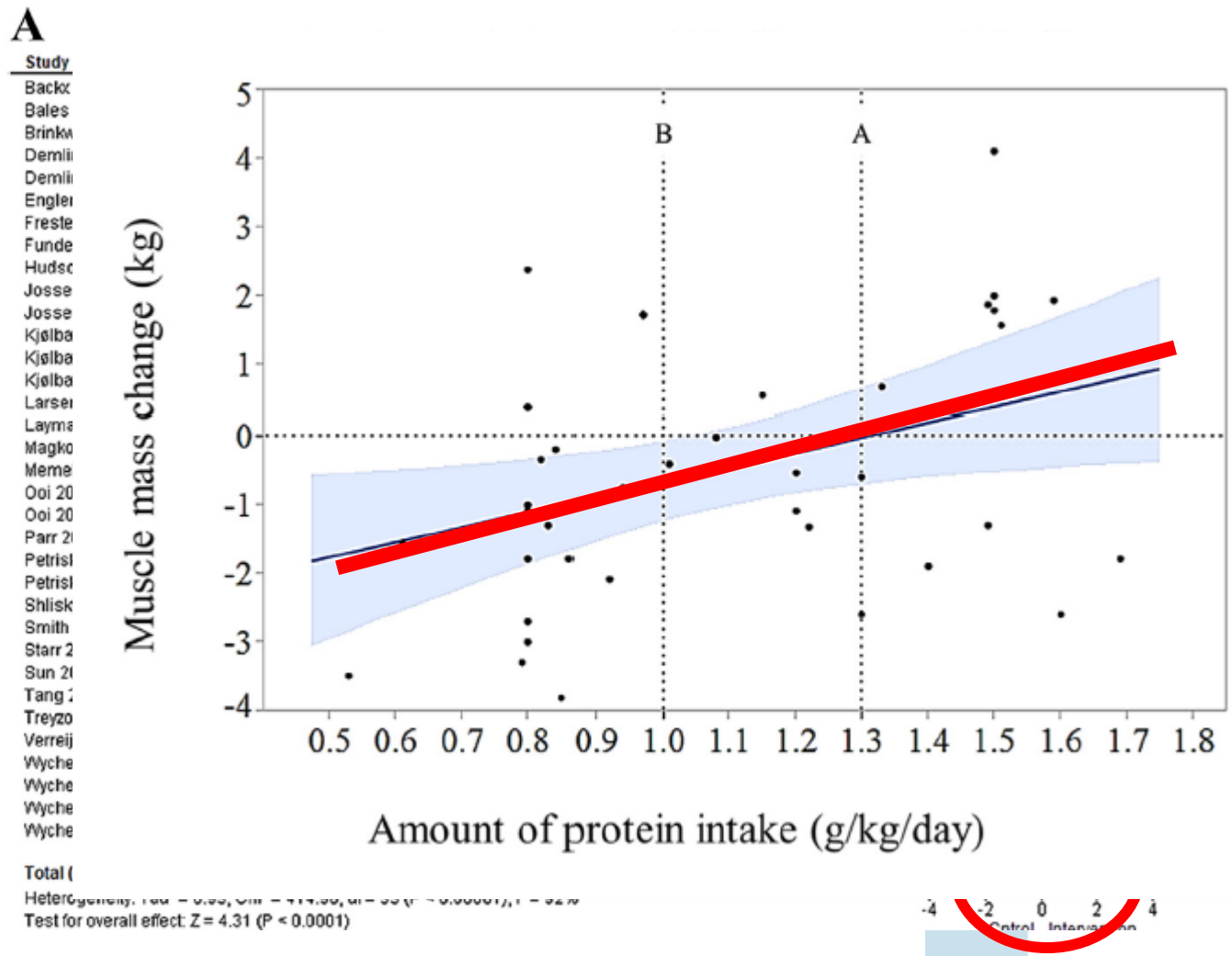
Higher Protein Intake Preserves Lean Mass and Satiety with Weight Loss in Pre-obese and Obese Women. Leidy et al. Obesity. 2007

Enhanced Protein Intake – Meta-analysis

Methods: The authors reviewed randomized controlled trials (RCTs) that compared high-protein diets (typically >1.2 g/kg/day) to lower-protein or standard-protein diets during weight loss interventions.

Findings:

- High-protein diets significantly **preserved lean mass** compared to control diets.
- **Muscle strength and functional performance** also showed favorable trends in the high-protein groups, although results varied by study.
- Benefits were more pronounced when **resistance training** was combined with increased protein intake.

