Night Fuel: How Evening Food Impacts Metabolism, Performance, & Sleep

Webinar Will Begin Momentarily

TODAY'S AGENDA:

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

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Florida State University

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INSTITUTE OF SPORTS SCIENCES & MEDICINE

NIGHT FUEL:

How Evening Food Impacts Metabolism, Performance, & Sleep.



Michael J. Ormsbee, PhD, FNAK, FACSM, FISSN, CSCS*D
Executive Director, Institute of Sports Sciences & Medicine
Margaret A. Sitton Endowed Professor, Health, Nutrition, & Food Sciences
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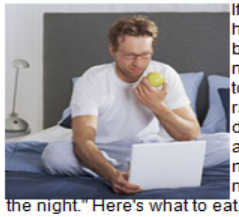
Men's Health TODAY

March 15, 2012

▸ FITNESS ▸ WOMEN ▸ HEALTH ▸ NUTRITION ▸ WEIGHT LOSS ▸ GROOMING ▸ VIDEO

THE BEST FOOD TO EAT BEFORE BED

Eating a protein snack at night could boost muscle growth



If you fall into the habit of eating dinner, hitting the gym, and then going straight to bed, you may be starving your body of needed protein to build muscles, according to new research. "Muscle protein synthesis rates [i.e. building muscles] are quite low during overnight recovery," says study author Luc J.C. van Loon, Ph.D. "As this might be attributed to the fact that there are not as many amino acids available during the night." Here's what to eat, when. Read more...

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Men's Fitness

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Home › Carbs Are Not the Enemy

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Carbs Are Not the Enemy

Turning carbohydrates into powerful muscle-building, fat-burning weapons is a lot easier than you think.

John Kiefer



Los Angeles Times | SCIEN

LOCAL U.S. WORLD BUSINESS SPORTS ENTERTAINMENT HEALT

Nighttime fasting may foster weight loss

A study involving mice suggests that someone on a high-fat, high-calorie diet c
with sufficient fasting between day's end and breakfast the next morning.

Helmholtz Association of German Research Centres in new study →

Why fat is not necessarily bad and why eating at night is

Posted on May 6, 2012 by Stone Hearth News

A Penn research team, led by Mitchell Lazar, MD, PhD, director of the Institute for Diabetes, Obesity, and Metabolism at the Perelman School of Medicine, University of Pennsylvania, reports in Nature Medicine that mice in which an enzyme called histone deacetylase 3 (HDAC3) was deleted had massively fatty livers, but lower blood sugar, and were thus protected from glucose intolerance and insulin resistance, the hallmark of diabetes.

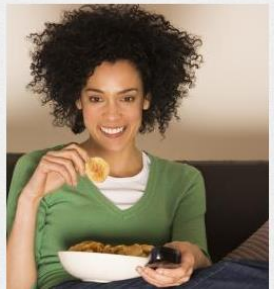
Insulin resistance occurs when the body does a poor job of lowering blood sugars. Typically,

Home / Fitness / Exercise Routines & Workouts / Work Outs / Working Out & Eating Before Bed

WORKING OUT & EATING BEFORE BED

Sep 8, 2011 | By Pam Murphy

0 COMMENTS Like 1 Send Pin it



Only 16 percent of Americans age 15 and over participate in regular exercise and sports activities, according to the Bureau of Labor Statistics. After adding to this statistic that less than 32 percent of adults in the U.S. are at a healthy body weight, the need to adopt healthy eating and exercise habits becomes clearer. For many, long workdays mean that workouts and evening meals get scheduled close to bedtime.

SIGNIFICANCE

When it comes to getting enough exercise and eating right, the timing of your workouts and meals is less important than putting the time in and making healthy food choices. If you can make time to spend 30 minutes on your bike before bedtime, for example, you get the same calorie-burning and fitness



SHAPE FITNESS HEALTHY EATING WEIGHT LOSS LIFESTYLE CELEBR

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SHAPE YOUR LIFE | Apr 11, 2014

Eating Late at Night May Help You Burn Calories

By DietsInReview.com

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Forget what you've heard about eating at night making

GET OUR

CONCERNS ABOUT LATE-NIGHT EATING



- 1. Store fat excessively
- 2. Reduce sleep quality
- 3. Circadian considerations
  - ↓ Metabolism
  - ↓ Glucose tolerance
  - ↓ Gastric emptying
  - ↓ Satiety

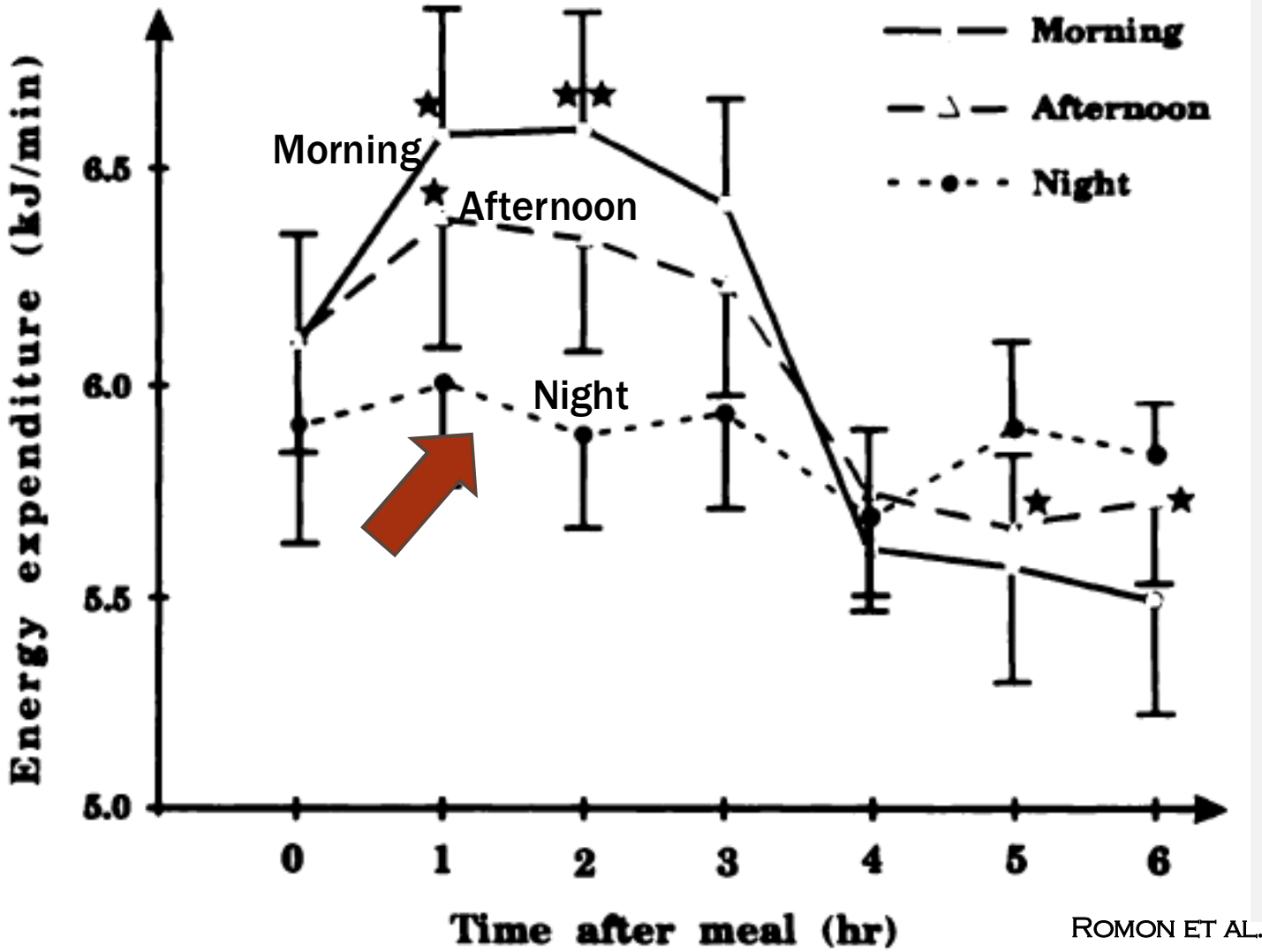
@MikeOrmsbee
@FSUISSM

TIME OF DAY AND YOUR RESPONSE TO FOOD

9am, 5pm, 1am

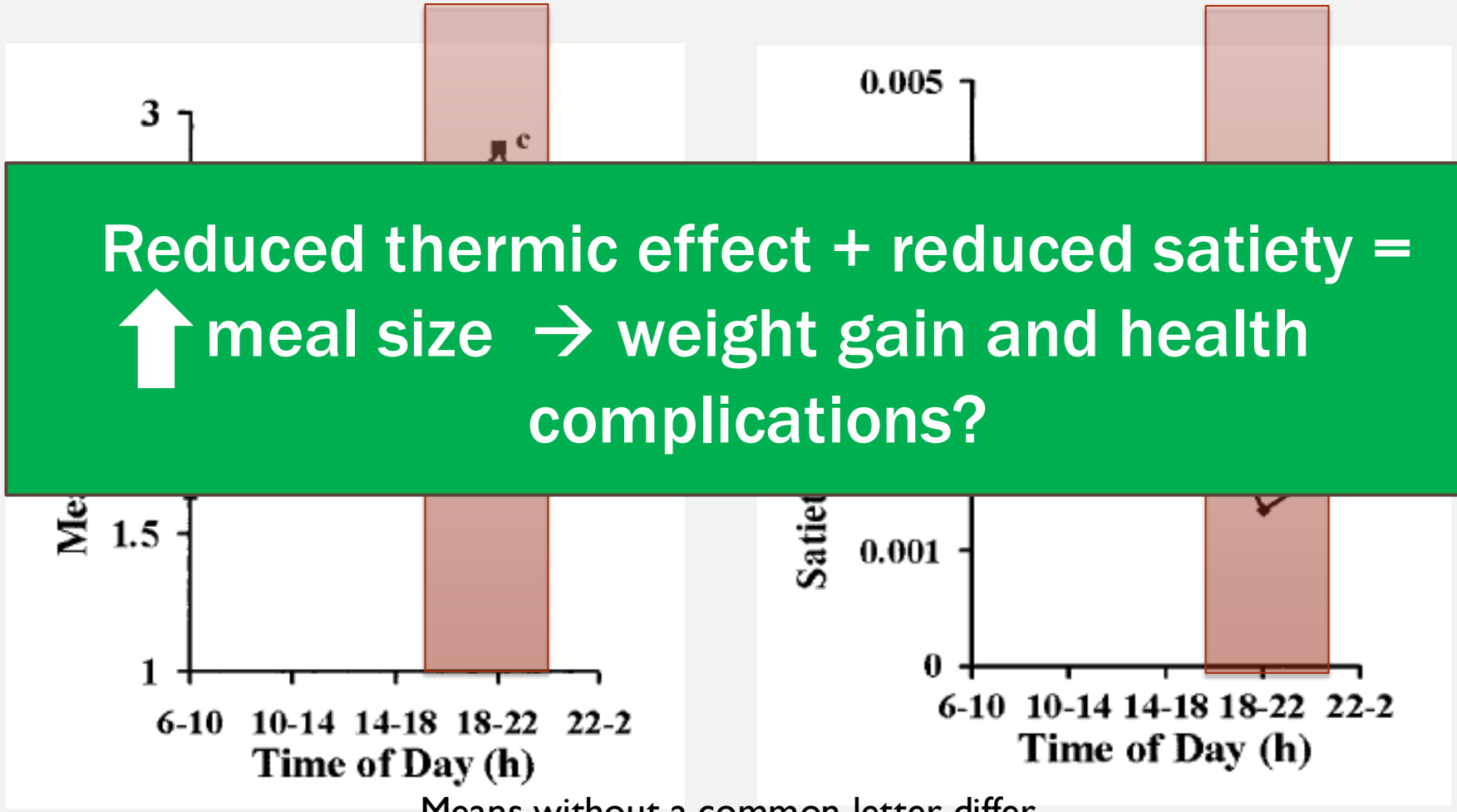
~544 kcals;
15% PRO,
35% FAT,
50% CHO

9 non-obese young men



ROMON ET AL. *AM J CLIN NUTR*, 1993,

REDUCED SATIETY



Reduced thermic effect + reduced satiety = ↑ meal size → weight gain and health complications?

