

Webinar Will Begin Momentarily

TODAY'S AGENDA:

- Welcome
- Speaker Introduction
- Presentation
- Q&A
- Closing



Professional Education Series

Support. Inform. Educate. Empower.

Protein, Resistance Training, & Body Composition



WEBINAR HOST:

Keith Hine, MS, RD

VP of Healthcare, Sports & Professional Education
Orgain, LLC



WEBINAR PRESENTER:

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Nutrition, and Food Sciences
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The Synergy of Protein & Exercise Training



A Focus on Body Composition



Michael J. Ormsbee, PhD, FACSM, FISSN, CSCS*D

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Six Pillars of Research

Our multidisciplinary research spans nutrition, physiology, medicine, and the science of performance.

- 1 Performance Nutrition
- 2 Clinical Physiology
- 3 Sport Science
- 4 Immunology
- 5 Orthopedics & Sports Medicine
- 6 Sports Psychology



A person is riding a blue and yellow Look road bike on a road surface. The bike has 'LOOK' written on the frame and 'CORSE' on the front fork. The rider's legs are visible, pedaling the bike. The background is a blurred road surface.

PRIMARY FOCUS: PROTEIN & EXERCISE TRAINING



ARE AMERICANS EATING TOO MUCH PROTEIN?

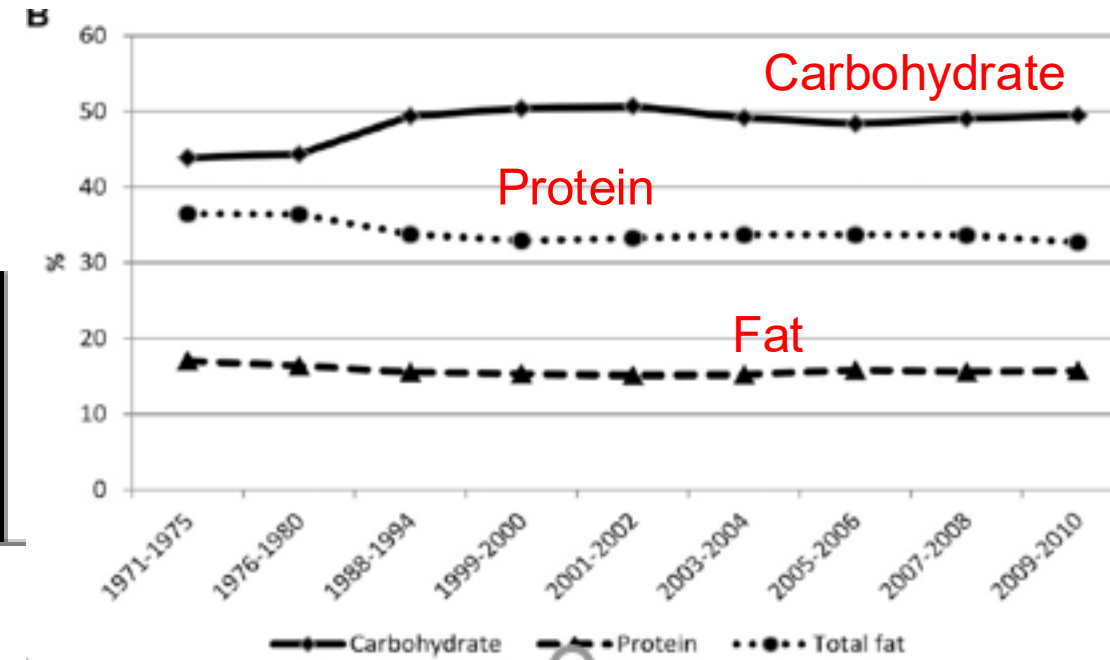
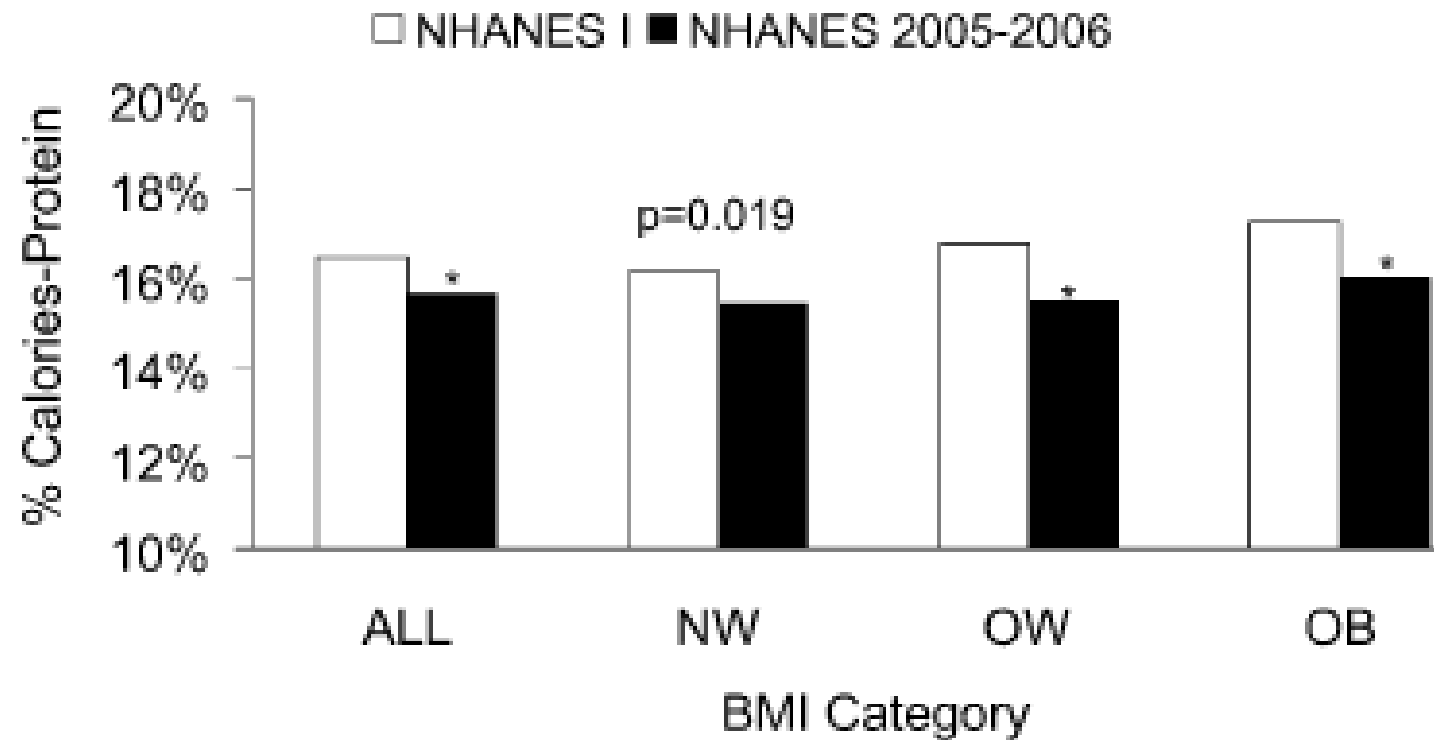


You're Eating Way Too Much Protein

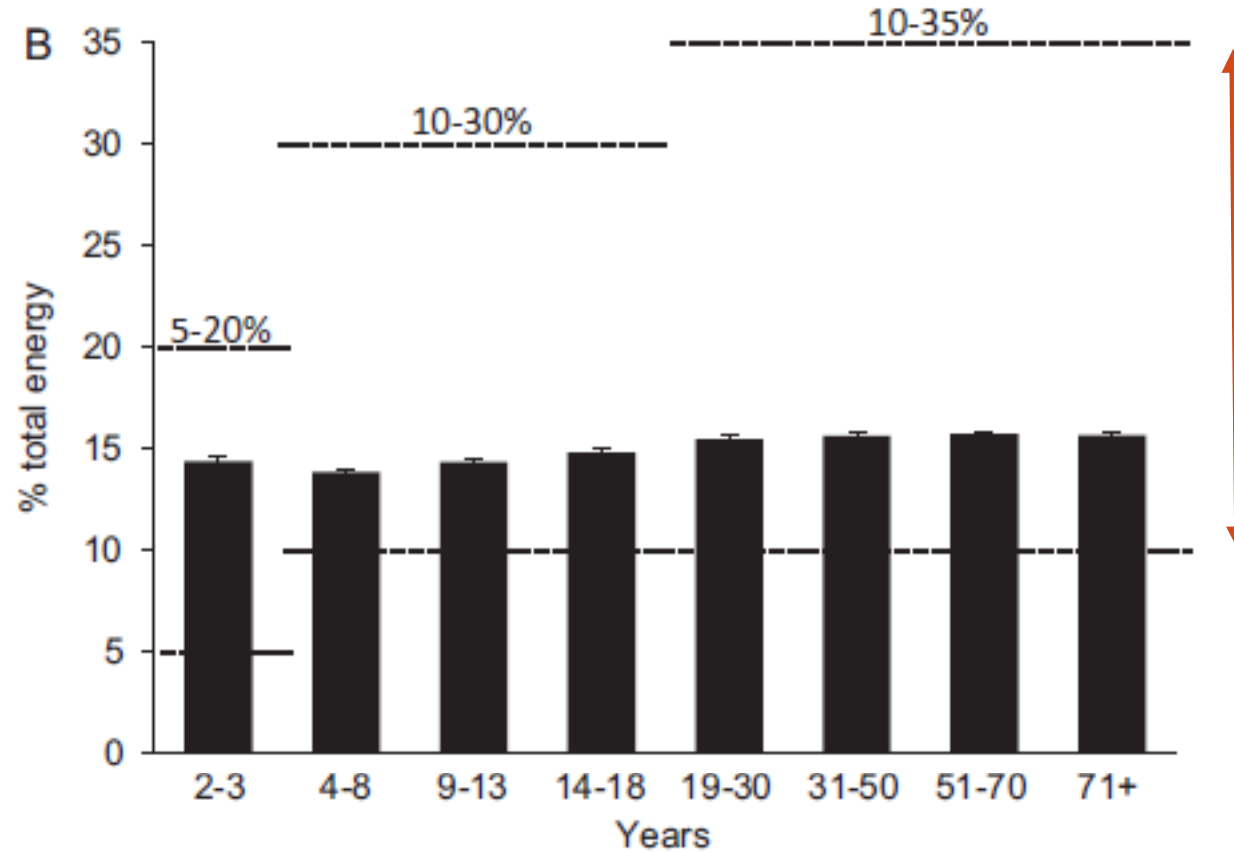
But how did Americans get so obsessed with it in the first place?



WELL...WE MAY BE PROTEIN & NUTRIENT DEPLETED



AMERICANS EAT AT THE LOW END OF THE RANGE FOR PROTEIN INTAKE

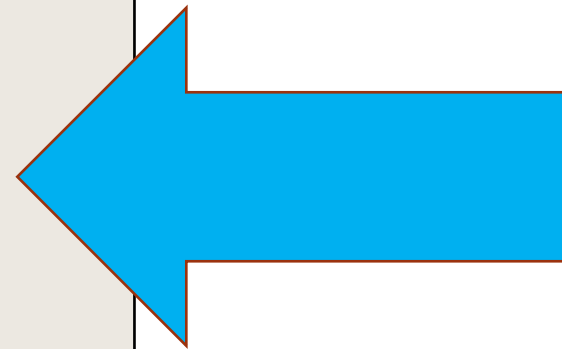


Berryman et al. AJCN, 2018

INDIVIDUALS WITH OBESITY MAY FALL BELOW THE RDA FOR PROTEIN INTAKE

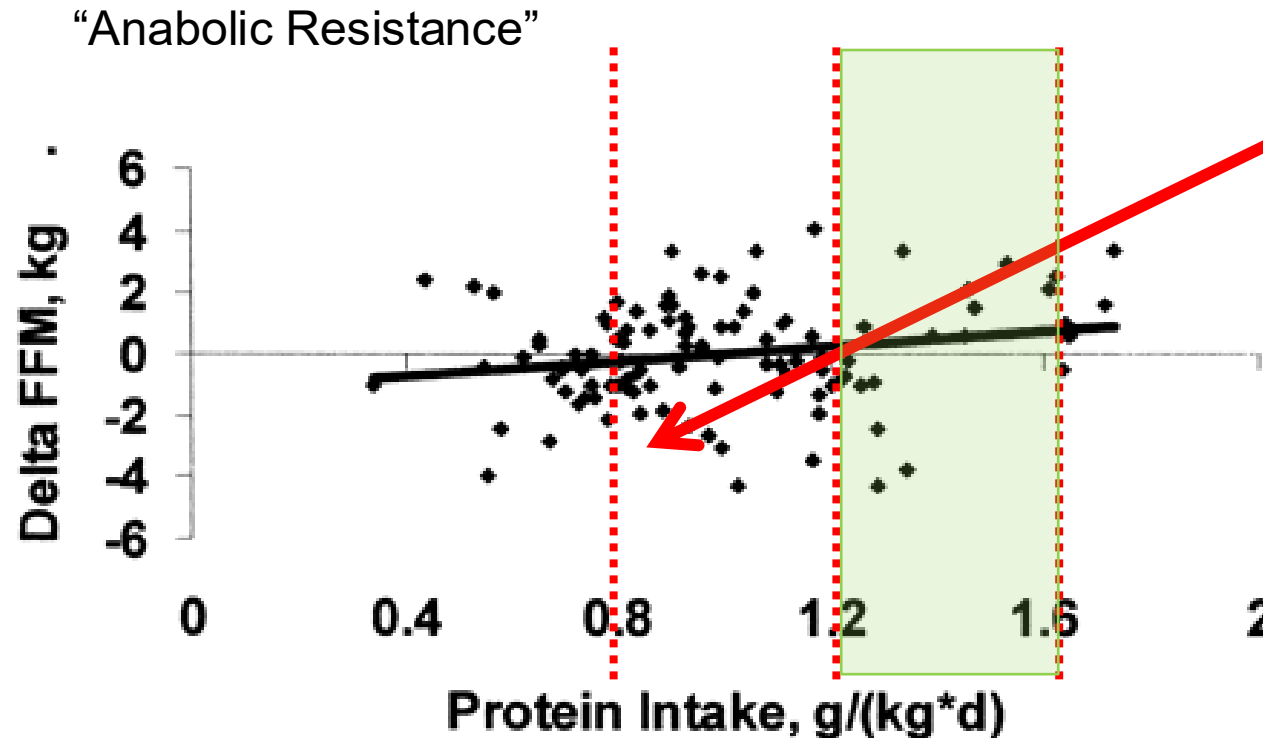
Clinically Obese patients at baseline:

- Mean initial total body mass= 126 kg
- Absolute daily protein intake= 70 g
- Relative daily protein intake= ~ 0.55 g/kg body mass





PROTEIN, FAT FREE MASS, AND AGE



The old RDA for protein equals a loss of 0.2 kg fat-free mass after 12 weeks (even with resistance training)

Fig. 1. Protein intake and fat-free mass changes after three months of resistance training in **50–80 year-old people**.
Regression equation: $\text{FFM} = (1.19955 \times \text{protein intake (kg)}) - 1.172$; $r = 0.202$, $P = 0.038$, $n = 106$ men and women.