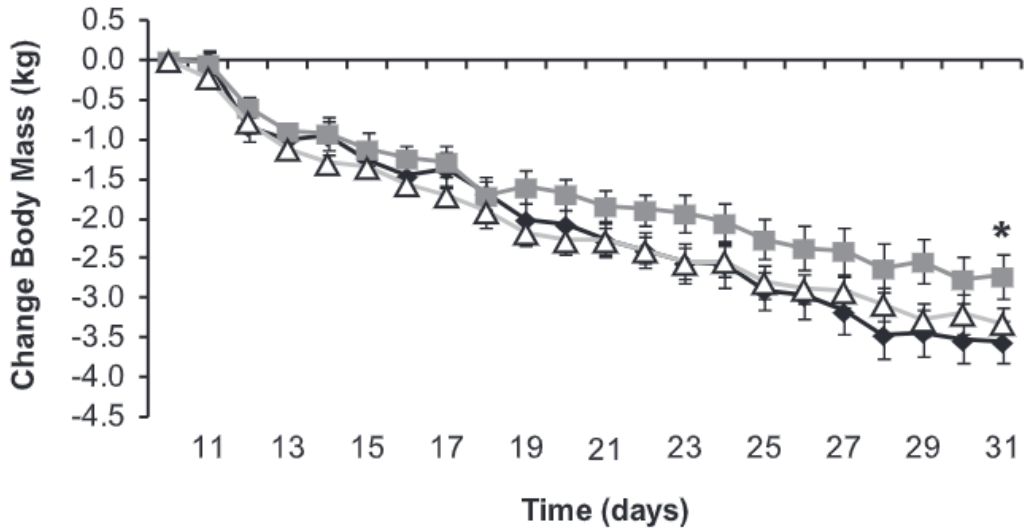


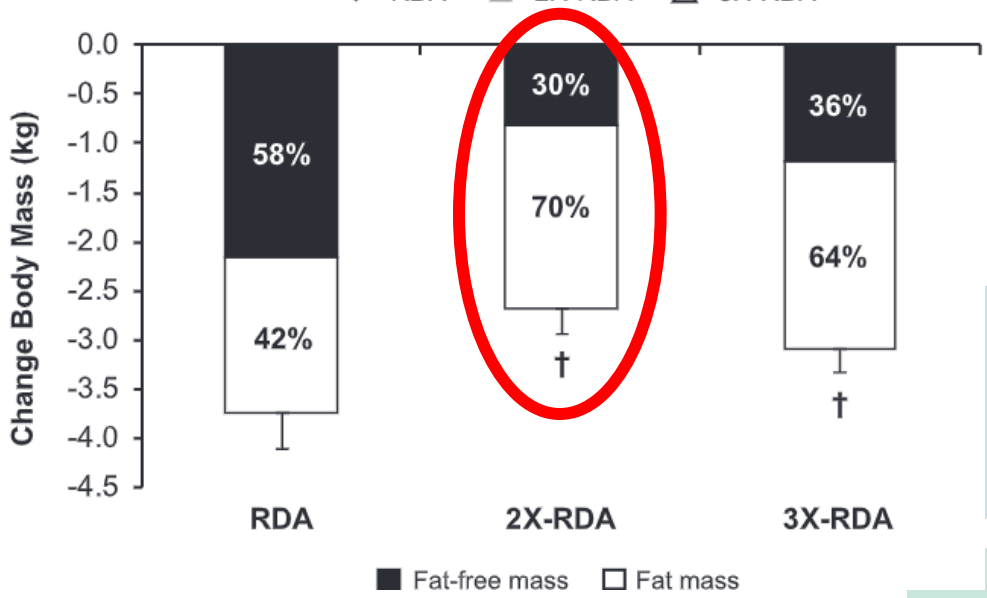
Enhanced protein intake on maintaining muscle mass, strength, and physical function in adults with overweight/obesity: A systematic review and meta-analysis. Kokura et al. Clinical Nutrition ESPEN 63 (2024)

Effects of high-protein intake on FFM

Methods:In a randomized controlled trial, 39 adults followed diets with varying protein levels (RDA, 2×RDA, 3×RDA) during a 21-day energy deficit, with assessments of body composition and muscle protein synthesis.

Conclusions:Consuming protein at twice the RDA (1.6 g/kg/day) preserved fat-free mass and maintained muscle protein synthesis during weight loss; higher intake (3×RDA) offered no additional benefit