Means without a common letter differ

DeCastro. *J Nutr.* 135: 104-111, 2004

ATHLETES EAT BEFORE BED

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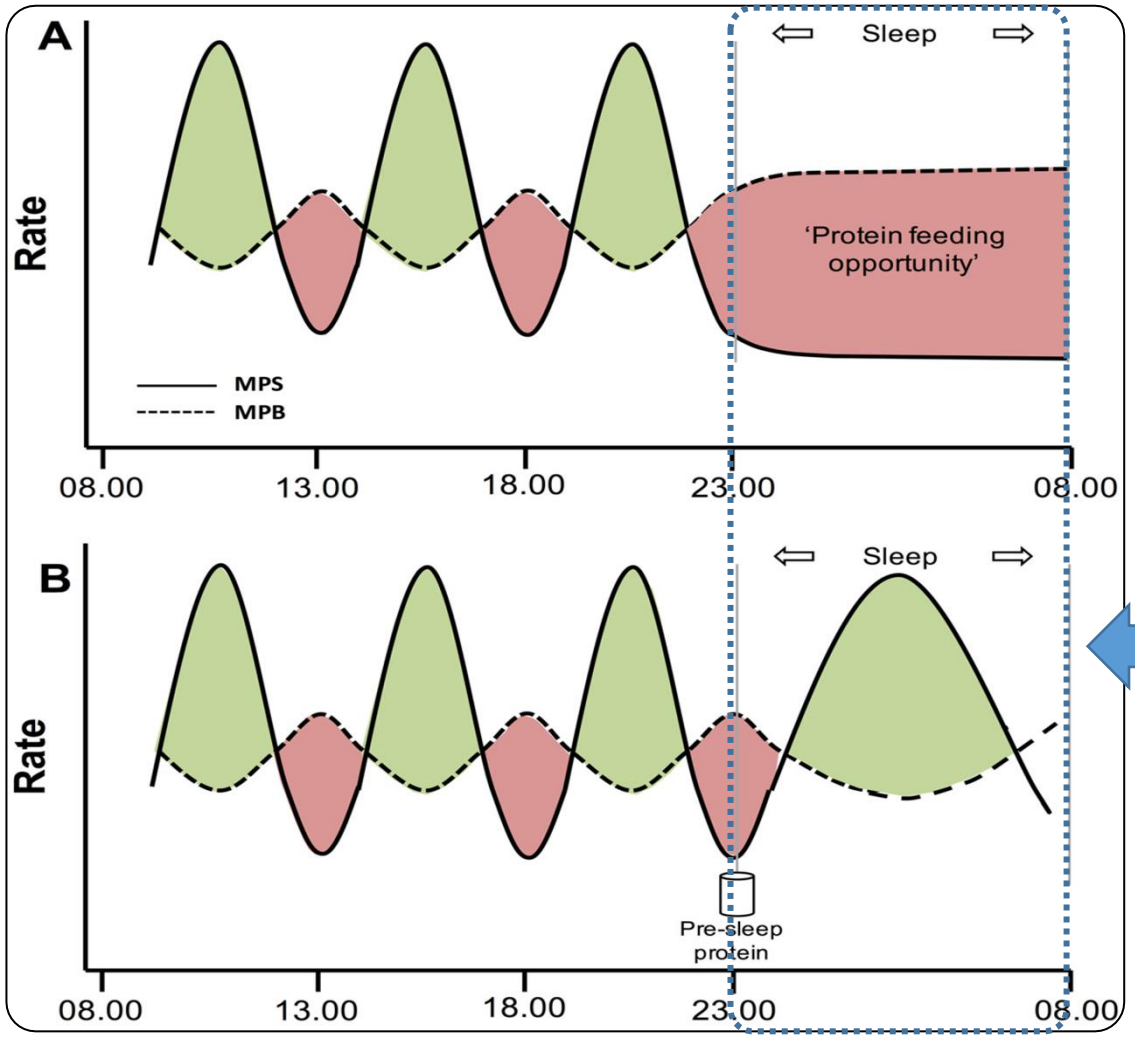
THE "WINDOW OF OPPORTUNITY"



A BIG PART OF WHAT SEEMS TO BE "MISSING" IS THE NEED TO OPTIMIZE THE NEXT TRAINING SESSION

TROMMELEN, 2016

DETAILS MATTER: It may be necessary to eat before sleep!



321.6 miles (517.5K)

Day 1: 6.2 mile (10K) Swim, 92 mi bike (148K)

Day 2: 171 mile bike (275K)

Day 3: 52.4 mile (84K) run



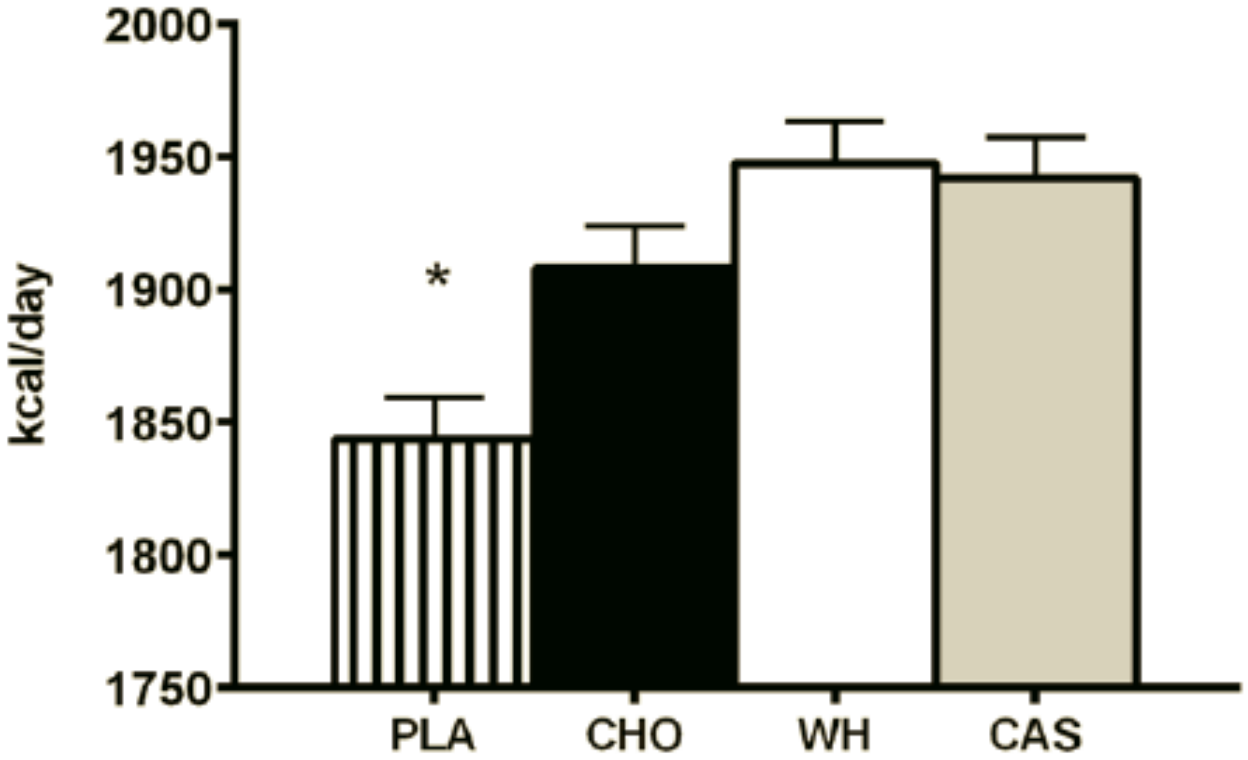


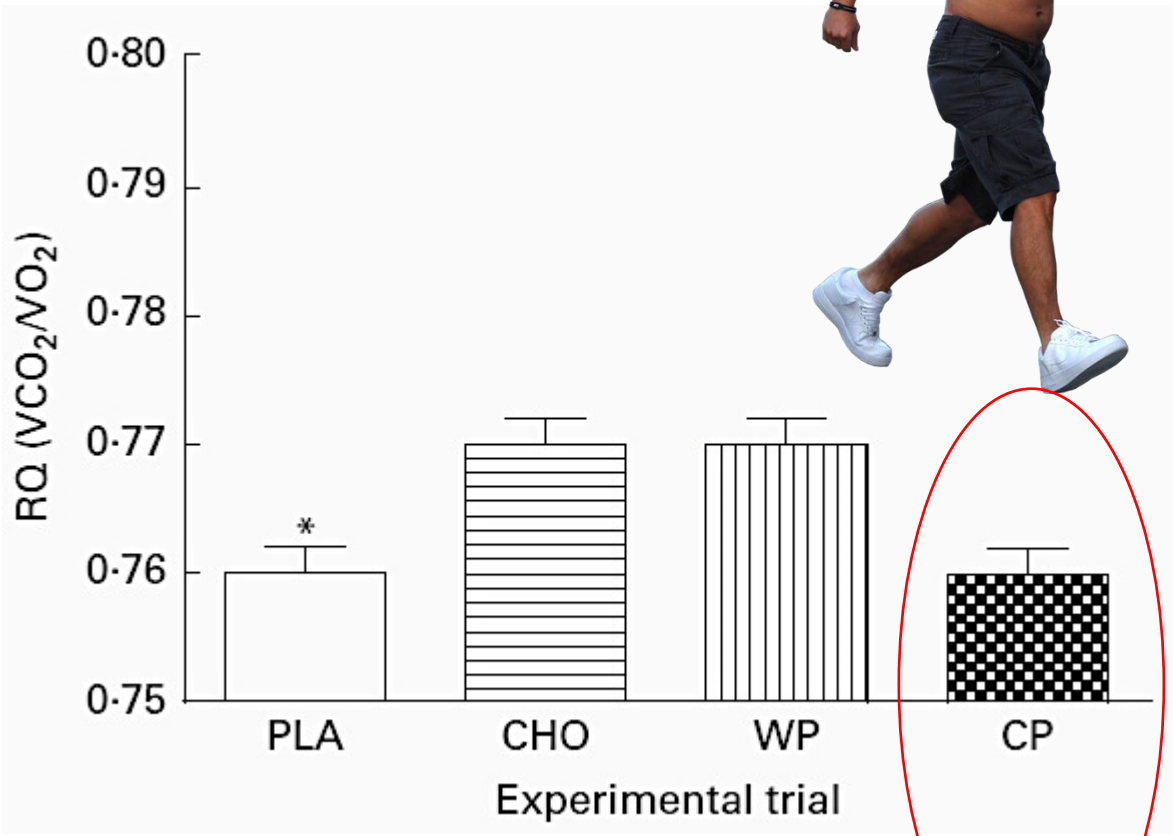




Baur et al. EJAP, 2016

Night-time consumption of protein or carbohydrate results in increased morning resting energy expenditure in active college-aged men