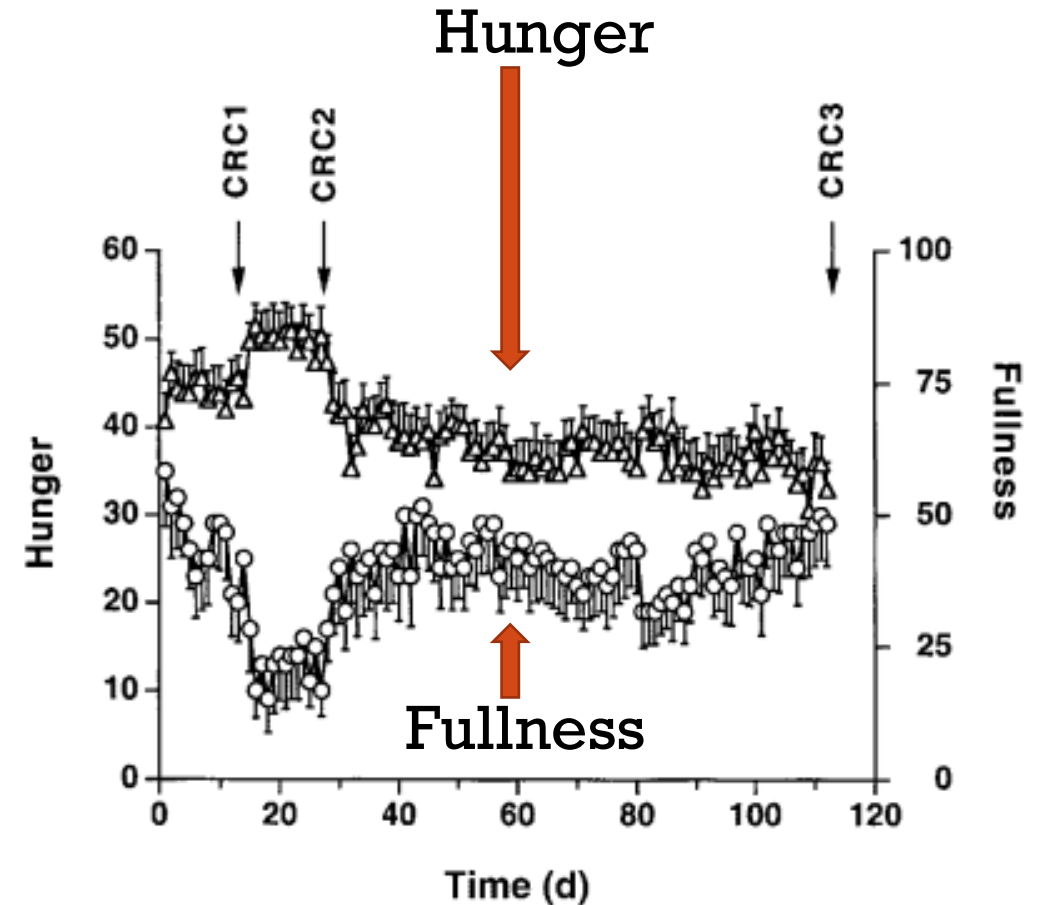
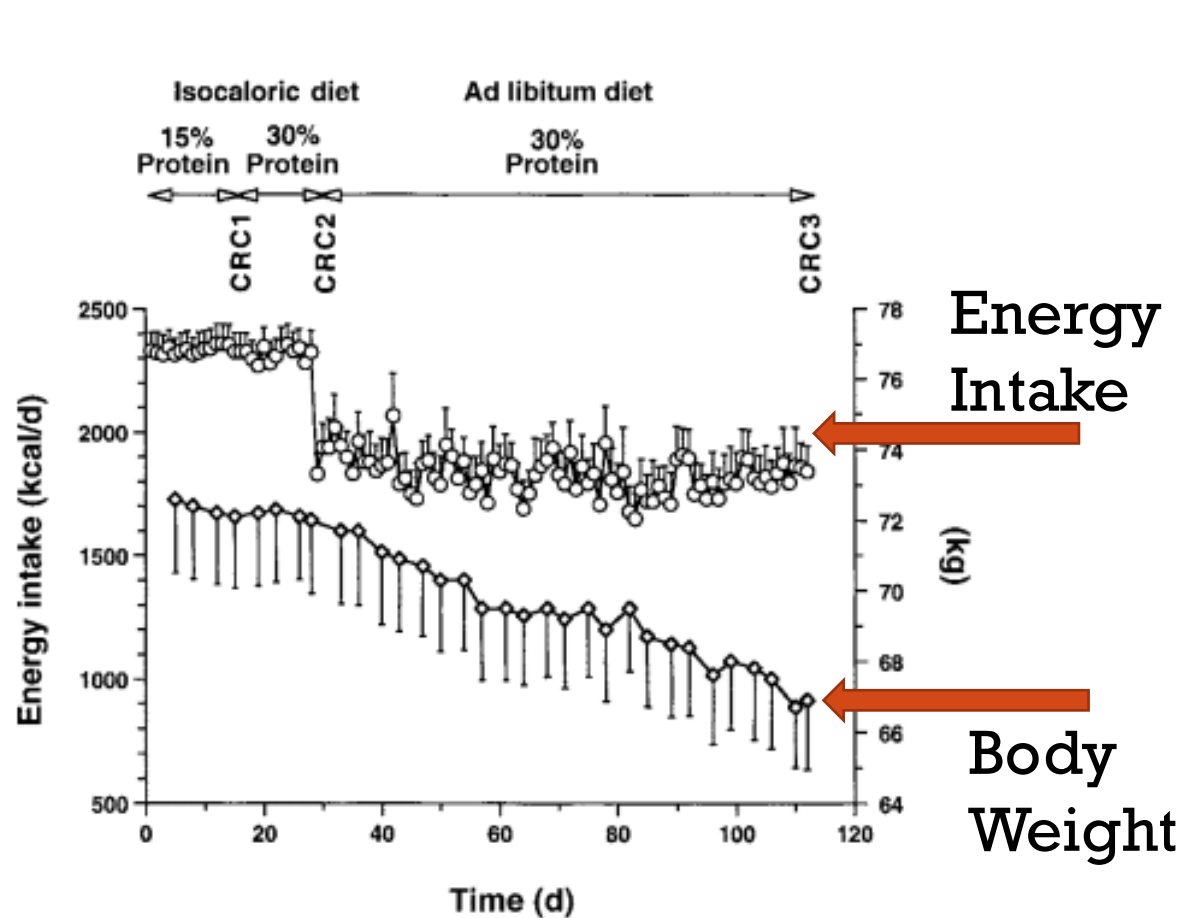




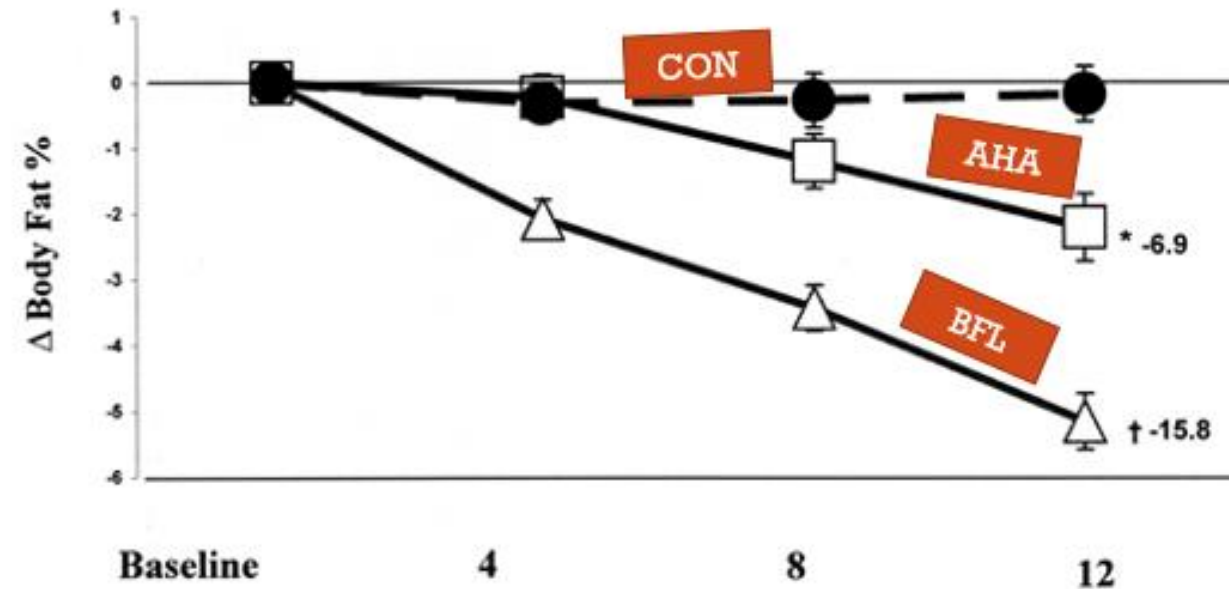
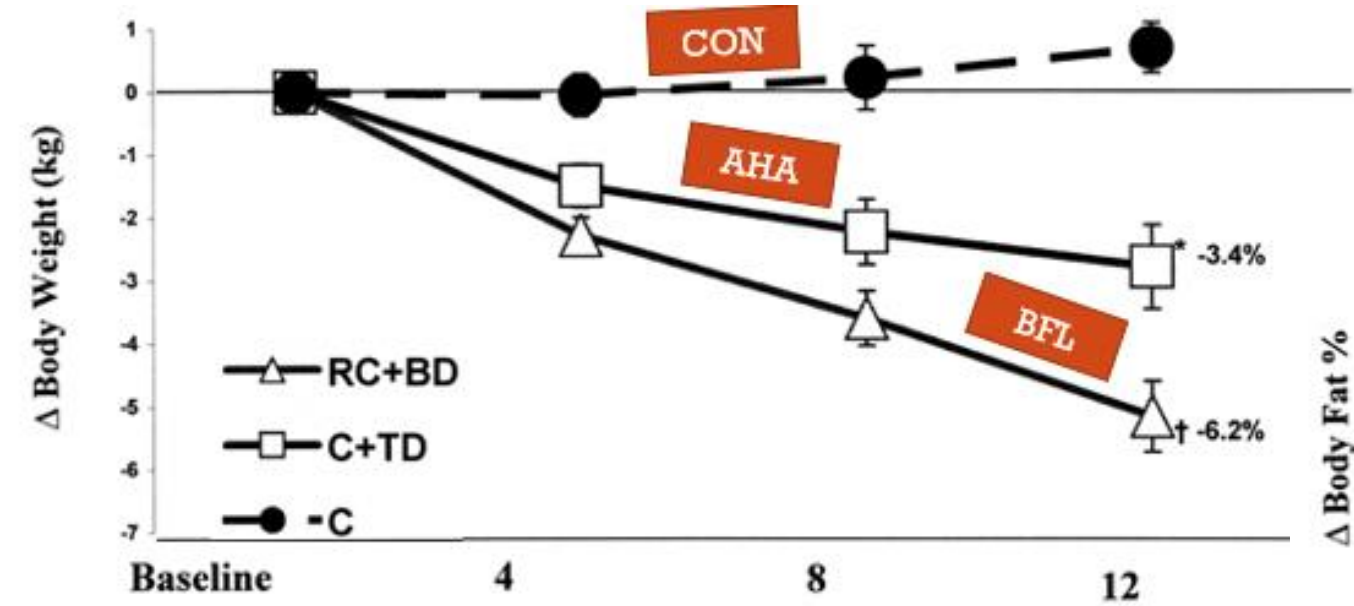
WHY SHOULD WE EAT MORE PROTEIN?



INCREASING FROM 15% TO 30% PROTEIN DECREASES KCAL INTAKE AND INCREASES SATIETY



Increased Dietary Protein and Combined High Intensity Aerobic and Resistance Exercise Improves Body Fat Distribution and Cardiovascular Risk Factors



Moderate protein intake improves total and regional body composition and insulin sensitivity in overweight adults

Variable	HPEX (n= 8)			MPEX (n= 8)			HPNx (n= 8)		
	Pre	Post	% Change	Pre	Post	% Change	Pre	Post	% Change
Age (y)	42 ± 3	—	—	44 ± 3	—	—	54 ± 2 ^b	—	—
Body weight (kg)	88.2 ± 5.7	82.0 ± 5.3	-7.0 ± 0.8 ^a	90.8 ± 4.9	85.3 ± 4.7	-6.3 ± 0.8 ^a	94.5 ± 6.5	89.3 ± 5.9	-5.3 ± 1.0 ^a
BMI	31.9 ± 1.3	29.7 ± 1.3	-6.9 ± 0.8 ^a	32.1 ± 1.0	30.1 ± 1.1	-6.4 ± 0.8 ^a	33.3 ± 2.2	31.5 ± 2.2	-5.4 ± 1.0 ^a
Body fat (%)	38.2 ± 2.7	34.1 ± 3.1	-11.8 ± 2.2 ^a	36.8 ± 3.0	33.2 ± 3.2	-11.0 ± 2.9 ^a	40.3 ± 2.4	38.3 ± 2.6	-5.4 ± 1.3 ^a
Total fat mass (kg)	31.4 ± 2.2	26.1 ± 2.3	-17.4 ± 2.3 ^a	31.0 ± 2.6	26.7 ± 2.6	-15.1 ± 3.2 ^a	35.7 ± 2.6	32.3 ± 2.8	-9.6 ± 1.8 ^a
Lean body mass (kg)	51.8 ± 4.6	51.7 ± 4.7	-0.3 ± 0.7	54.6 ± 4.5	54.8 ± 4.5	0.7 ± 0.8	53.6 ± 4.9	52.9 ± 4.8	-1.1 ± 1.0
Lean body mass/body weight (%)	58.3 ± 2.6	62.6 ± 2.9	7.3 ± 1.1 ^a	59.6 ± 2.8	63.9 ± 3.0	7.6 ± 1.3 ^a	56.4 ± 2.1	59.0 ± 2.5	4.5 ± 0.9 ^a
Waist circumference (cm)	101.6 ± 5.4	92.1 ± 4.9	-9.3 ± 0.7 ^a	103.0 ± 3.9	94.6 ± 3.7	-8.5 ± 0.8 ^a	102.2 ± 5.8	94.3 ± 4.8	-7.5 ± 0.8 ^a
Abdominal fat (%)	40.7 ± 2.3	37.1 ± 2.7	-9.2 ± 2.4 ^a	39.4 ± 2.8	36.6 ± 3.0	-6.2 ± 3.6 ^a	42.0 ± 2.2	40.3 ± 2.3	-4.0 ± 1.2 ^a
Abdominal fat (kg)	4.0 ± 0.4	3.3 ± 0.4	-18.7 ± 3.3 ^a	4.1 ± 0.3	3.6 ± 0.3	-12.6 ± 3.3 ^a	4.6 ± 0.4	4.3 ± 0.5	-7.2 ± 2.5 ^a