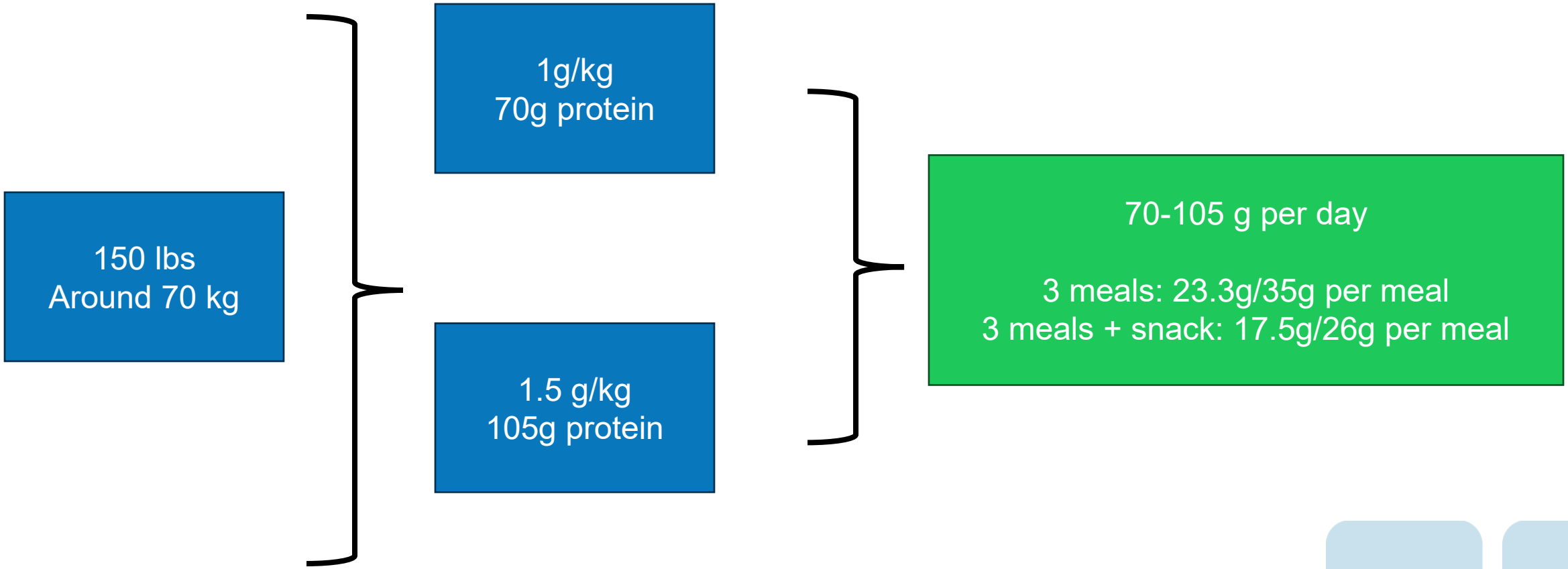
Effects of high-protein diets on fat-free mass and muscle protein synthesis following weight loss: a randomized controlled trial. Pasiakos at al. FASEB Journal. 2013.

Current Protein Recommendations

- Institute of Medicine: **0.8 g/kg**
- Guidelines for bariatric surgery: **60 g/day up to 1.5g/kg**
- Joslin Guidelines Diabetes Center: **1-1.5 g/kg ideal body weight adjusted body weight (ideal body weight + 0.35 x excess body weight)**
- International Society of Sports Nutrition: **protein and exercise: for building and maintain muscle a range of 1.4-2g/kg is sufficient**
- **Protein quality**

Institute of Medicine. Dietary reference intakes for energy, carbohydrates, fiber, fat, fatty acids, cholesterol, protein, and amino acids. The National Academies Press; 2005
Deutz NE et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. Clin Nutr. 2014
Mechanick JI. Clinical practice guidelnes for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures – 2019 update. AACE/ACE, obesity society, ASMBS, OMA, MSA. Surg Obes Relat Dis. 2020
International Society of Sports Nutrition Position Stand: protein and exercise. Journal of International Society of Sports Nutrition. 2017

Practical Example



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Deutz NE et al. Protein intake and exercise for optimal muscle function with aging: recommendations from the ESPEN Expert Group. Clin Nutr. 2014

Mechanick JI. Clinical practice guidelnes for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures – 2019 update. AACE/ACE, obesity society, ASMBS, OMA, MSA. Surg Obes Relat Dis. 2020

Animal-Based Protein

Food Item	Portion Size	Protein (g)
	3 oz (85g) cooked	26 g
	3 oz (85g) cooked	25 g
	Lean beef (sirloin)	22 g
	1 large	6 g
	Greek yogurt	17–20 g
	Cottage cheese	14 g
	Milk (%)	1 cup (240 mL)
	Tuna (canned in water)	20 g
	Salmon (cooked)	3 oz (85g) cooked

Plant-Based Proteins

Food Item		Portion Size	Protein (g)
	Lentils (cooked)	1 cup (198 g)	18 g
	Chickpeas (cooked)	1 cup (164 g)	15 g
	Black beans (cooked)	1 cup (172 g)	15 g
	Quinoa (cooked)	½ cup (126 g)	8 g
	Tofu (firm)	½ cup (126 g)	10 g
	Edamame (cooked)	1 cup (240 mL)	17 g

What’s your take on high protein for muscle health?

- Absolutely! I’m basically 90% chicken breast at this point
- Show me the evidence… otherwise I’m sticking with carbs and vibes
- Doesn’t matter. Just eat your veggies and pray

Cleveland Clinic