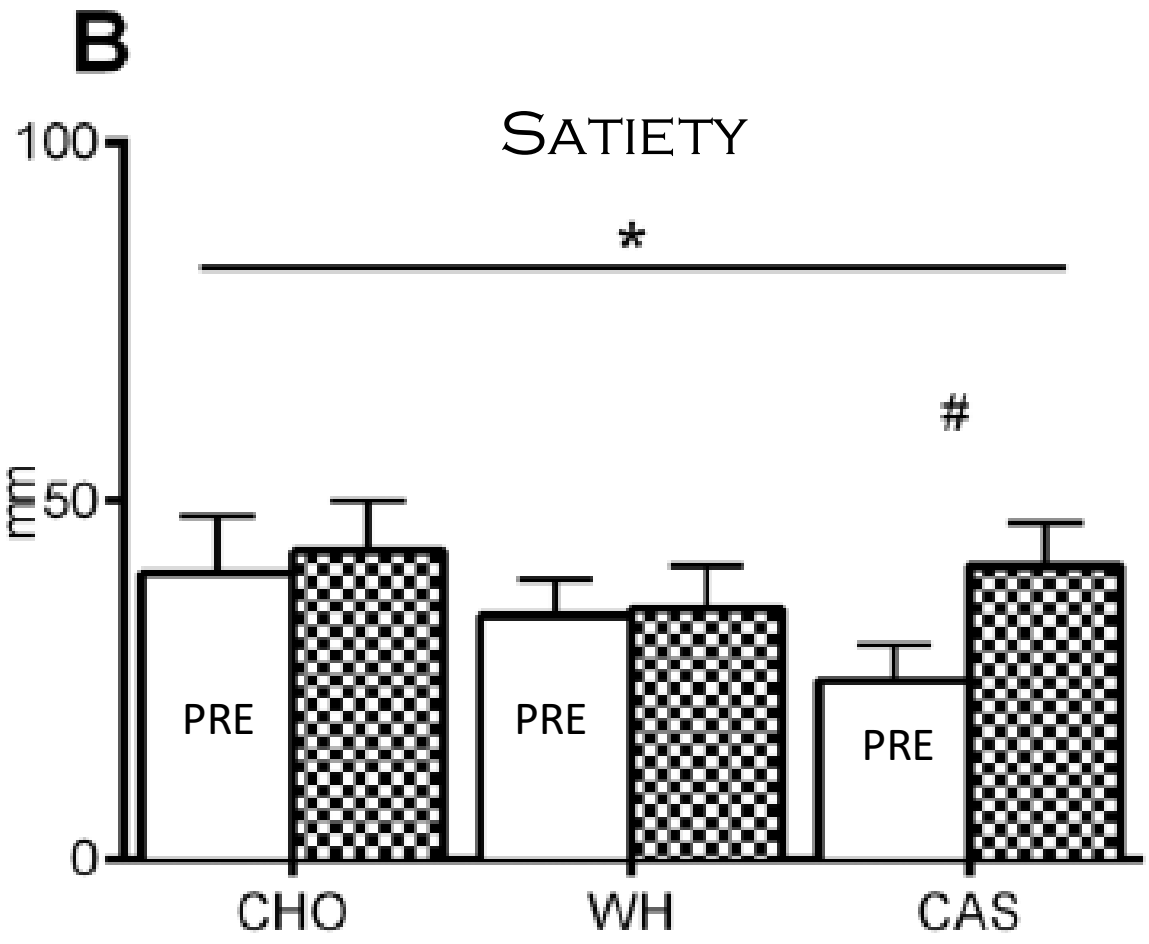


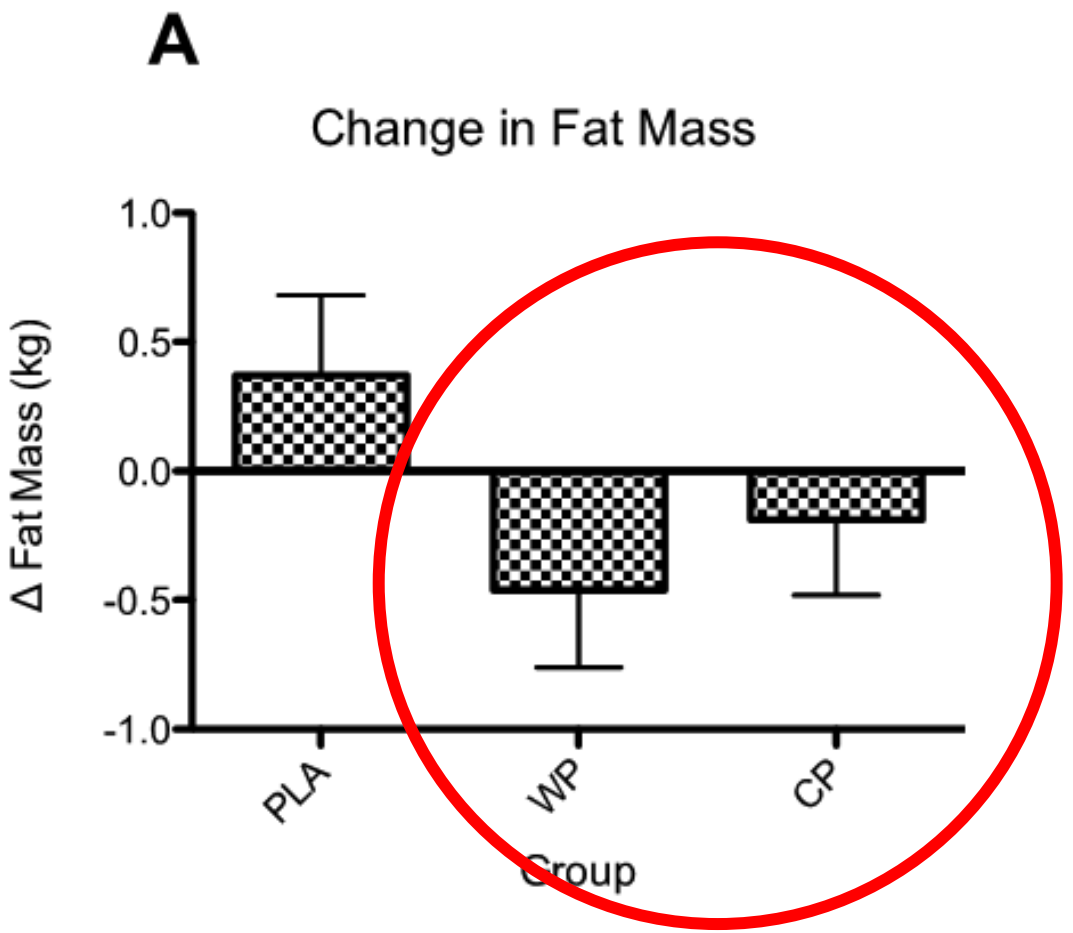


FSU | ISSM

Madzima et al. Brit J Nutr, 2014

The influence of nighttime feeding of carbohydrate or protein combined with exercise training on appetite and cardiometabolic risk in young obese women





No significant differences between groups

Ormsbee et al., APNM, 2015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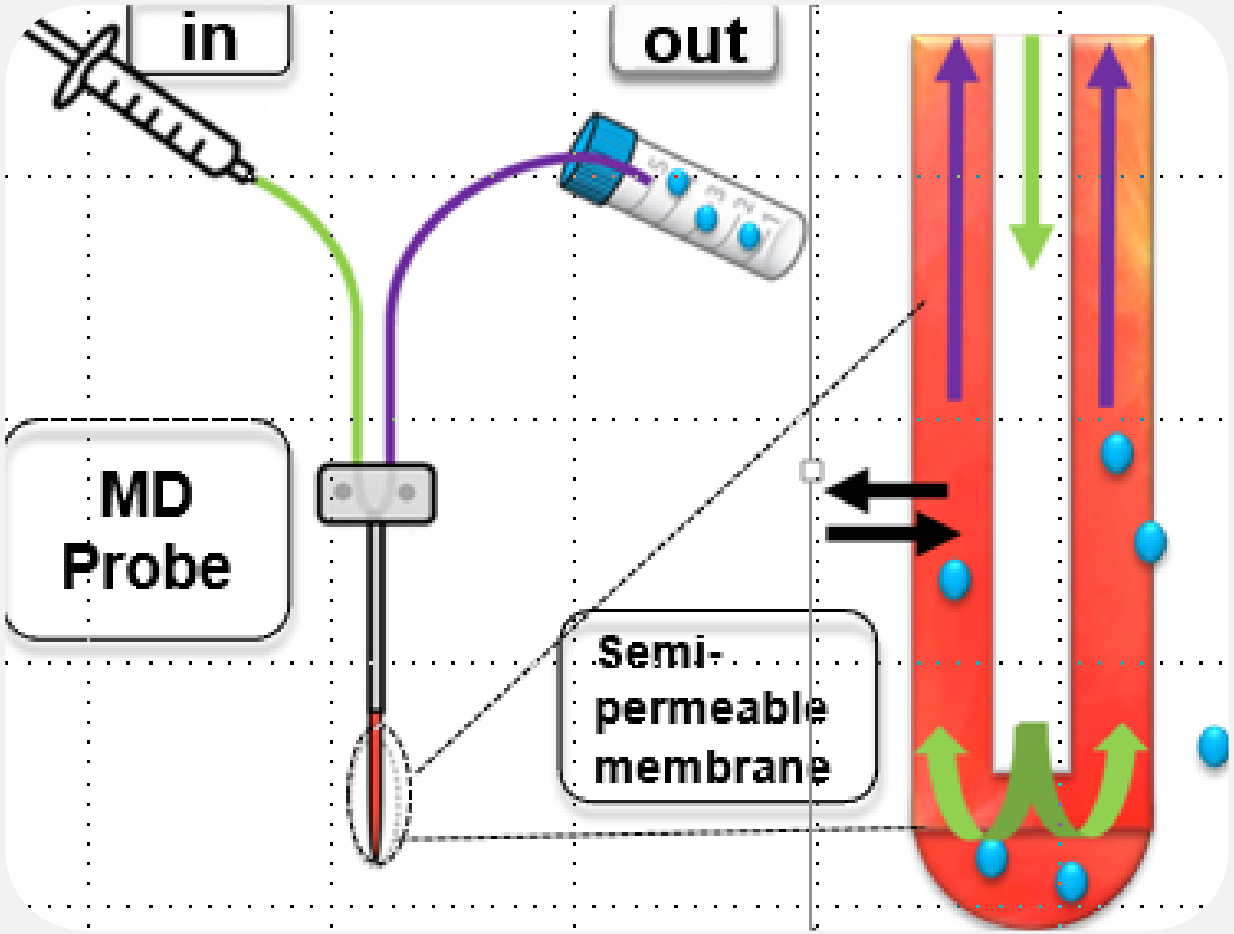
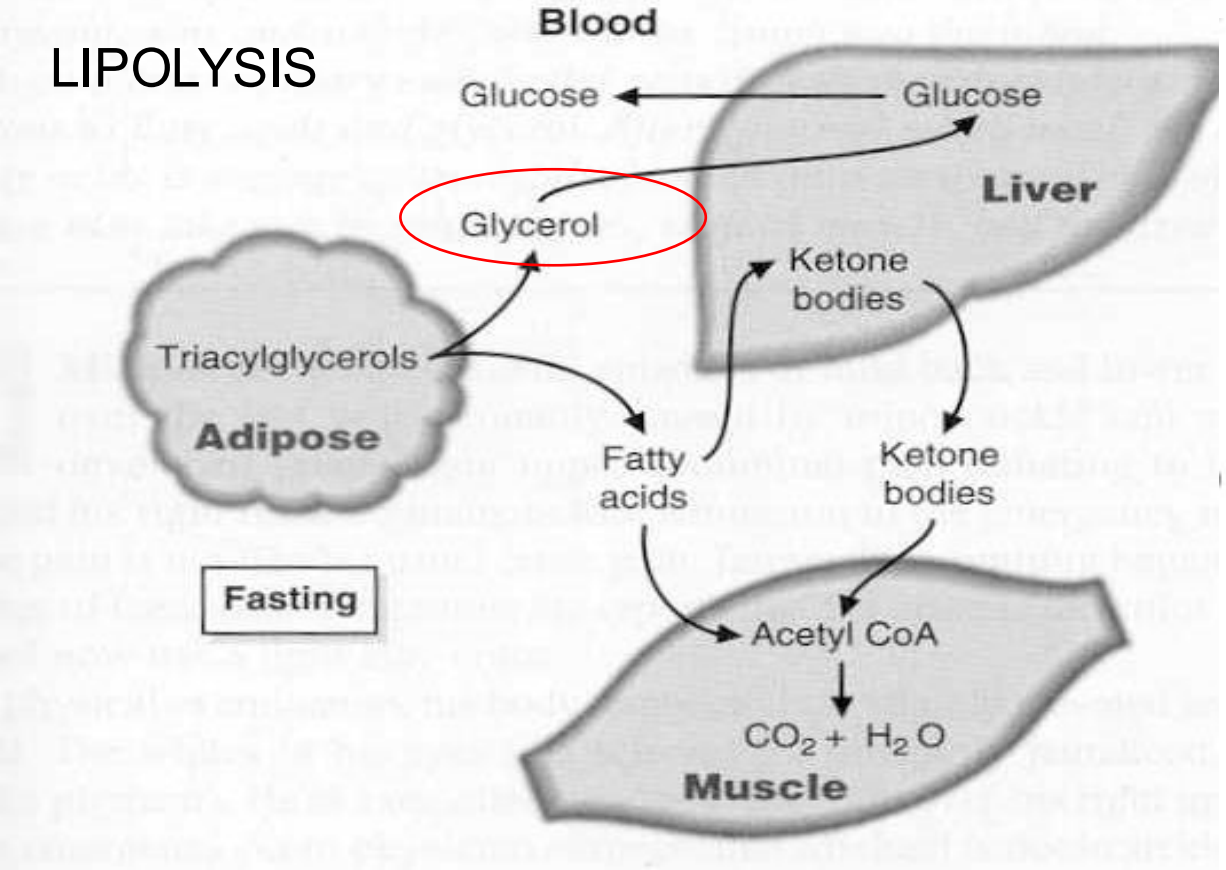
WHAT ABOUT LIPOLYSIS & FAT OXIDATION