40%

© Can Stock Photo

25%



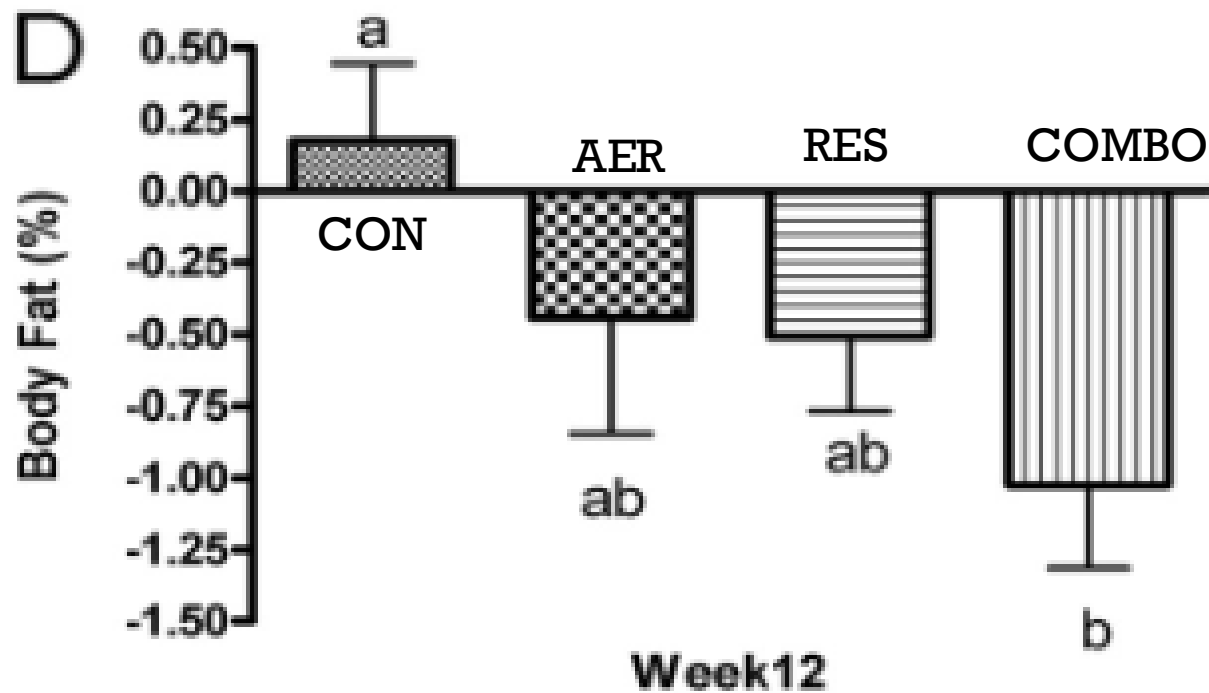


Figure 2D: Comparison of changes from baseline between groups body fat %.

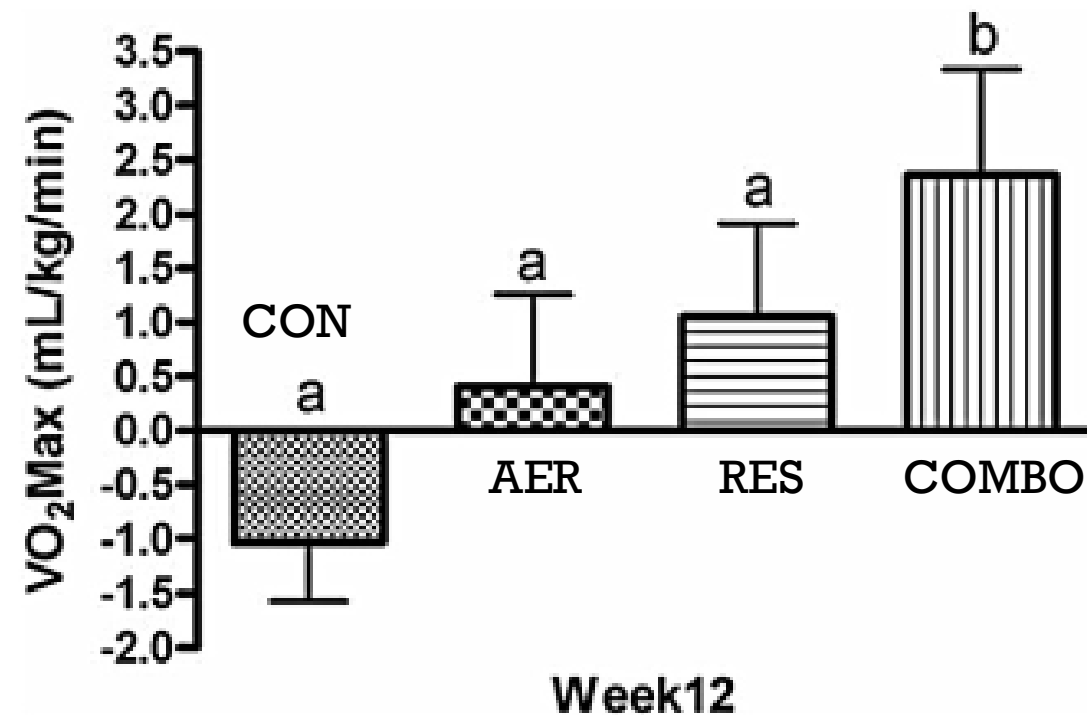
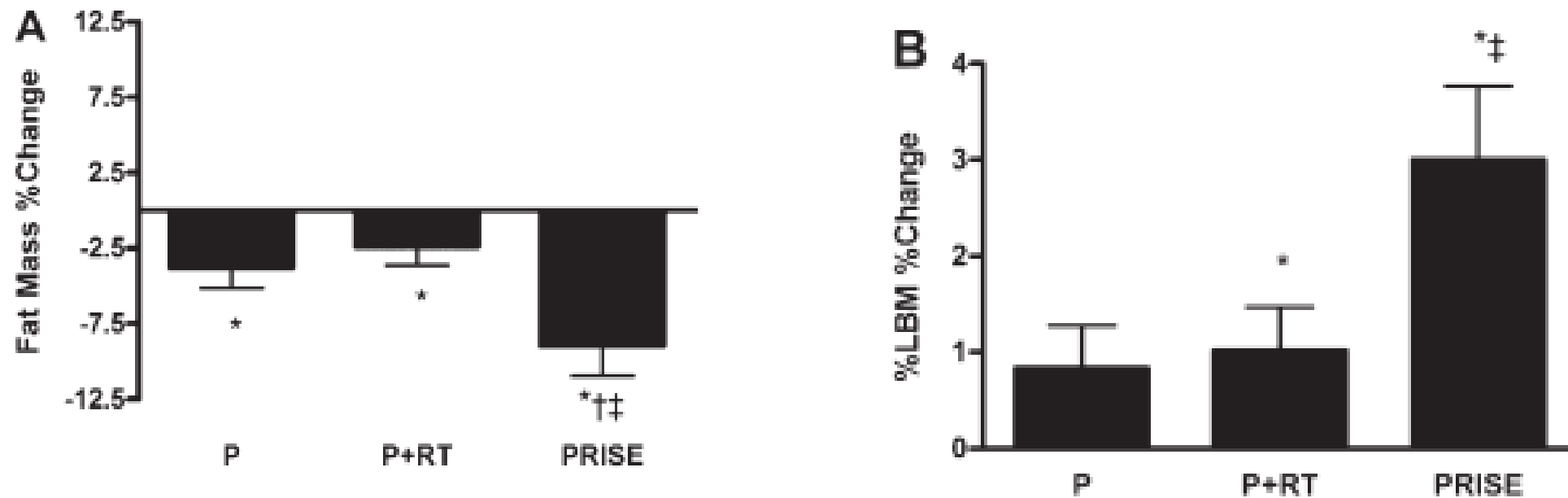


Figure 3: Comparison of changes from baseline between groups for cardio-respiratory fitness.

Timed-daily ingestion of whey protein and exercise training reduces visceral adipose tissue mass and improves insulin resistance: the PRISE study

Paul J. Arciero,¹ Daniel Baur,² Scott Connelly,³ and Michael J. Ormsbee^{2,4}



- 20g WP, 3X/day added to habitual diet of overweight/obese men/women for 16 weeks.



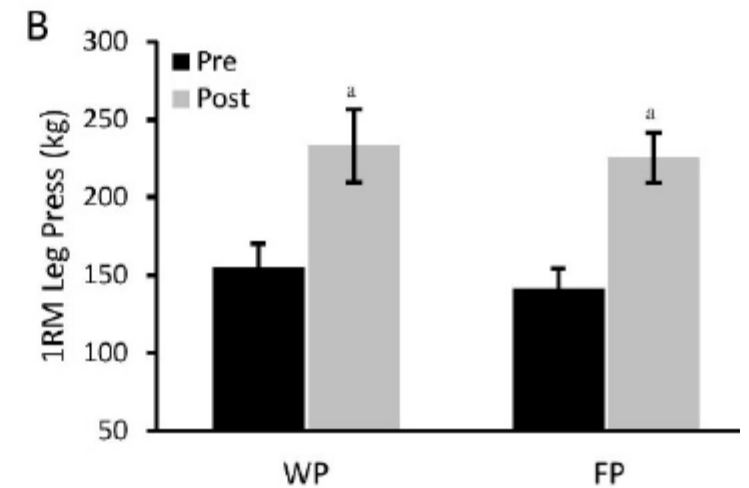
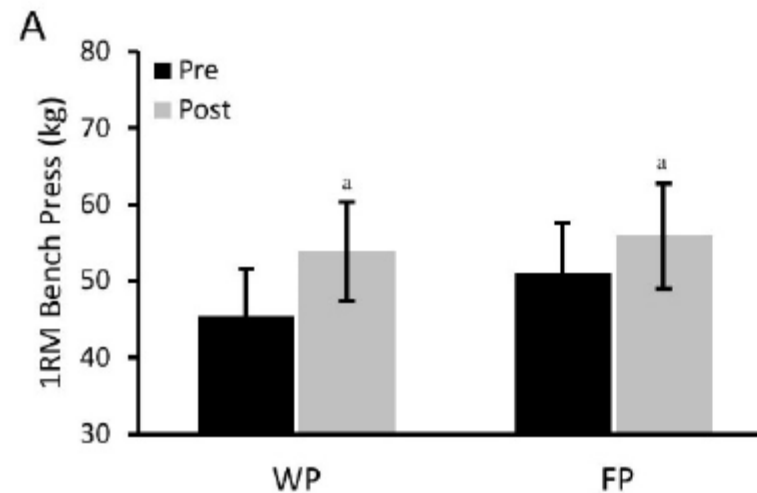
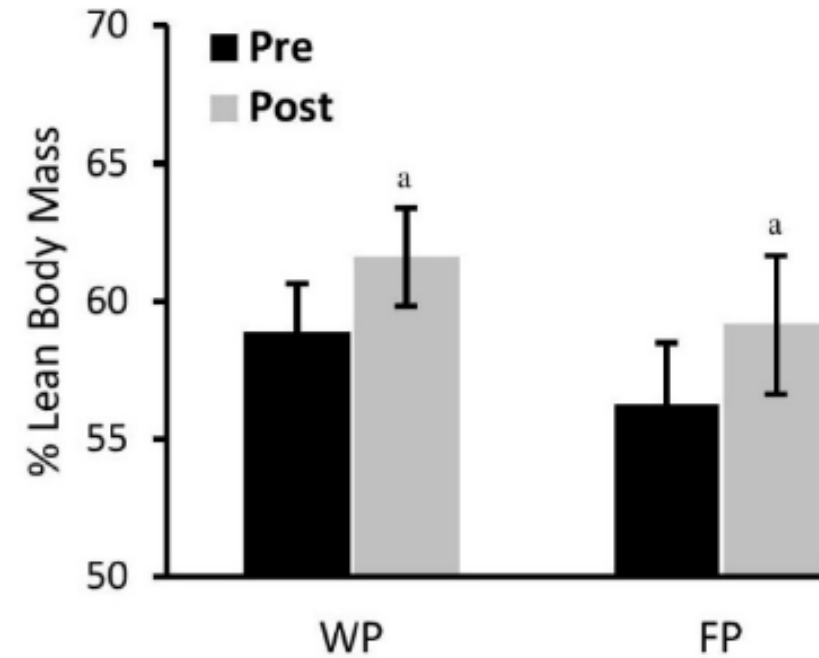
Protein-Pacing from Food or Supplementation Improves Physical Performance in Overweight Men and Women: The PRISE 2 Study

Paul J. Arciero ^{1,*}, Rohan C. Edmonds ¹, Kanokwan Bunsawat ², Christopher L. Gentile ³, Caitlin Ketcham ¹, Christopher Darin ¹, Mariale Renna ¹, Qian Zheng ¹, Jun Zhu Zhang ¹ and Michael J. Ormsbee ^{4,5}

Table 1. Participant Characteristics.

Variable	WP	FP
Sex (M/F)	4/5	7/5
Age (year)	48 ± 4	52 ± 1
Height (cm)	173 ± 3	172 ± 3
Weight (kg)	96 ± 3	97 ± 5
Body mass index	32 ± 2	33 ± 1

WP: whey protein; FP: food protein. All values are means ± SE.



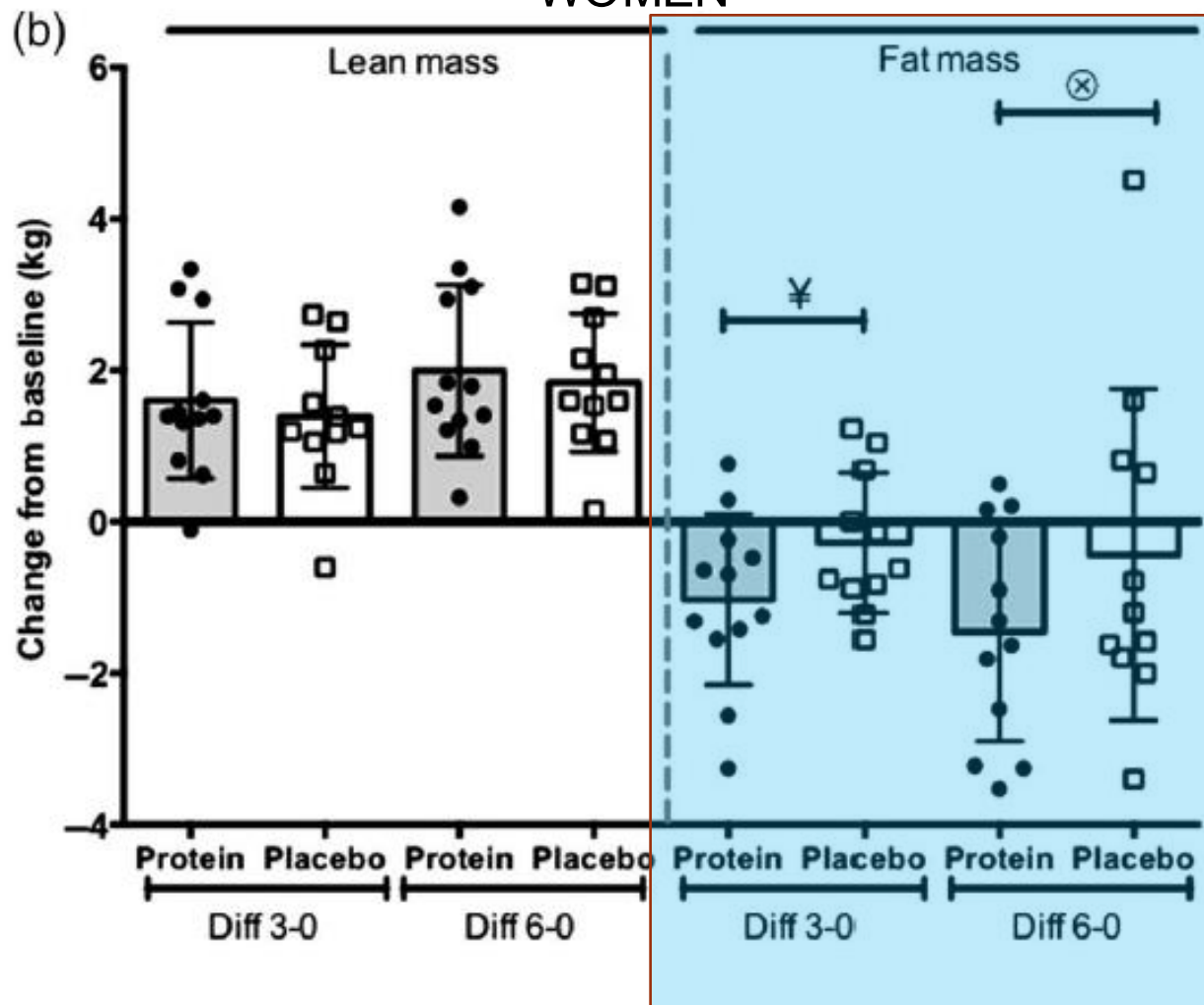
Protein Supplementation During a 6-Month Concurrent Training Program: Effect on Body Composition and Muscular Strength in Sedentary Individuals

42g PRO or CHO 2x/d

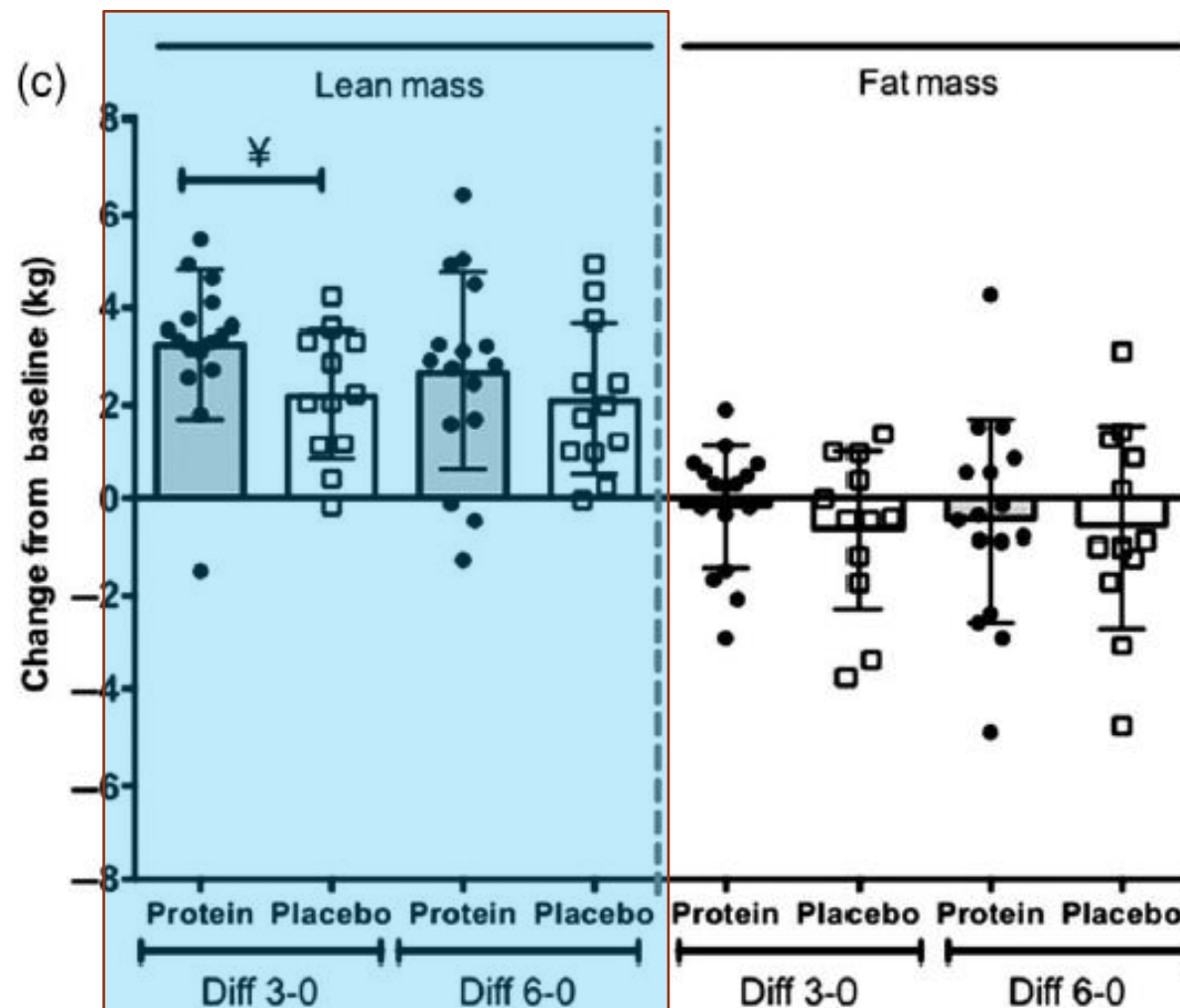
5d/week of training



WOMEN



MEN

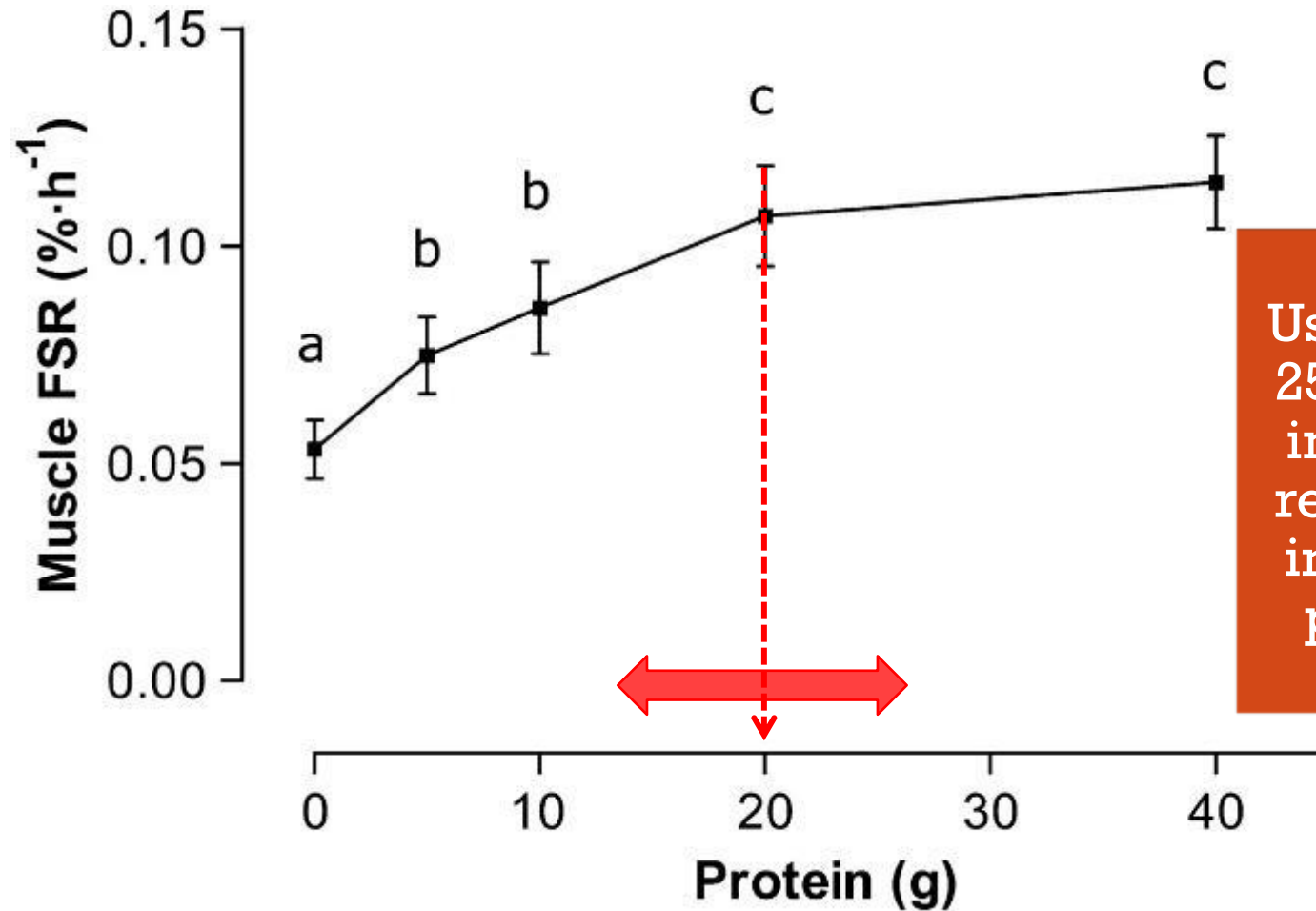


(PRO: 2.2 g/kg; CON: 1.1 g/kg; $p < .001$).

Ormsbee et al. IJSNEM, 2018

WHAT IS THE OPTIMAL DOSE OF PROTEIN?

MAXIMAL RATE OF MUSCLE PROTEIN SYNTHESIS AT 20G OF COMPLETE PROTEIN FOR YOUNG MEN



20g of egg protein
~8.6g EAA

or

0.25 g protein/kg/meal

Using more than 20-25 grams of protein in a single feeding results in no further increase in muscle protein synthesis

THE “OPTIMAL” DOSE OF PROTEIN CHANGES BASED ON AGE AND GOAL

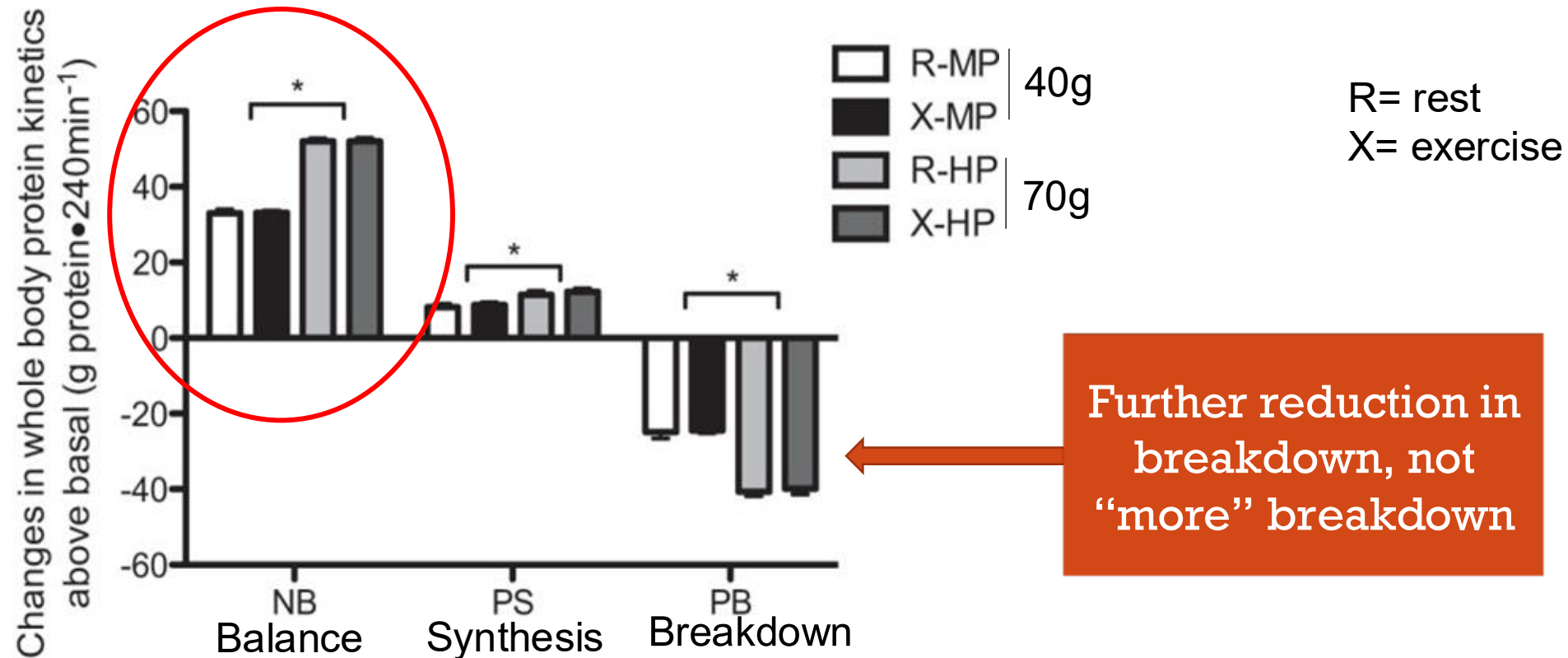


40g (~16.8g essential amino acids) maximally stimulates muscle protein synthesis after RE in elderly men

RE: Resistance Exercise
FSR: Fractional Synthetic Rate

THERE IS MORE TO PROTEIN INTAKE THAN MUSCLE PROTEIN SYNTHESIS

- Protein breakdown can't be overlooked as a factor for muscle anabolism
- When looking at net protein synthesis there is no plateau at higher levels of intake