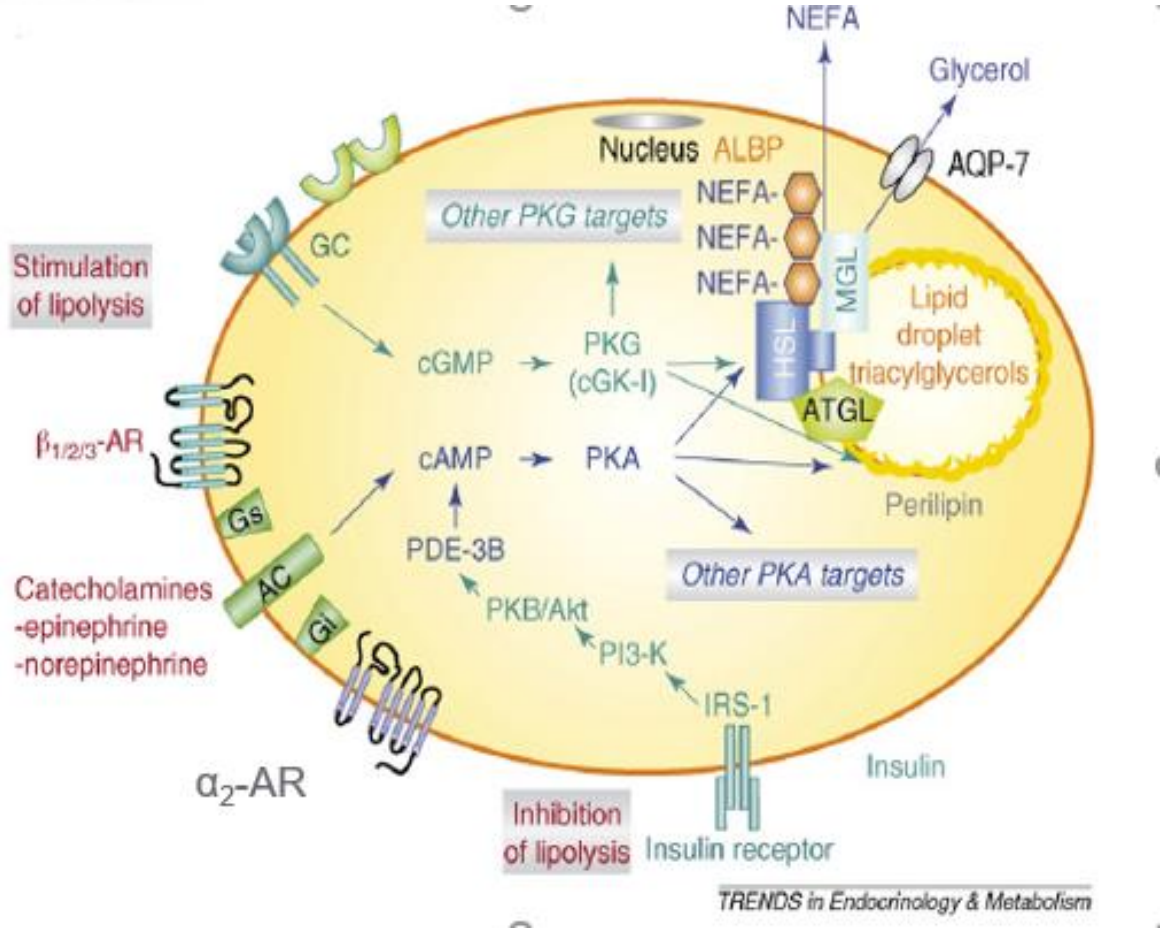




MOBILIZATION OF THE FAT STORES

LIPOLYSIS





Mark's Basic Medical Biochemistry

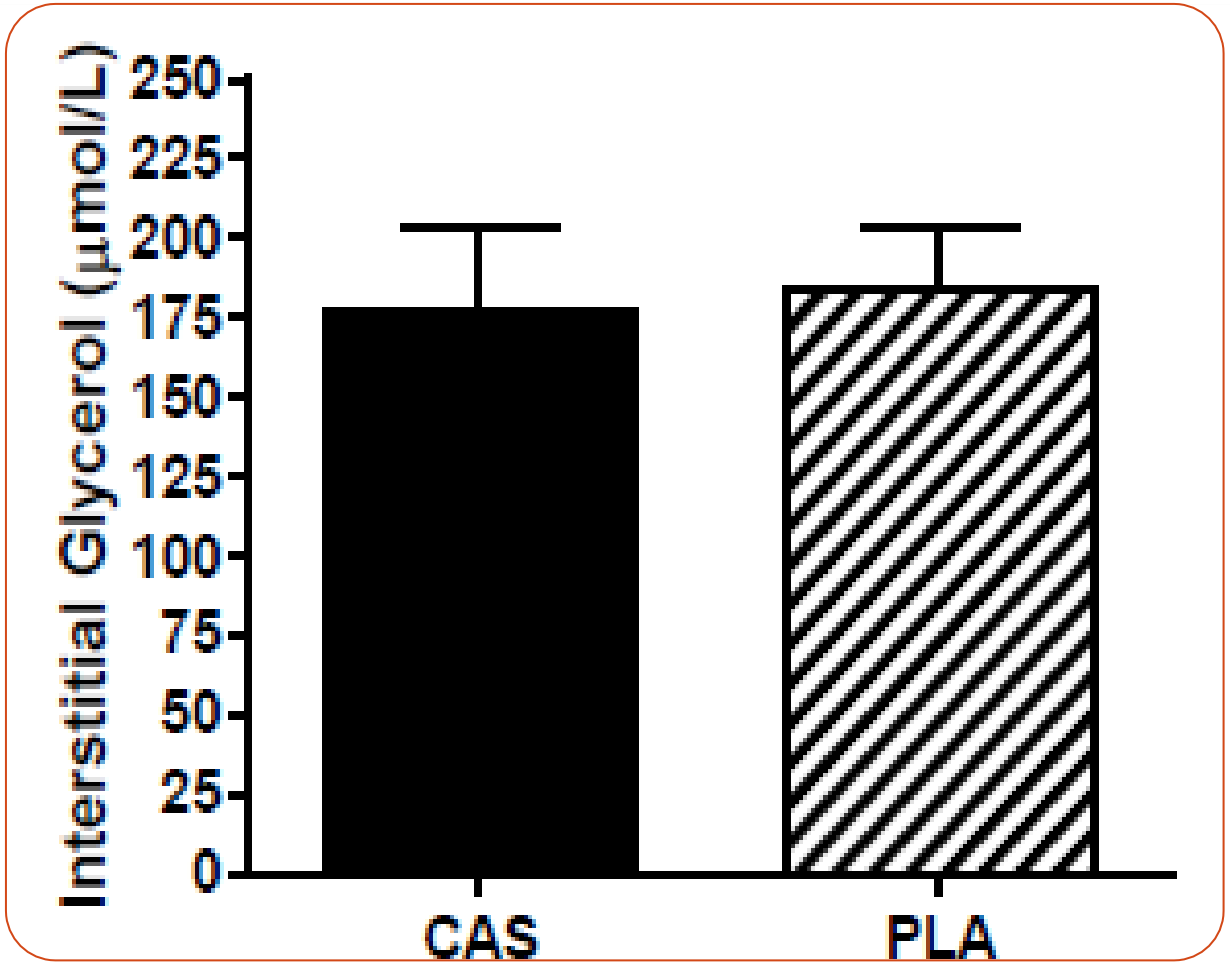
La Fontan, 2008

Article

The Effect of Casein Protein Prior to Sleep on Fat Metabolism in Obese Men

Amber W. Kinsey [1,2], Stacy R. Cappadona [3], Lynn B. Panton [3,4], Brittany R. Allman [3], Robert J. Contreras [5], Robert C. Hickner [6,7] and Michael J. Ormsbee [3,7,*]



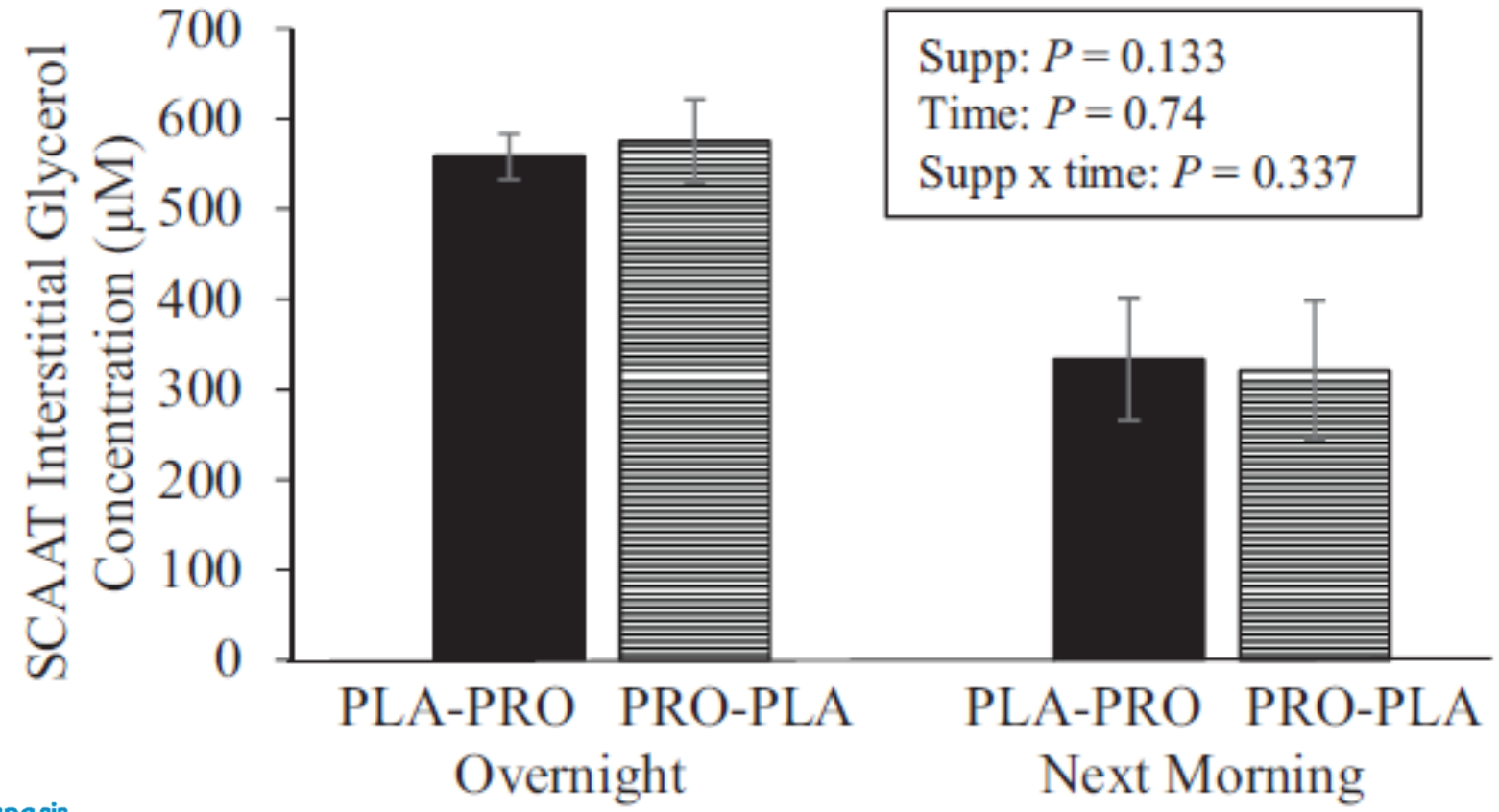






Kinsey et al. Nutrients, 2016.

Lipolysis and Fat Oxidation Are Not Altered with Presleep Compared with Daytime Casein Protein Intake in Resistance-Trained Women







Allman et al. J Nutr, 2020.

WHAT ABOUT WHOLE FOODS?