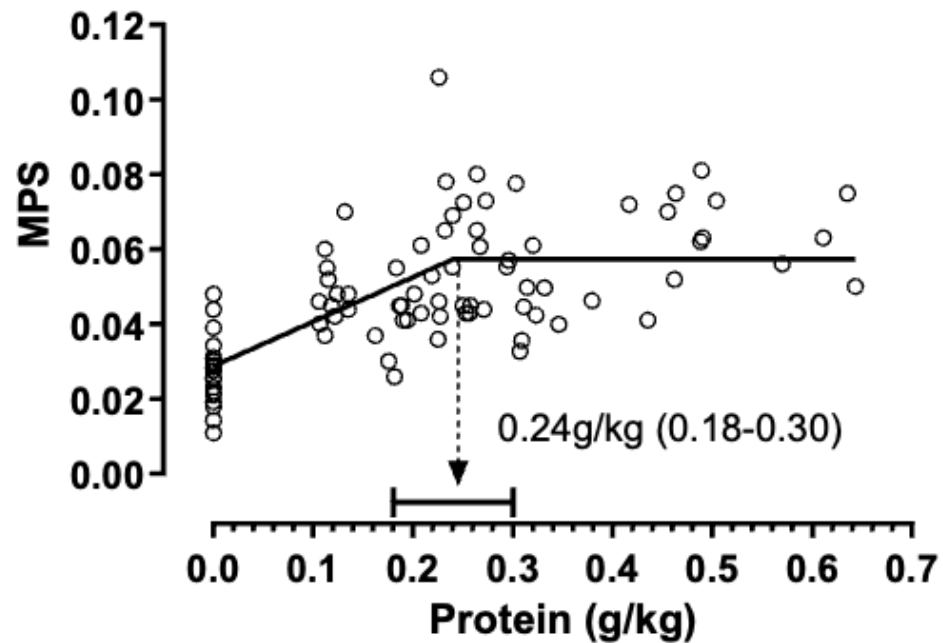


Changes in rates of whole body protein from fasted state to fed state for net balance (NB), synthesis (PS), and breakdown (PB) with 40g (MP) and 70g (HP) of dietary protein

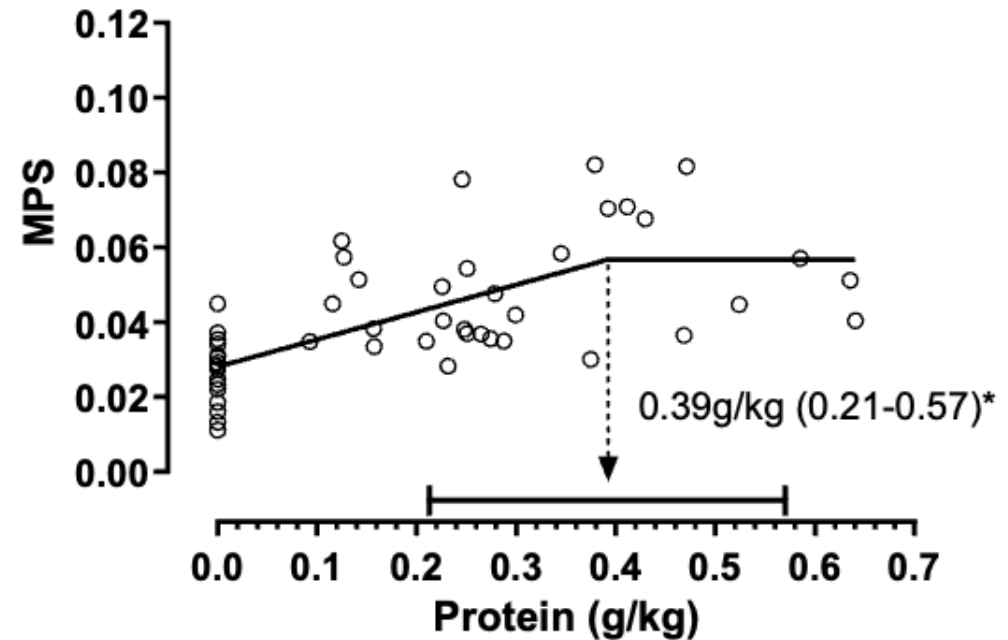
Il-Young et al., *AJPEM*, 2015; Deutz et al., *Clin Nutr*, 2014

YOUNGER VS. OLDER: MORE PROTEIN TO OPTIMALLY STIMULATE MPS *PER MEAL*

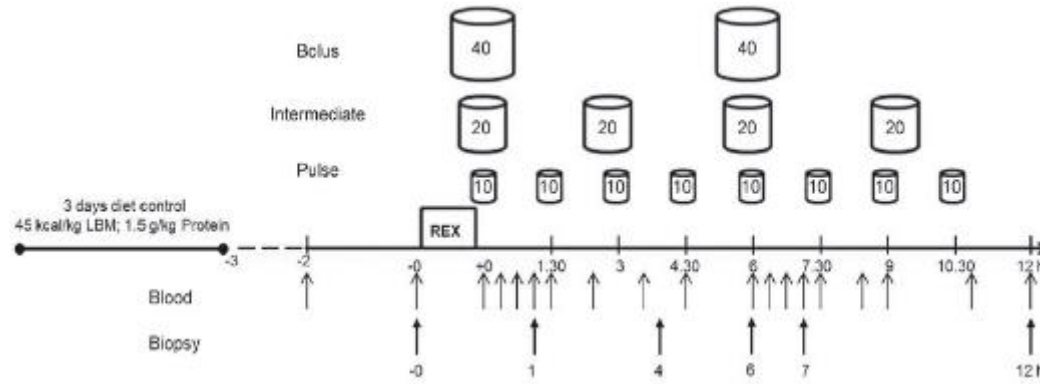
Younger



Older

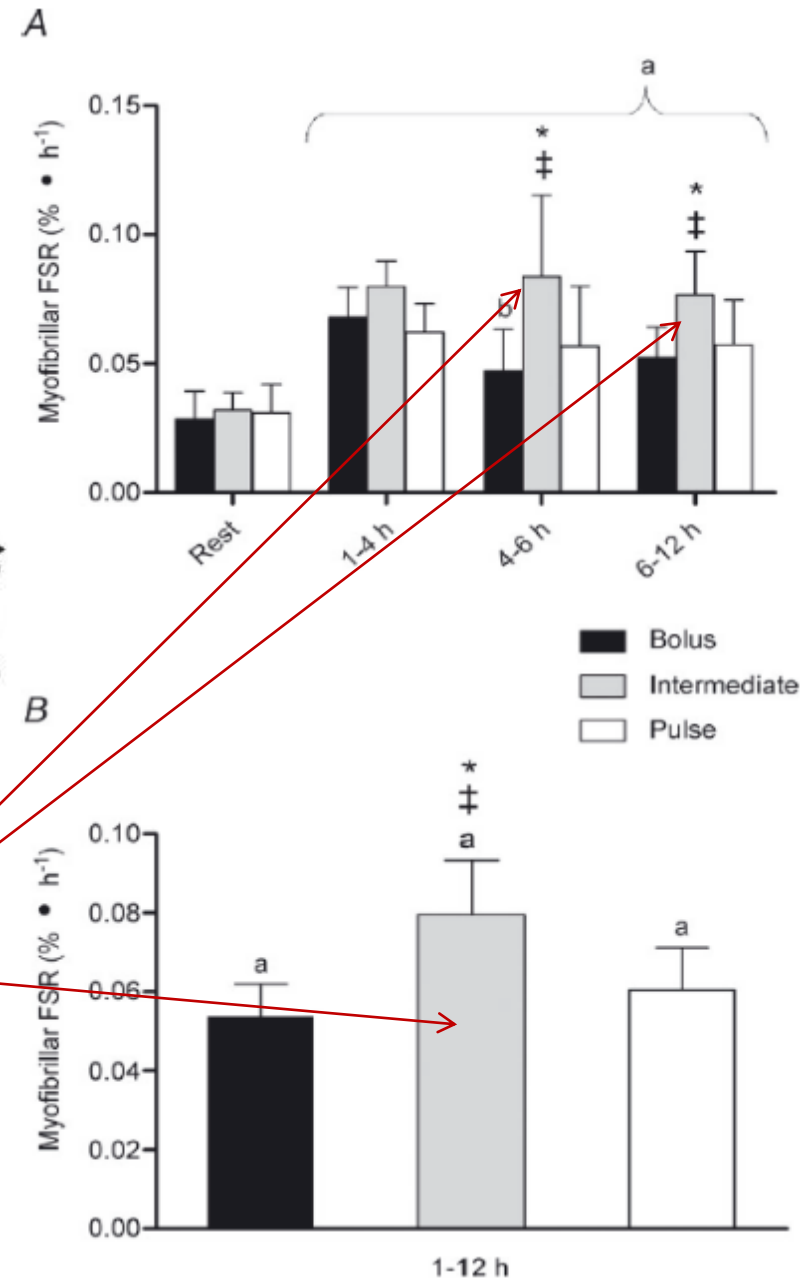


PROTEIN DISTRIBUTION MAY BE IMPORTANT FOR MUSCLE AND BODY COMPOSITION

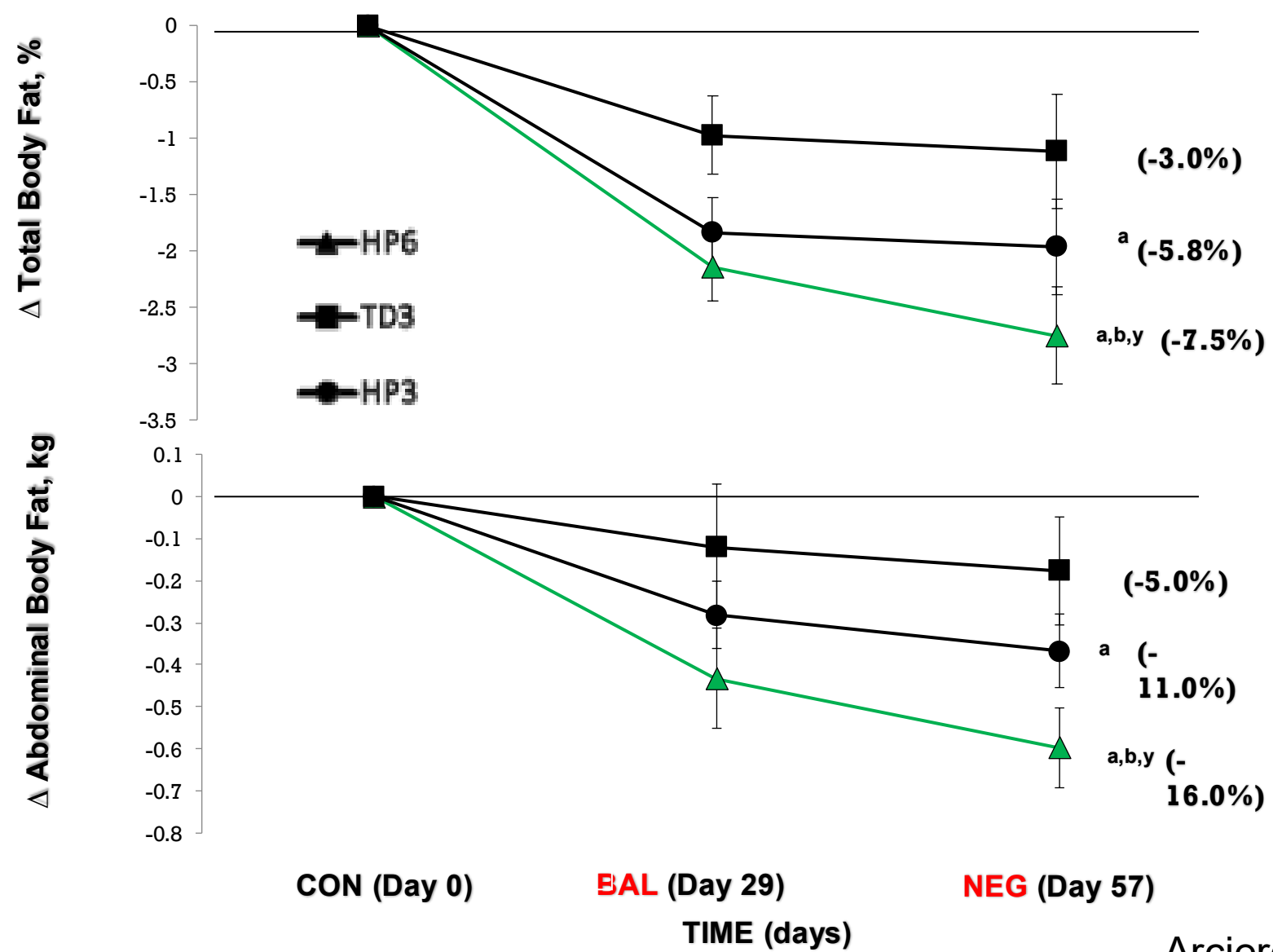


3 Trials of 80 grams of Protein:

- 1) **Bolus** – 2 X 40 g every 6 hrs
- 2) **Intermediate** – 4 X 20g every 3 hrs
- 3) **Pulse** – 8 X 10 g every 1.5 hrs



PROTEIN TIMING ENHANCED TOTAL AND ABDOMINAL BODY FAT LOSS



SIDE NOTE: WHAT IS BODY COMPOSITION INDEX (BCI)?



“...The BCI is the [outcome] of scoring losses of FM and gains of FFM as positive outcomes and gains of FM and losses of FFM as negative outcomes. The BCI is the net result of combining these positive and negative outcomes.”

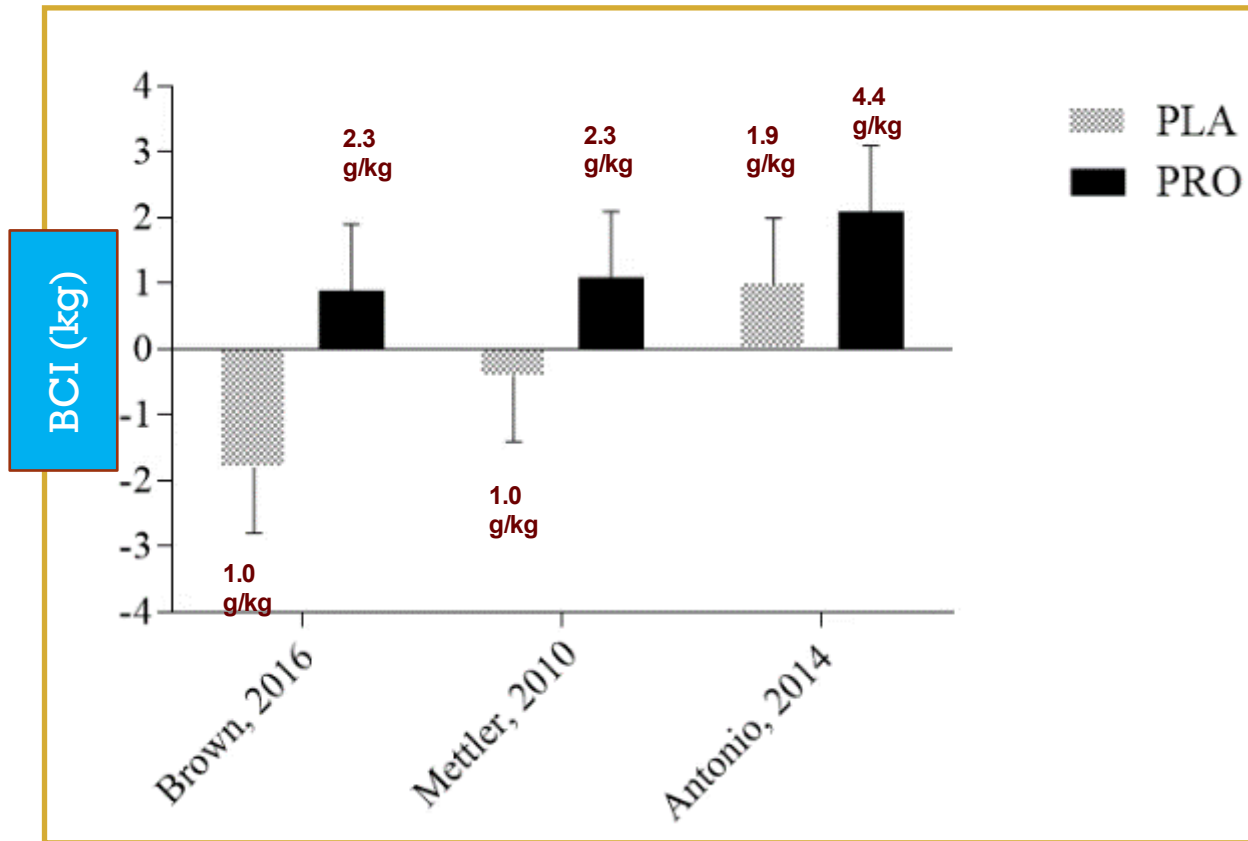
*LSTI and DBMI have also been used to describe BCI

Stohs et al. Phyto Res, 2016.

BODY COMPOSITION INDEX: PROTEIN & ATHLETES



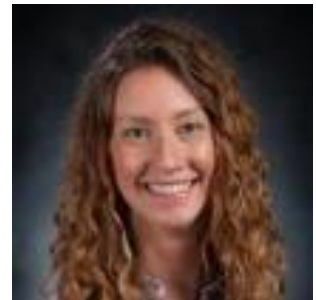
Different way to share data?



* indicates $p \leq 0.05$ from baseline between groups

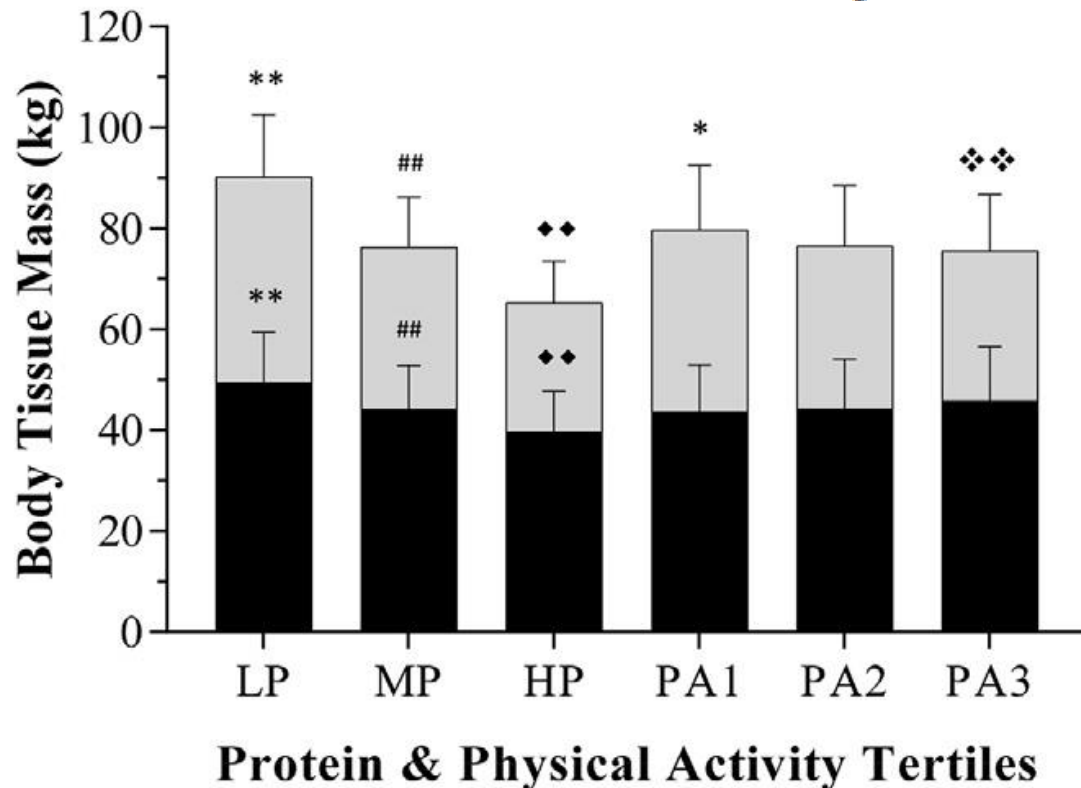


Brown et al. 2021



Higher-protein intake and physical activity are associated with healthier body composition and cardiometabolic health in Hispanic adults

Ann F. Brown^{a, b}, Carla M. Prado^c, Sunita Ghosh^d, Shawn M. Leonard^b, Paul J. Arciero^{e, f}, Katherine L. Tucker^g, Michael J. Ormsbee^{b, h, *}



□ Fat mass
■ Lean soft tissue

The highest tertile of energy-adjusted dietary protein intake (≥ 1.11 g/kg/d) and greater PA (> 3.2 km/d) were associated with healthier body composition phenotype and cardiometabolic risk factors in the BPRHS cohort.

N=959



Boston
Puerto Rican
Health Study

Effects of Resistance Training and Protein Supplementation in Breast Cancer Survivors

TAKUDZWA A. MADZIMA; MICHAEL J. ORMSBEE; ERICA A. SCHLEICHER; ROBERT J. MOFFATT; LYNN B. PANTON

TABLE 4. Comparison of muscular strength, physical activity, and body composition (*N* = 33).

	RT Group (<i>n</i> = 16)		RT + PRO Group (<i>n</i> = 17)	
	Baseline	12 wk	Baseline	12 wk
Handgrip (kg)	47.9 ± 7.3	52.4 ± 7.5*	53.2 ± 9.2	55.1 ± 9.0*
1-RM chest press (kg)	78.5 ± 21.9	109.2 ± 28.8*	92.3 ± 21.5	121.5 ± 29.8*
1-RM leg extension (kg)	88.1 ± 23.4	103.4 ± 25.8*	105.2 ± 24.4 ^c	128.9 ± 31.3*
Physical activity (steps per day)	6700 ± 2724	5912 ± 3300	5945 ± 2777	5395 ± 2027
Waist girth (cm)	82.7 ± 14.1	80.9 ± 13.8*	88.3 ± 13.0	86.2 ± 12.0*
LM (kg)	39.4 ± 6.1	40.1 ± 6.6*	41.3 ± 6.2	42.4 ± 6.4*
FM (kg)	28.6 ± 9.5	28.1 ± 9.5*	30.1 ± 9.3	29.5 ± 9.6*
LM/FM ratio	1.46 ± 0.37	1.52 ± 0.41*	1.46 ± 0.32	1.53 ± 0.35*
Total body fat (%)	41.4 ± 5.6	40.6 ± 5.7*	41.4 ± 5.4	40.3 ± 5.7*

Data are presented as mean ± SD.

**P* ≤ 0.05 significantly different from baseline within group.

***P* ≤ 0.05, significant interaction between groups.

****P* ≤ 0.05, significantly different between groups at same time point.



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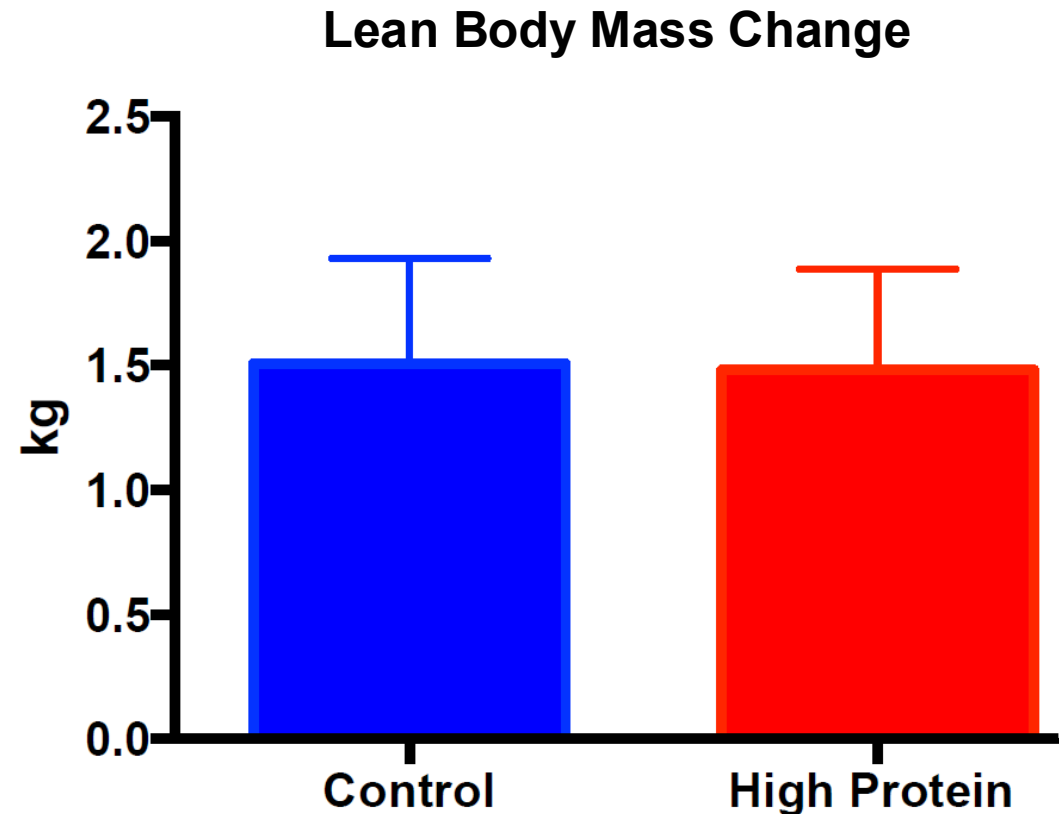
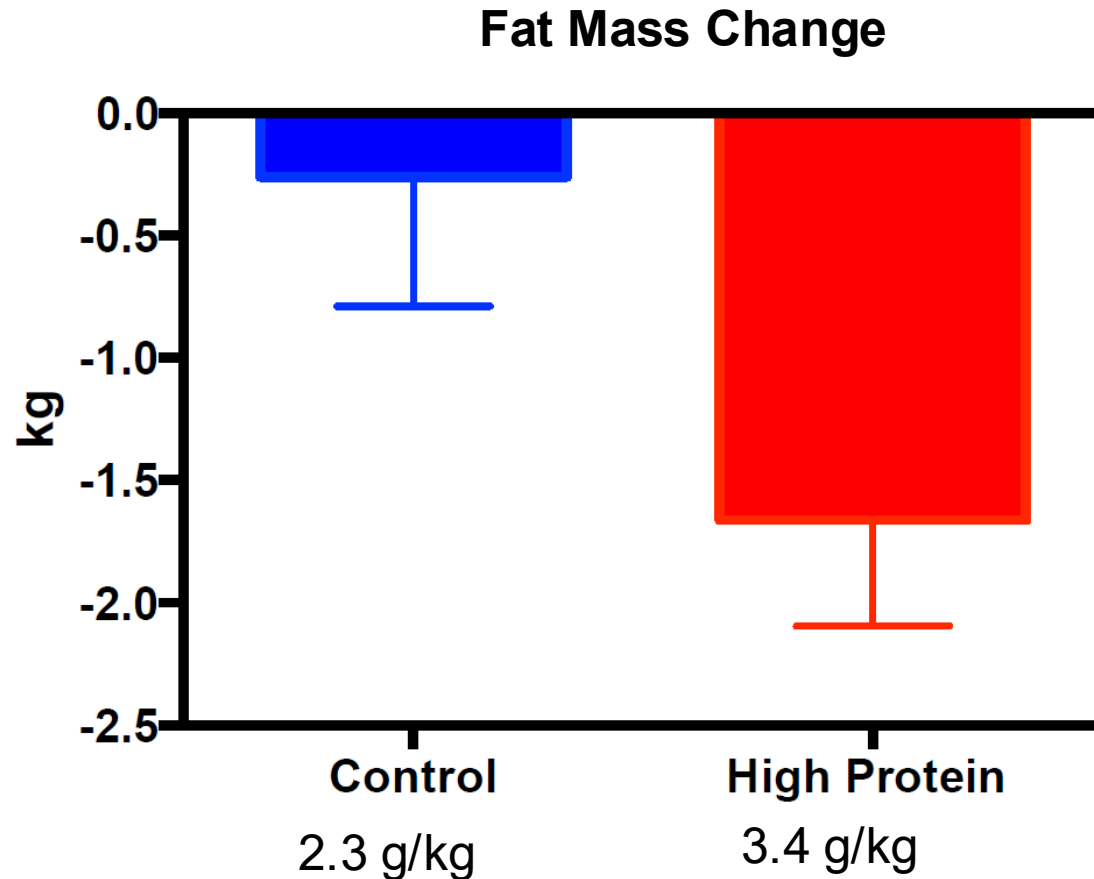
1 R15 CA176614-01A1