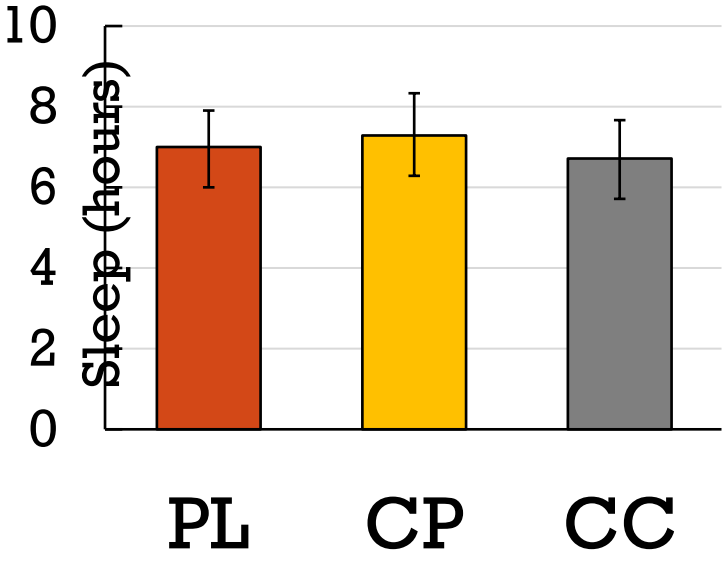


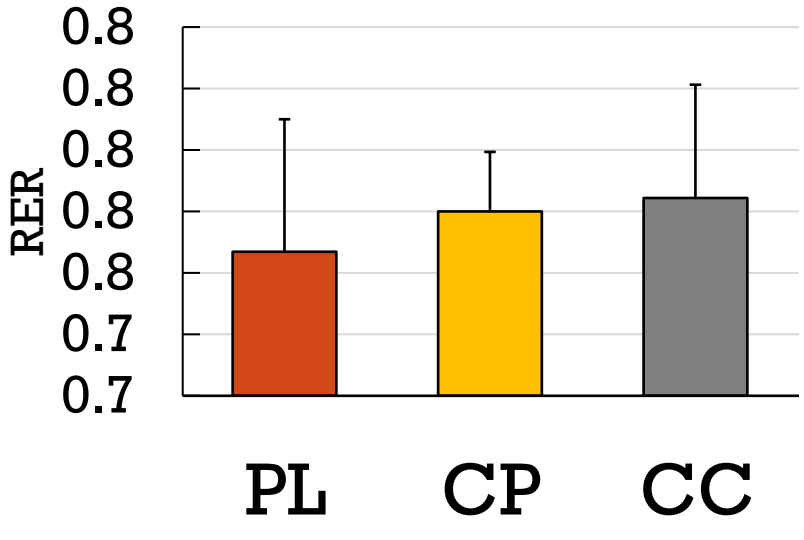


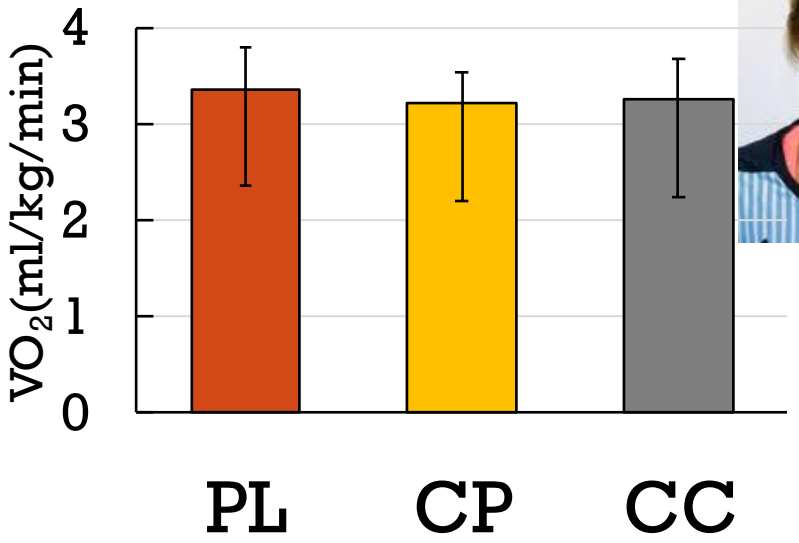
Cottage Cheese: 160 kcals (30g PRO; 10g CHO); Protein Matched Drink; Placebo

Leyh et al. BJN, 2018

Pre-sleep protein in casein supplement or whole-food form has no impact on resting energy expenditure or hunger in women











Treatment	kcal/day	kj/day	Protein (g/kg)
Placebo	1850 ± 334	7740 ± 1397	1.75 ± 0.4
CP	1895 ± 339	7928 ± 1418	1.86 ± 0.3
CC	1783 ± 298	7460 ± 1246	1.85 ± 0.5

Cottage Cheese: 160 kcals (30g PRO; 10g CHO); Protein Matched Drink; Placebo

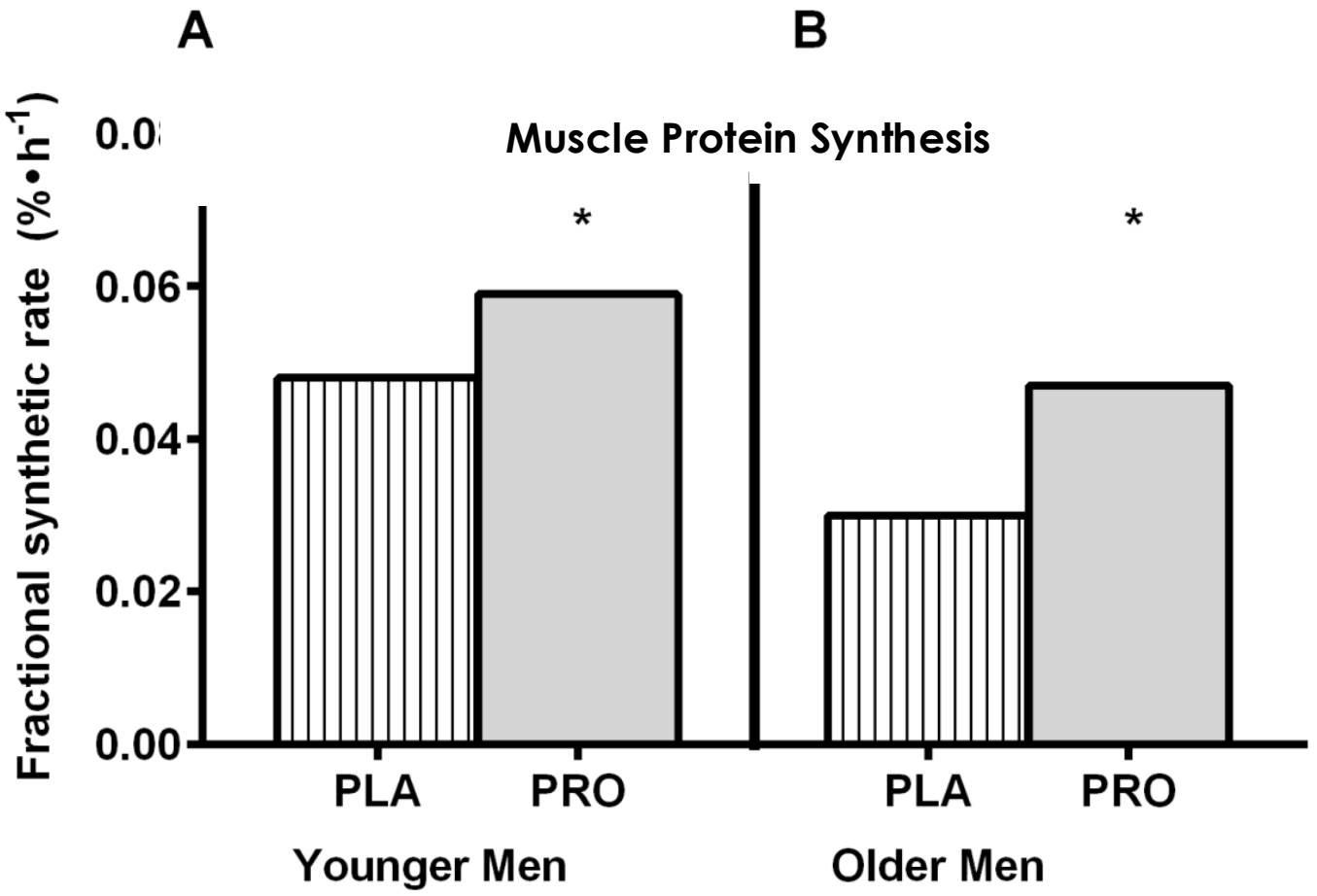
Leyh et al., BJN, 2018

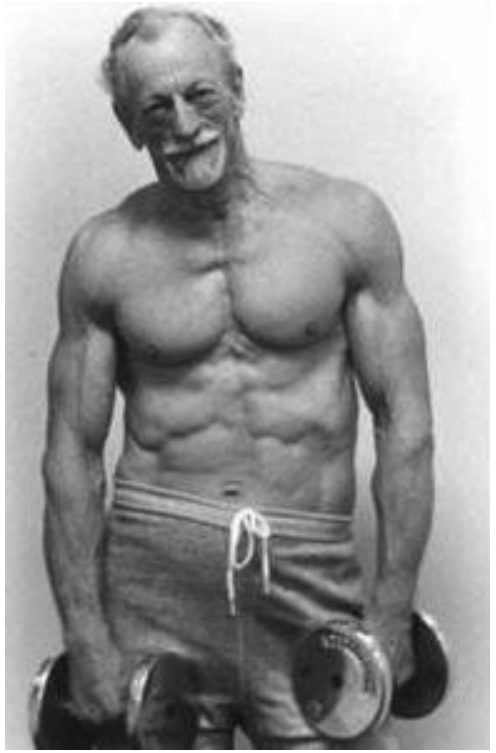




What about muscle and performance?

Acute Muscle Protein Synthesis

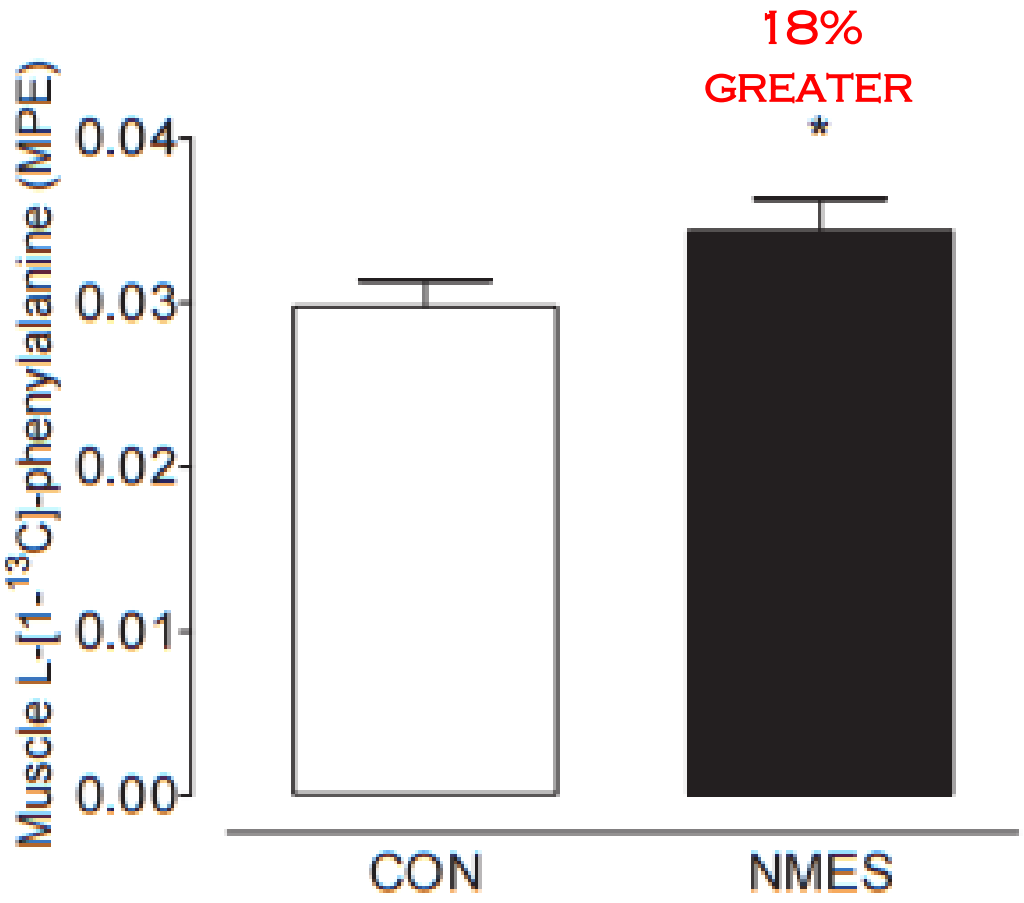


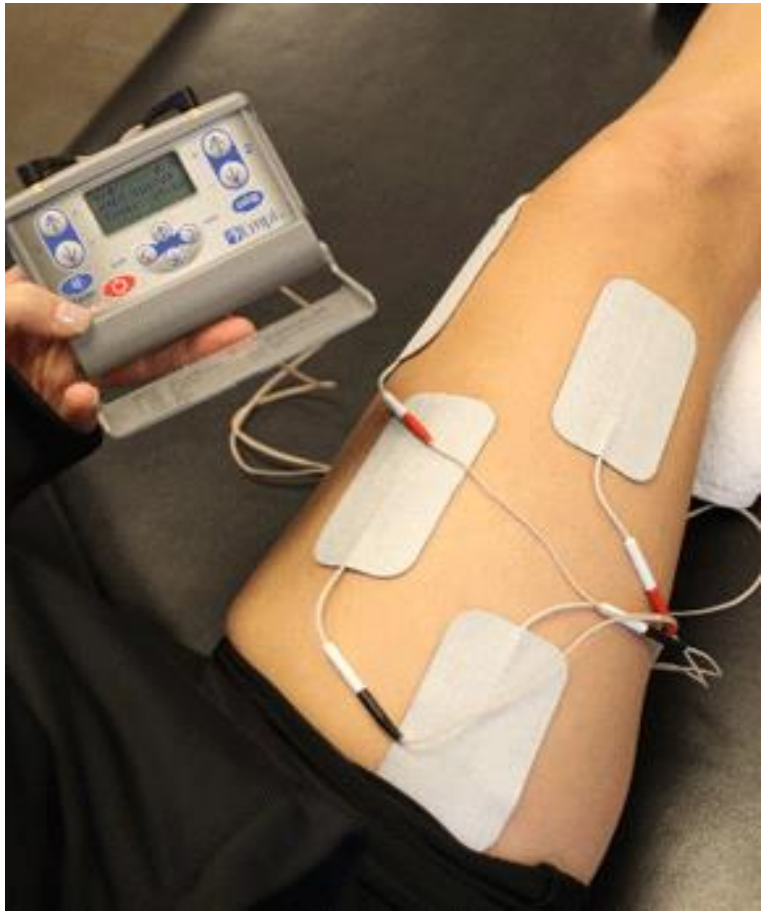


Adapted from Res et al. 2012 & Groen et al. 2012

Rehabilitation?

Neuromuscular electrical stimulation (NMES)



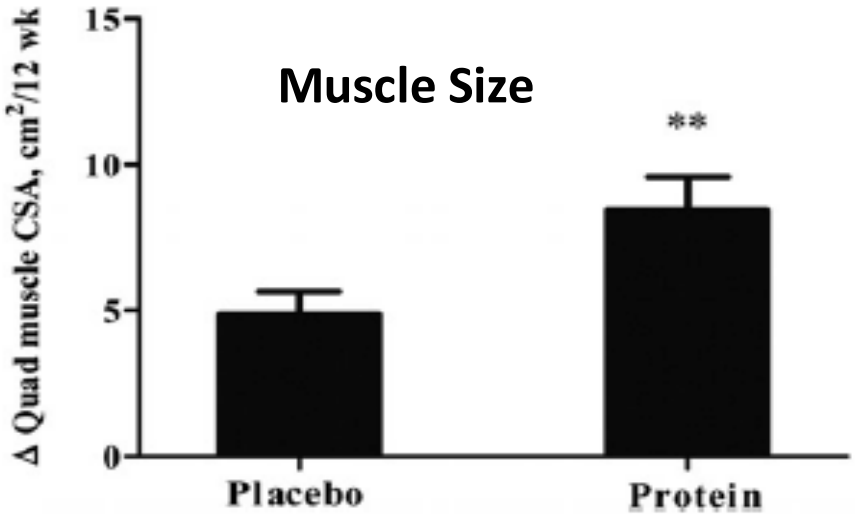


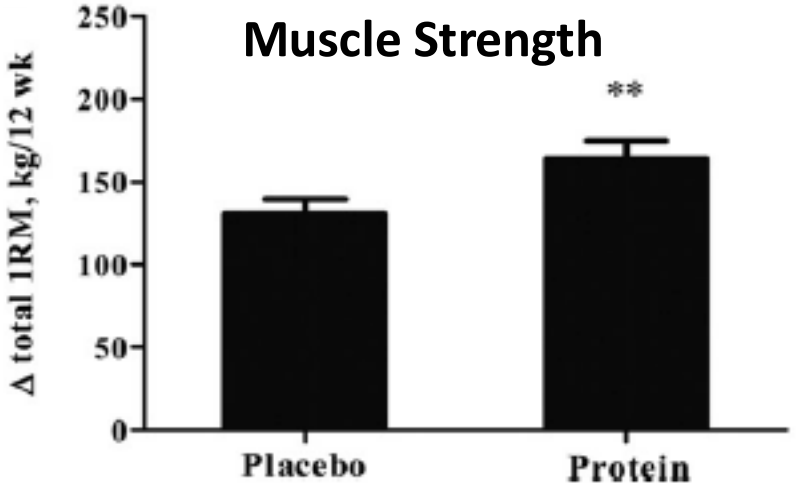
70 min of one-legged NMES

23 older men
~70 years old

Dirks et al., JAP, 2016

Longer-Term (12-week) Adaptations?





<u>Pre-sleep Drink</u>

27.5g Pro

15g CHO

0.1g Fat

*1.3 v. 1.9 g PRO/kg/d

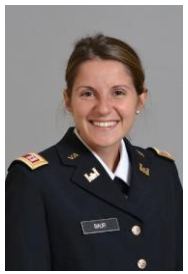


Snidjers et al., J Nutr, 2015

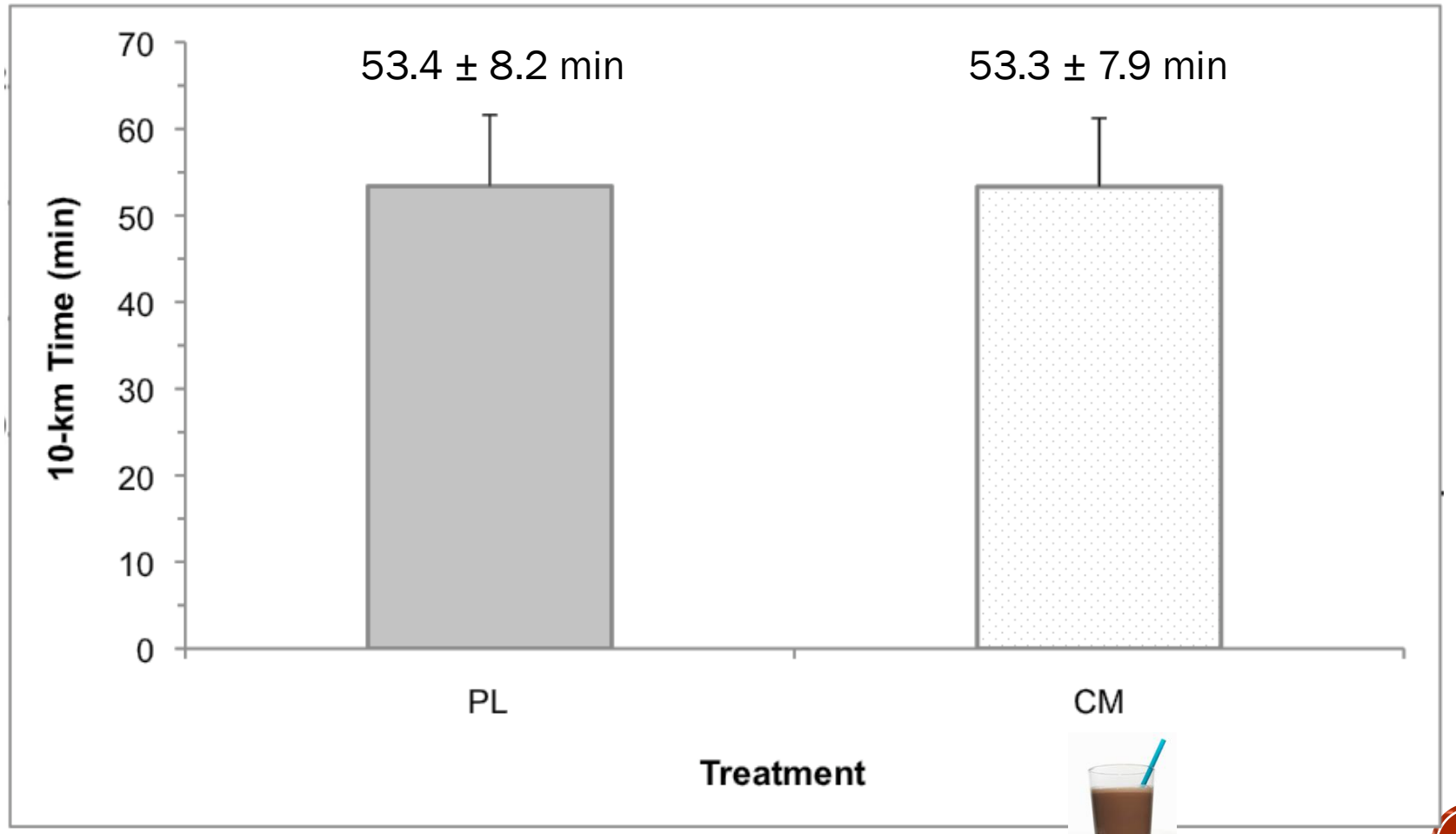
Nighttime feeding likely alters morning metabolism but not exercise performance in female athletes

Michael J. Ormsbee, Katherine A. Gorman, Elizabeth A. Miller, Daniel A. Baur, Lisa A. Eckel, Robert J. Contreras, Lynn B. Panton, and Maria T. Spicer









Ormsbee et al. APNM, 2016

CONCLUSION VS. APPLICATION

"Pre-sleep chocolate milk... did not translate to 10K running performance improvements."

"I would tell these athletes to fuel before bed."



What about EXERCISE timing?