**DESPITE THE HIGHER
PROTEIN (AND KCAL)
INTAKE, BODY COMPOSITION
INDEX IMPROVED!**



DESPITE INCREASED CALORIE INTAKE, HIGH PROTEIN INTAKE MAY RESULT IN GREATER FAT LOSS



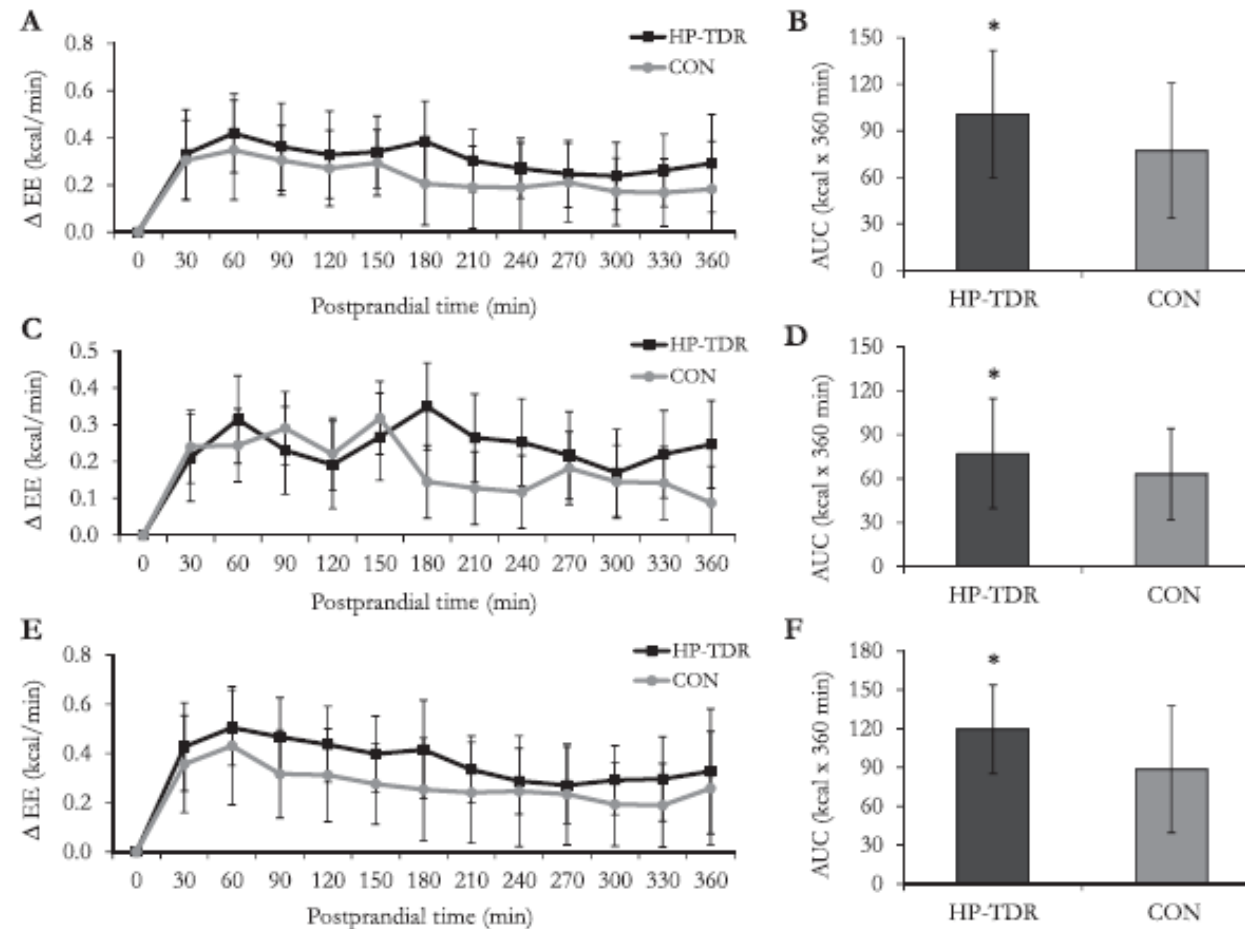
A high-protein total diet replacement increases energy expenditure and leads to negative fat balance in healthy, normal-weight adults

Camila LP Oliveira,^{1,2} Normand G Boulé,^{2,3} Arya M Sharma,⁴ Sarah A Elliott,^{1,5} Mario Siervo,⁶ Sunita Ghosh,⁷ Aloys Berg,⁸ and Carla M Prado^{1,2}

32h inside a whole-body
Calorimetry Unit

Higher protein resulted in
a slight negative EB (-18
Kcals) and normal protein
resulted in positive EB (+92
Kcals). **The total difference
was ~110 Kcals.**

40% v. 15% PRO



ALL

Women

Men



Oliveira et al. 2021

WHAT ABOUT MORE EXTREME WEIGHT LOSS GOALS?



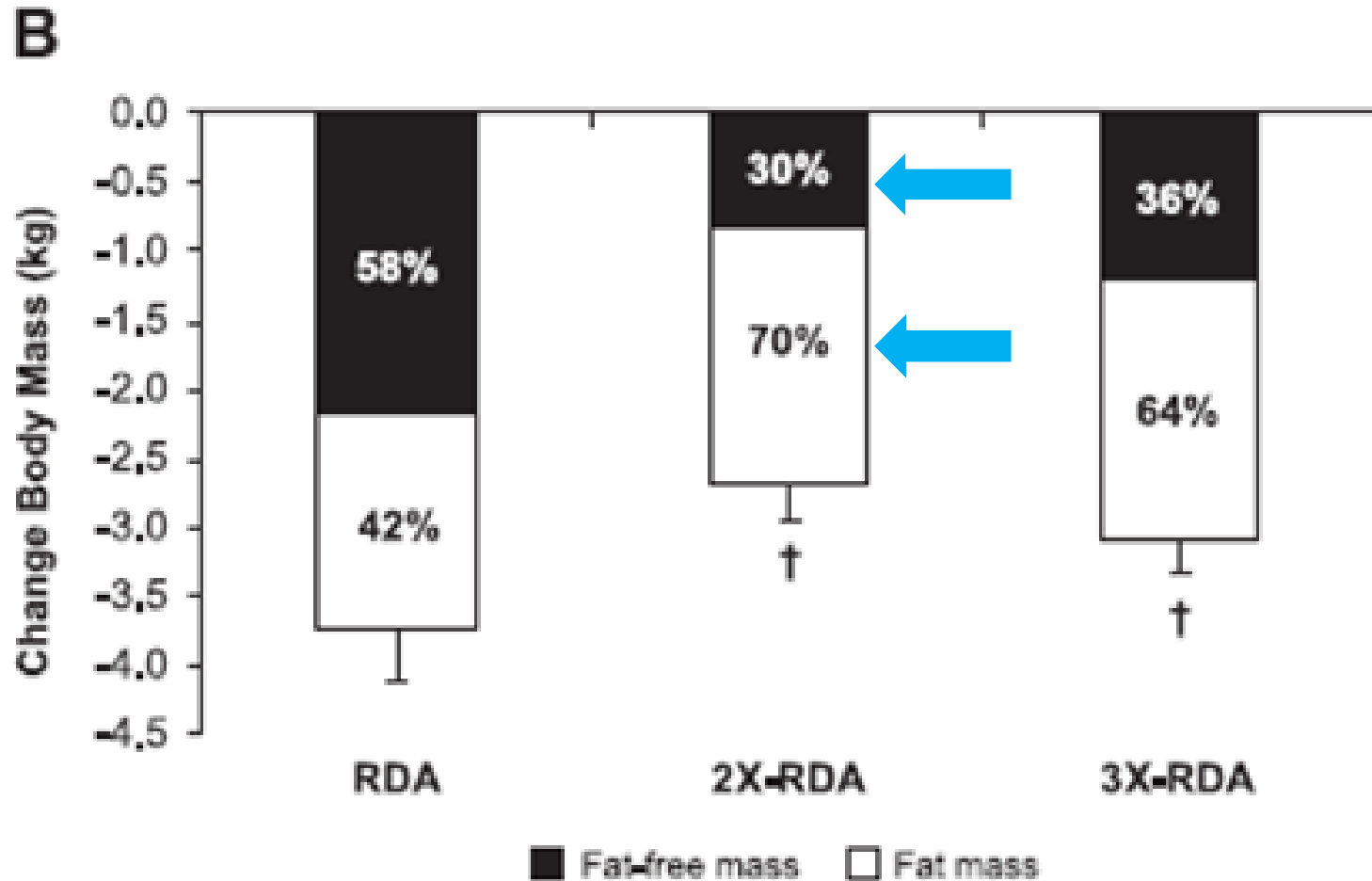
@mikeormsbee
@fsuissm

EATING PROTEIN AT 2-3X RDA IS BEST FOR PRESERVING MUSCLE MASS DURING WEIGHT LOSS

39 men and women aged 21 years old. BMI was 22-29 and they were physically active.

40% Energy Deficit for 21 days.

RDA: Recommended Daily Allowance



Pasiakos et al. FASEB J., 2013.

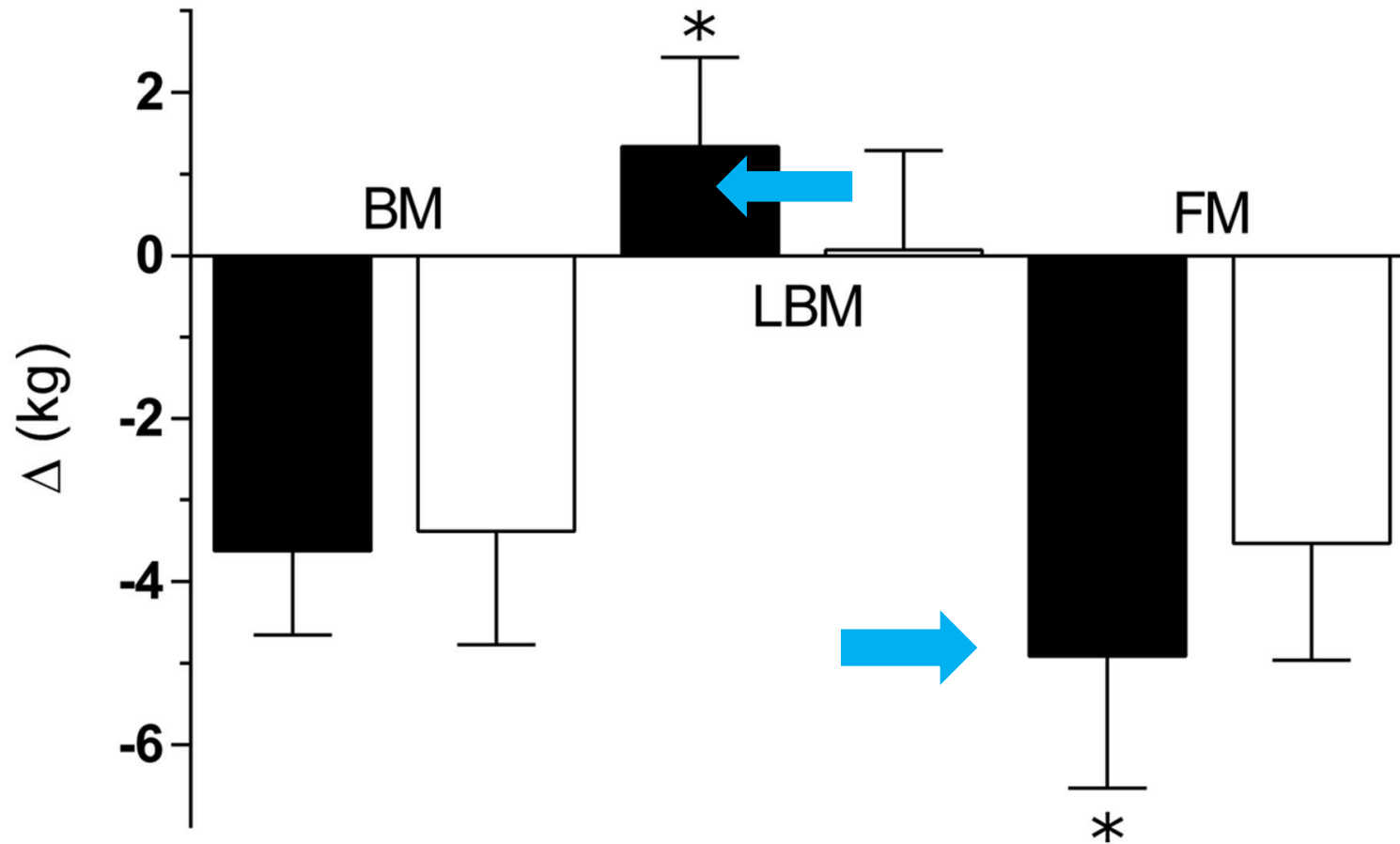
HIGHER COMPARED WITH LOWER DIETARY PROTEIN DURING AN ENERGY DEFICIT COMBINED WITH INTENSE EXERCISE PROMOTES GREATER LEAN MASS GAIN AND FAT MASS LOSS: A RANDOMIZED TRIAL

- Young men (n=20/group)
- 40% reduction/d in estimated energy needs for 28d
- Exercising 6d/wk
- PROTEIN: 1.2 vs. 2.4 g protein/kg/d – timed post-exercise
- CHO: ~3 g/kg/d
- 85% of difference in protein – whey protein-containing milkshake (i.e., whey in milk)



@mikeormsbee
@fsuissm

DESPITE 40% REDUCTION IN CALORIE INTAKE, 2.4G/KG/D PROTEIN IMPROVED BODY COMPOSITION (4 WEEKS)

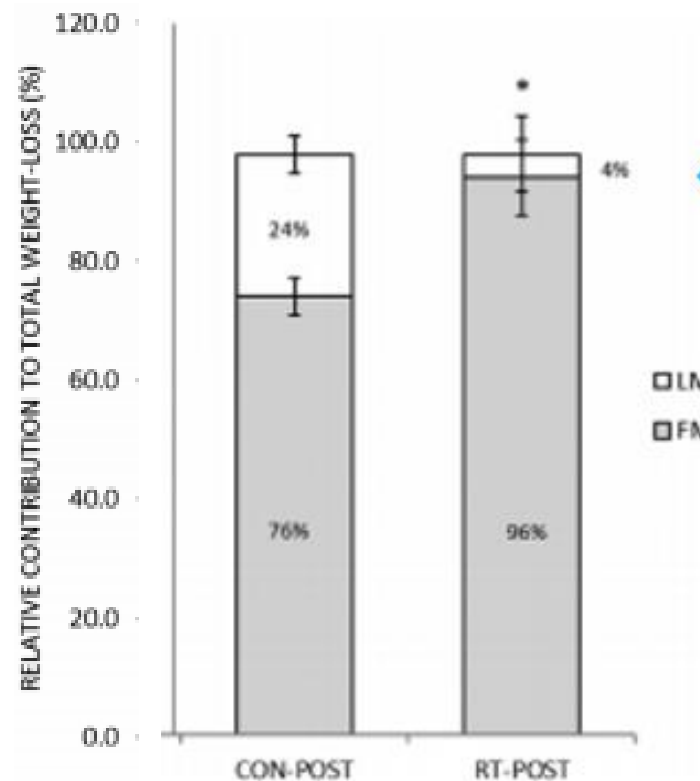


PRO (black bars): 2.4 g/kg/d
CON (white bars): 1.2 g/kg/d

Thomas M Longland et al. Am J Clin Nutr 2016;103:738-746

Resistance training during a 12-week protein supplemented VLCD treatment enhances weight-loss outcomes in obese patients

Edward Jo ^a, Phillip R. Worts ^b, Marcus L. Elam ^a, Ann Frost Brown ^e, Andy V. Khamoui ^f, Do-Houn Kim ^b, Ming-Chia Yeh ^b, Michael J. Ormsbee ^{b, c, d}, Carla M. Prado ^g, Angelina Cain ^h, Katie Snyder ^h, Jeong-Su Kim ^{b, c, *}