Daytime

Evening

Protein Pre-sleep



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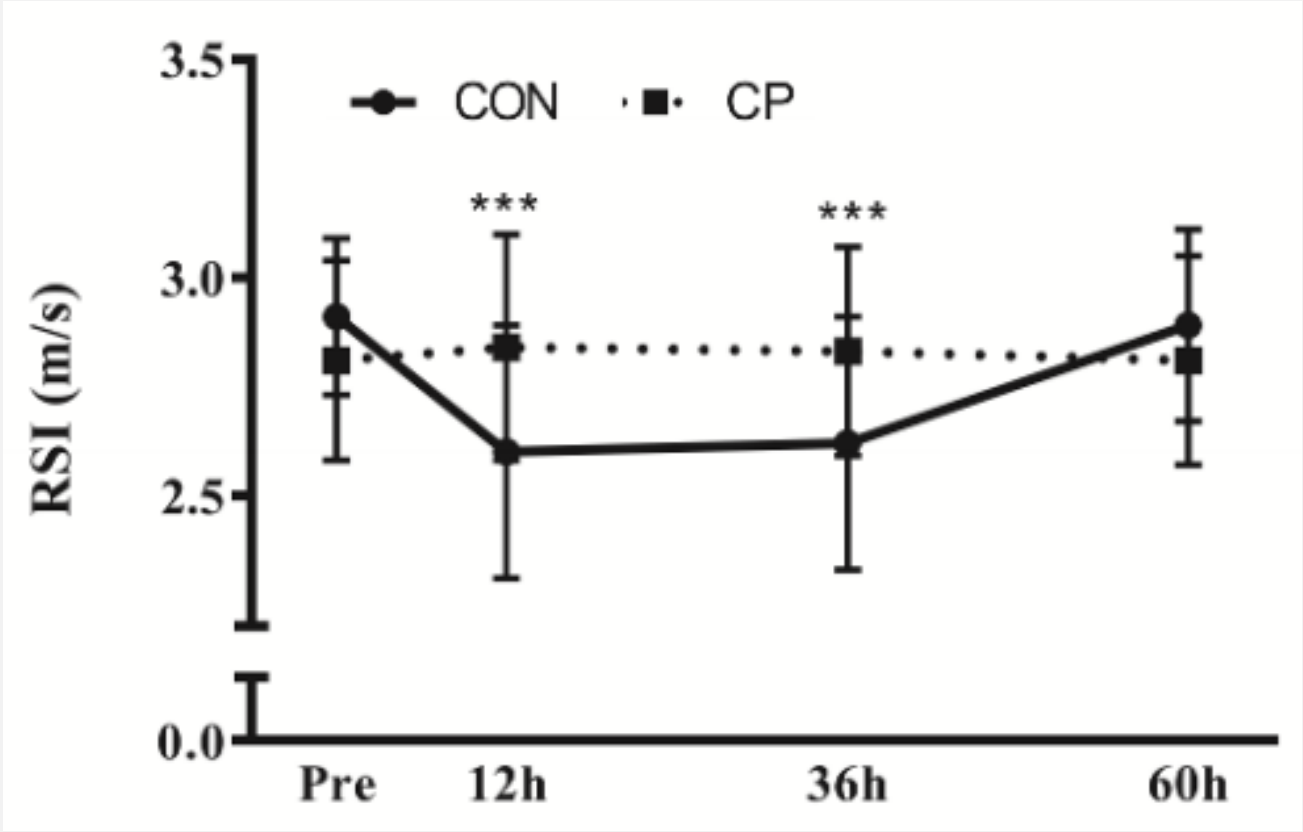
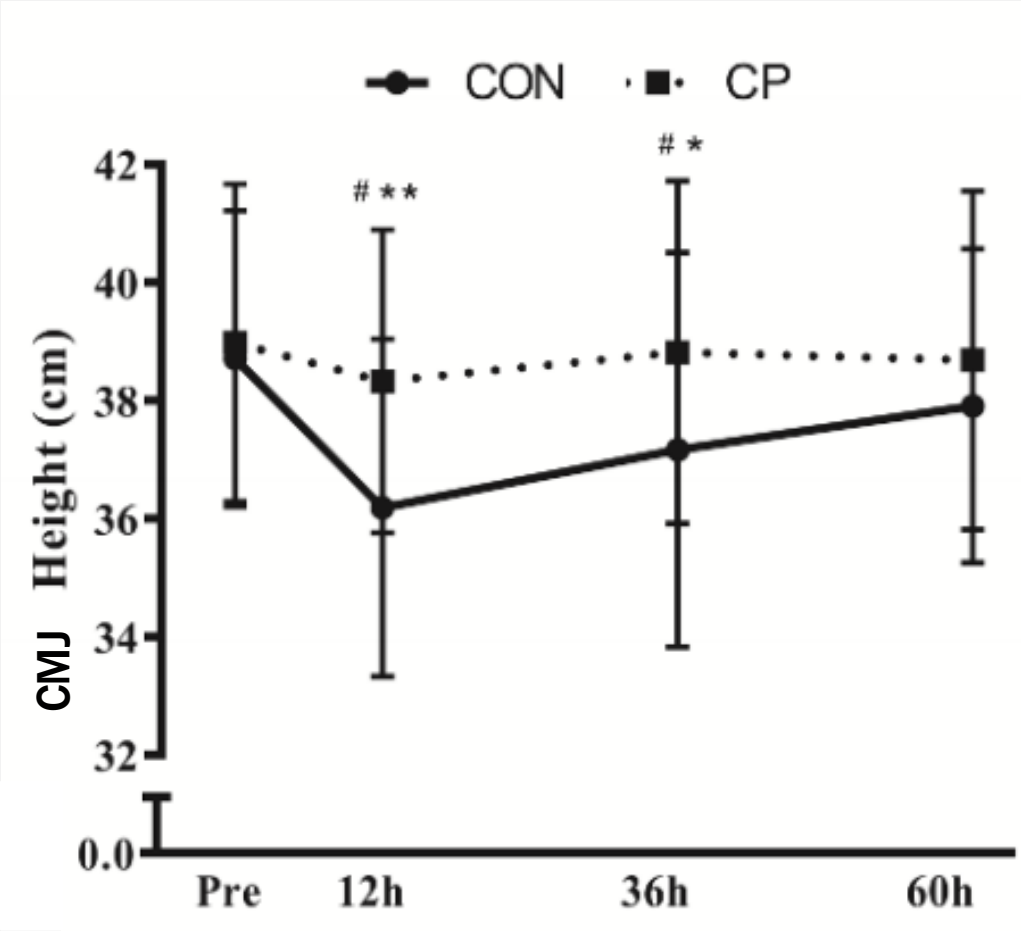
PRE-SLEEP PROTEIN ACCELERATES FUNCTIONAL RECOVERY IN PROFESSIONAL SOCCER PLAYERS





40g PRO or CHO Pre-sleep
Soccer match time: 7-9 PM = BENEFIT

Abbott et al. 2018

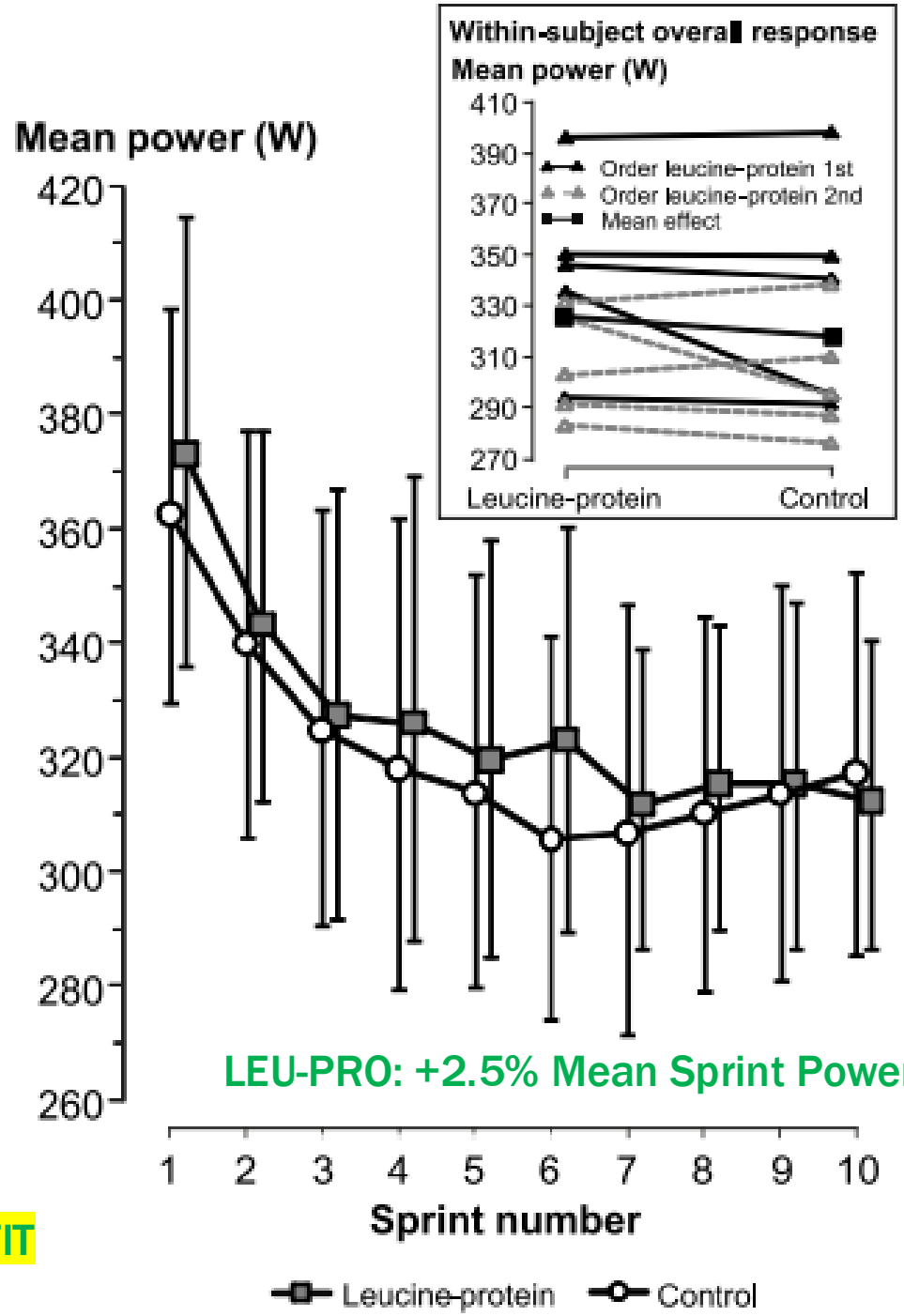
Leucine + Protein + CHO

Vs.

Isocaloric control

Reduced Perceived "Overall" Tiredness By 13%.

Reduced CK before sprints by 19%



Exercise time: 4pm-6PM = BENEFIT

IMPROVED SPRINT POWER FOR CYCLISTS

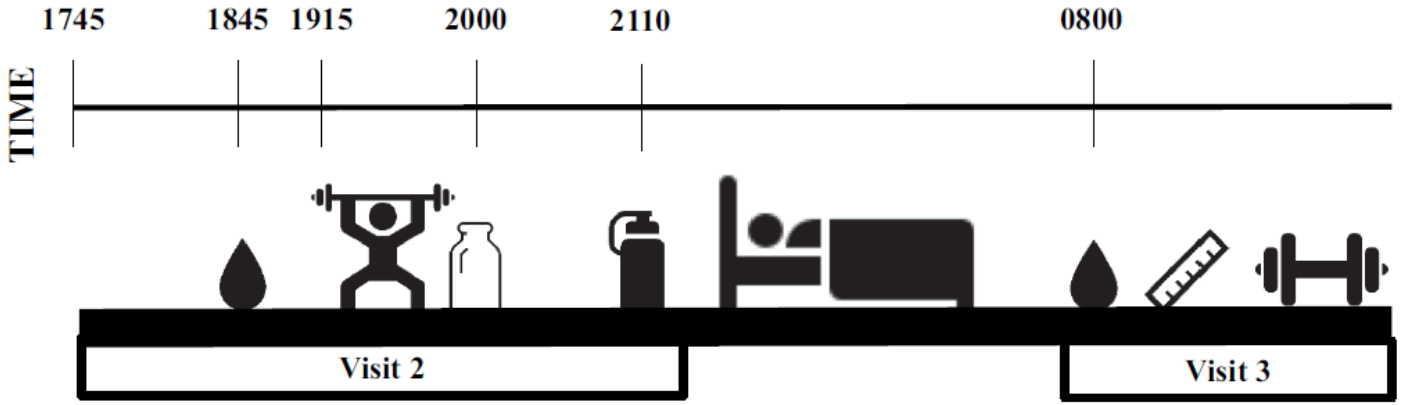
Thomson et al. 2011

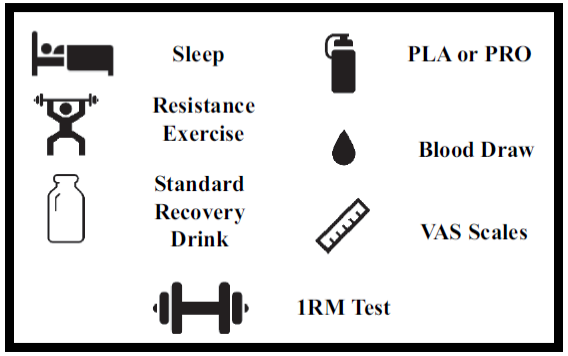
Pre-sleep protein supplementation after an acute bout of evening resistance exercise does not improve next day performance or recovery in resistance trained men

Michael J. Ormsbee[a,b], Patrick G. Saracino[a], Margaret C. Morrissey[c], Jaymie Donaldson[b], Liliana I. Rentería[a] and Andrew J. McKune[a,b,d]