Lean Mass Loss
24% v. 4%



@mikeormsbee
@fsuissm

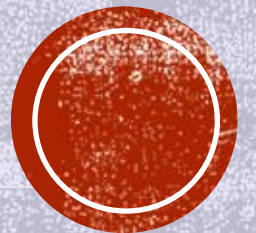
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SCIENCES & MEDICINE

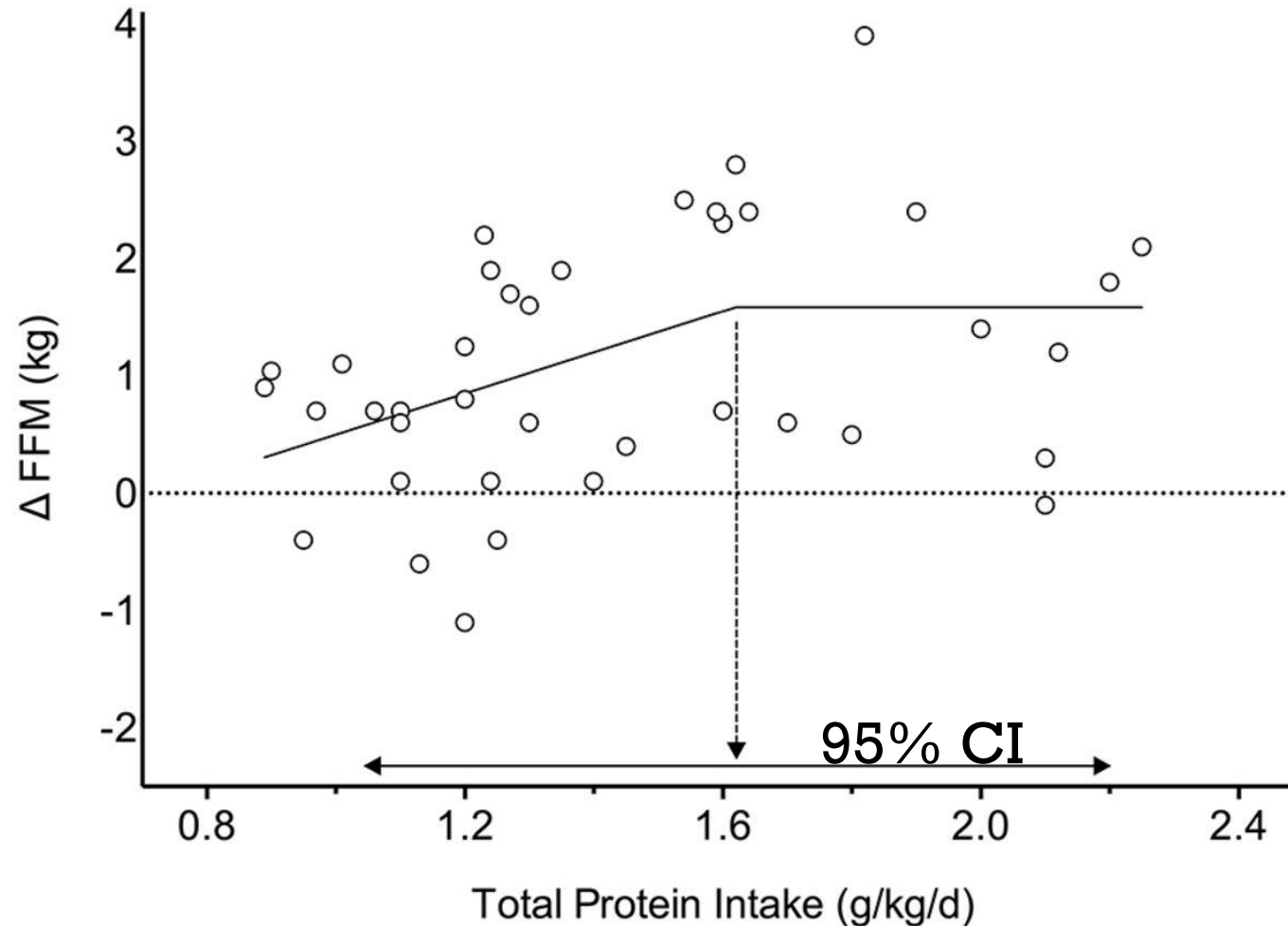
Jo et al. Clinical Nutrition (2019)



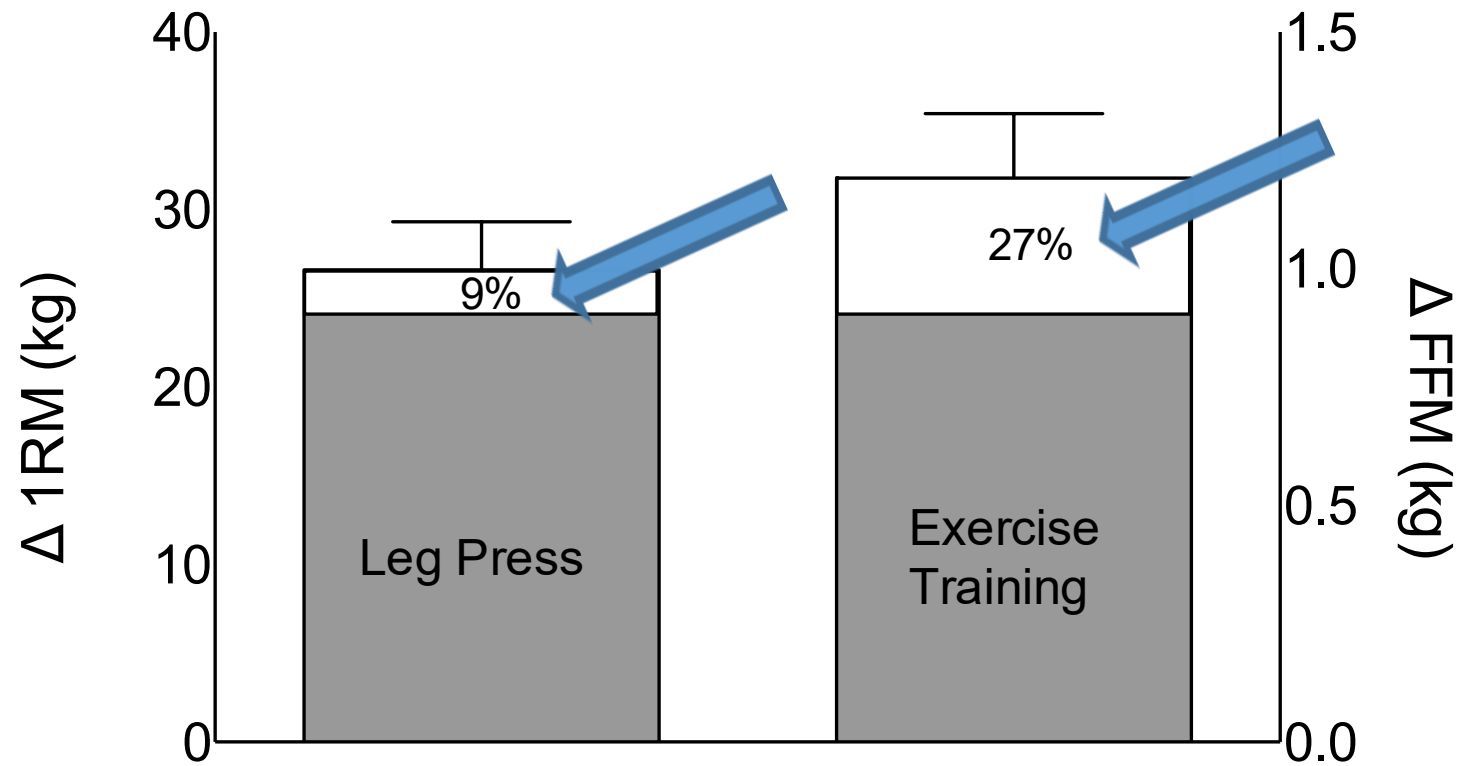
SO WHAT DO I DO? HOW MUCH?



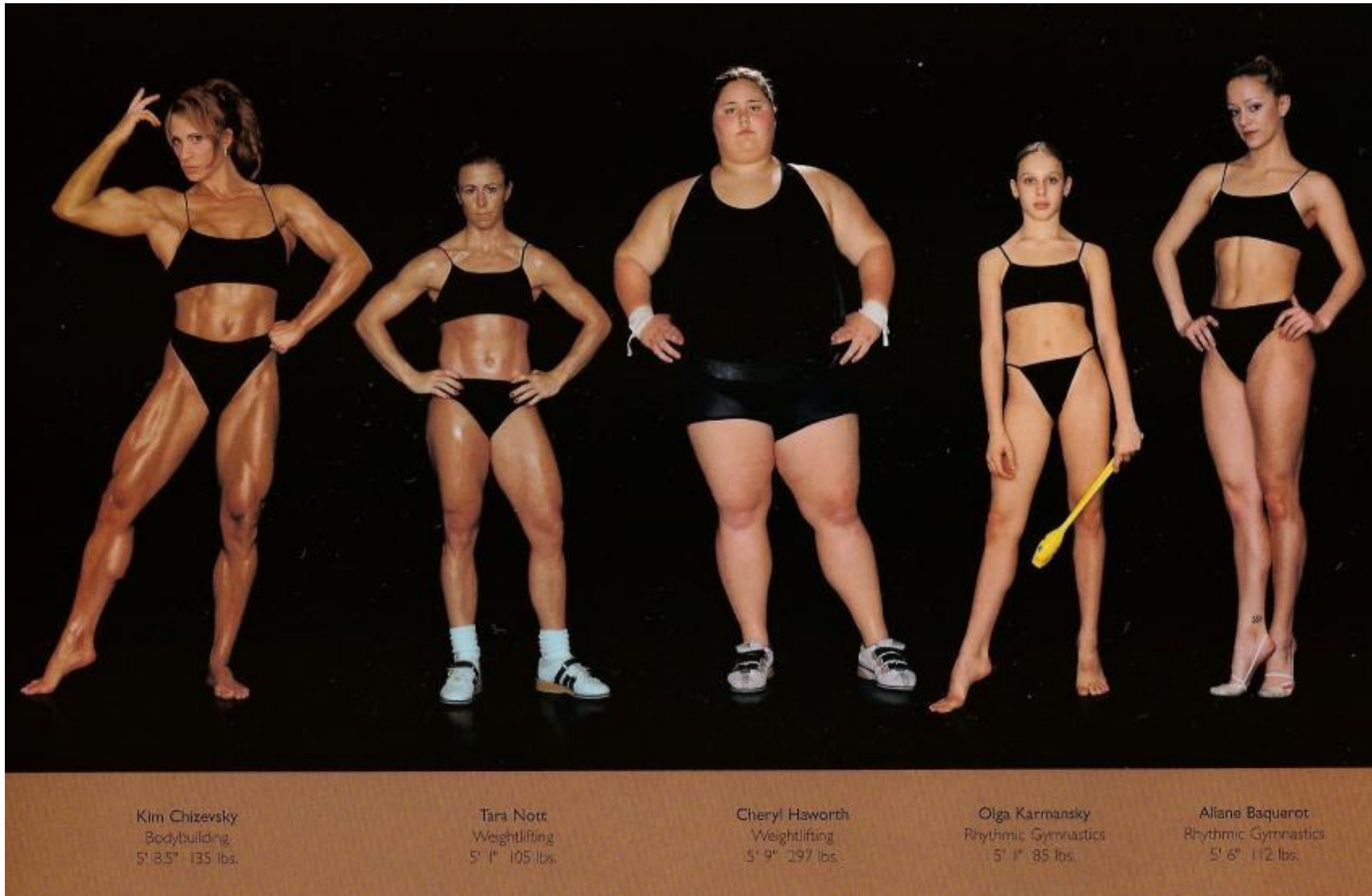
RELATIVE TOTAL PROTEIN INTAKE (G/KG BODY MASS/DAY) AND THE CHANGE IN FAT-FREE MASS (Δ FFM)



WHAT IS THE ROLE OF RESISTANCE EXERCISE VS. PROTEIN SUPPLEMENTATION FOR INCREASING STRENGTH AND FAT-FREE MASS?



FIT DOESN'T COME IN ONE SIZE!



WHAT IS RECOMMENDED?

5.1. *Individuals in Energy Balance*

1. Consume ~ 0.4 g/kg body mass (i.e., 0.24 plus 0.06 with protein added to account for the influence of other macronutrients in meals and protein quality), to maximally stimulate MPS following a ~~period of rest or exhaustive resistance~~ resistance exercise.
2. Spacing protein-containing meals $\sim 3\text{--}5$ h throughout the day maximizes MPS rates over the course of a 12 h (i.e., waking) period.
3. Practice pre-sleep protein ingestion (1–3 h prior to sleep) to offset declines in MPS that would occur during an overnight fasting period.
4. To maximize muscle protein accretion with resistance exercise, daily protein intakes should be ~ 1.6 g/kg/day and up to 2.2 g/kg/day. This intake can be achieved by ingesting 3 meals, each containing ~ 0.53 g/kg protein, or 4 meals containing ~ 0.4 g/kg protein.

WHAT IS RECOMMENDED?

REVIEW

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International Society of Sports Nutrition Position Stand: protein and exercise

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Abstract

Position statement: The International Society of Sports Nutrition (ISSN) provides an objective and critical review related to the intake of protein for healthy, exercising individuals. Based on the current available literature, the position of the Society is as follows:

- 1) An acute exercise stimulus, particularly resistance exercise, and protein ingestion both stimulate muscle protein synthesis (MPS) and are synergistic when protein consumption occurs before or after resistance exercise.
- 2) For building muscle mass and for maintaining muscle mass through a positive muscle protein balance, an overall daily protein intake in the range of 1.4–2.0 g protein/kg body weight/day (g/kg/d) is sufficient for most exercising individuals, a value that falls in line within the Acceptable Macronutrient Distribution Range published by the Institute of Medicine for protein.
- 3) Higher protein intakes (2.3–3.1 g/kg/d) may be needed to maximize the retention of lean body mass in resistance-trained subjects during hypocaloric periods.
- 4) There is novel evidence that suggests higher protein intakes (>3.0 g/kg/d) may have positive effects on body composition in resistance-trained individuals (i.e., promote loss of fat mass).
- 5) Recommendations regarding the optimal protein intake per serving for athletes to maximize MPS are mixed and are dependent upon age and recent resistance exercise stimuli. General recommendations are 0.25 g of a



Summary Part 1



Exercise is non-negotiable

RT, Endurance, HIIT, Stretching...

Optimal dose is 1.2-2.2 g/kg/d

Increase protein during weight loss



Summary Part 2



Be on the lookout for “Skinny Fat” & pay attention to FFMI

PRO intake is good for muscle, fat loss, and weight control

*Don't be afraid of eating protein before bed

*Prioritize Sleep. It is your superpower.





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