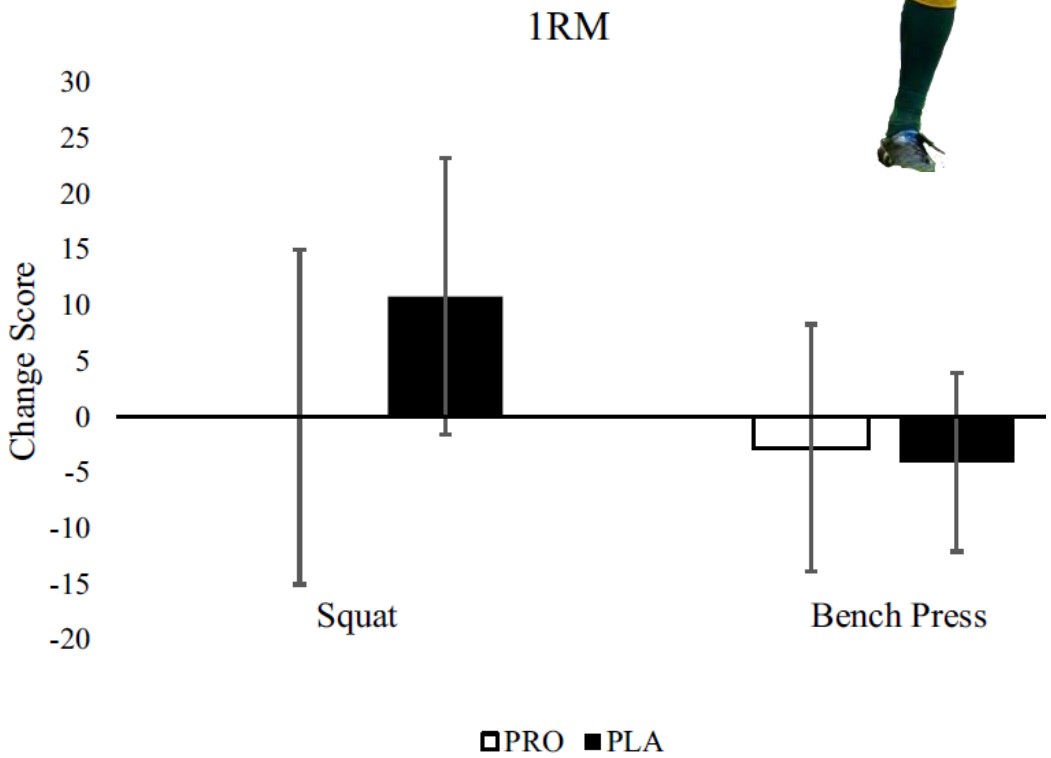


Exercise Time: 7:15pm





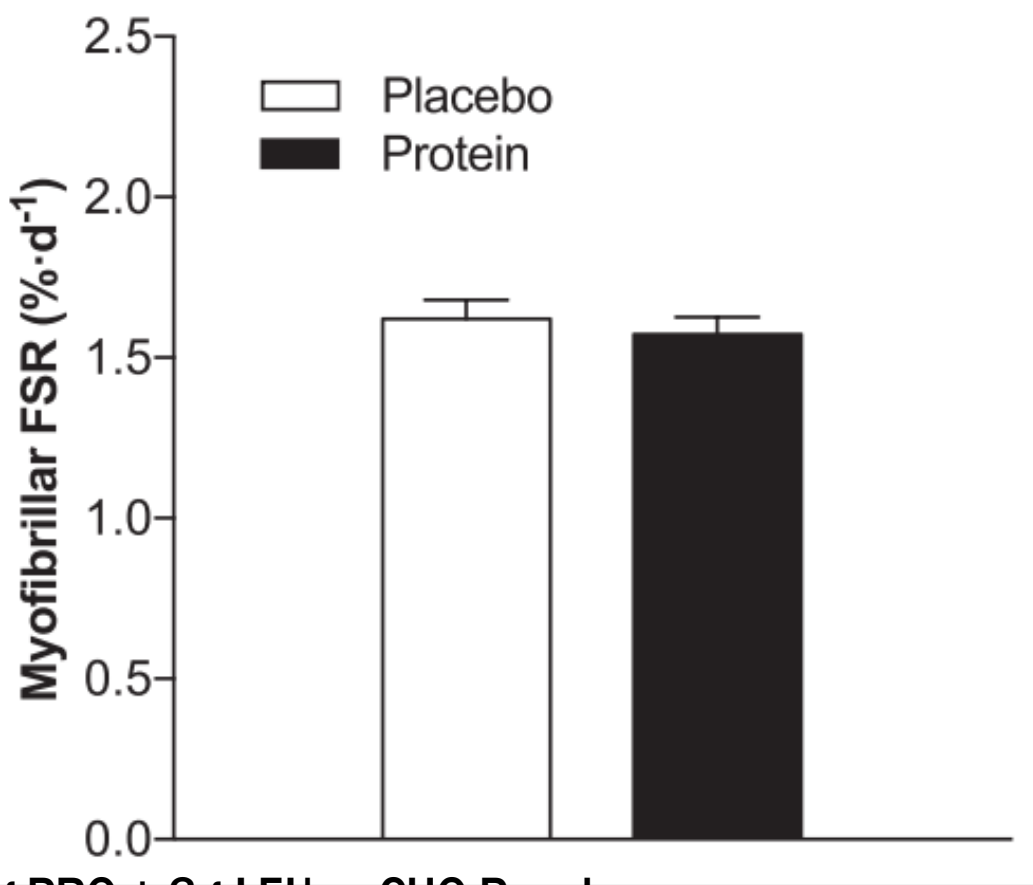


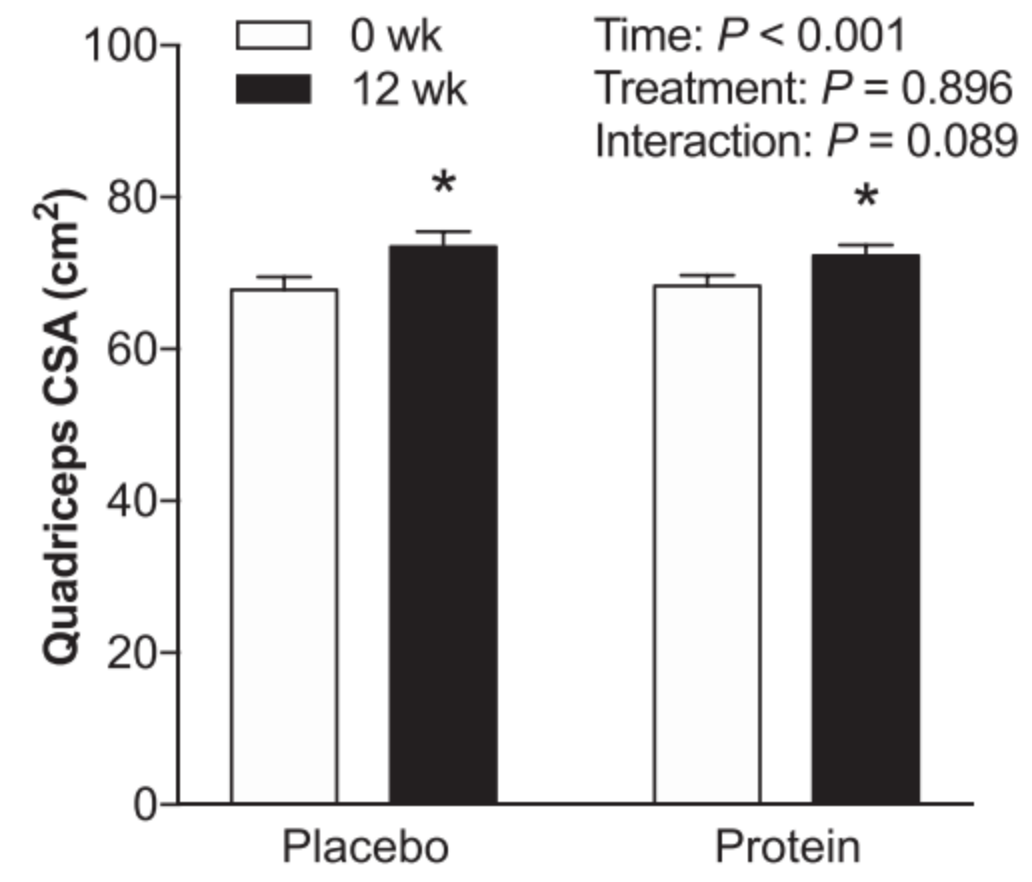


Ormsbee et al. 2022.

NO BENEFIT OF PRE-SLEEP WHEY FOLLOWING 12 WEEKS OF RESISTANCE TRAINING

age: 70 ± 1 y





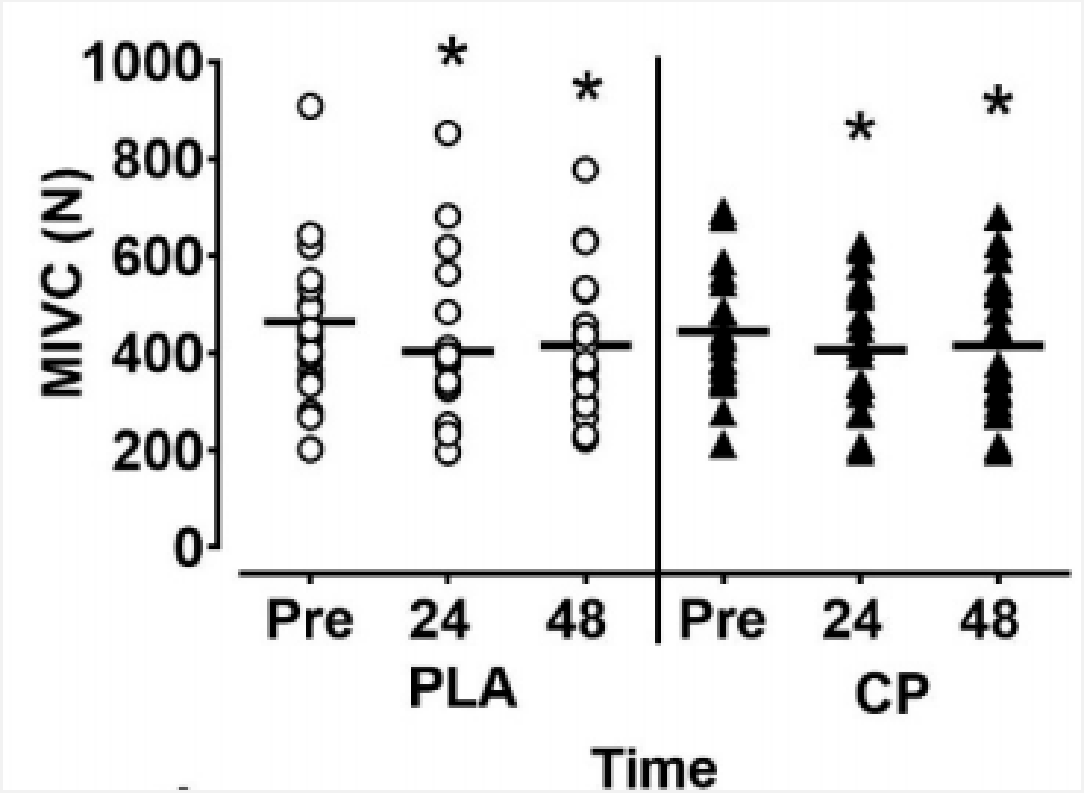
21g PRO + 3g LEU or CHO Pre-sleep

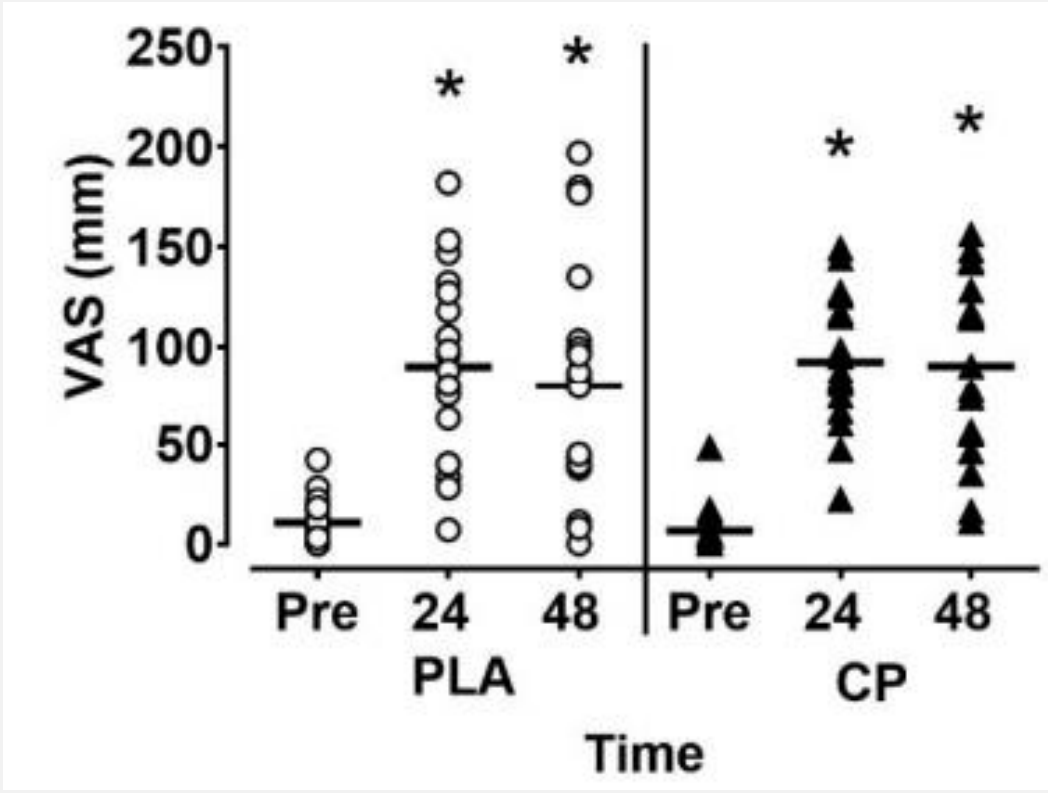
Exercise time: 8-11 AM = NO BENEFIT

Holwerda et al. 2018

PRE-BED CASEIN DOES NOT ENHANCE ACUTE FUNCTIONAL RECOVERY IN MALES AND FEMALES WHEN EXERCISE IS PERFORMED IN THE MORNING

100 drop jumps



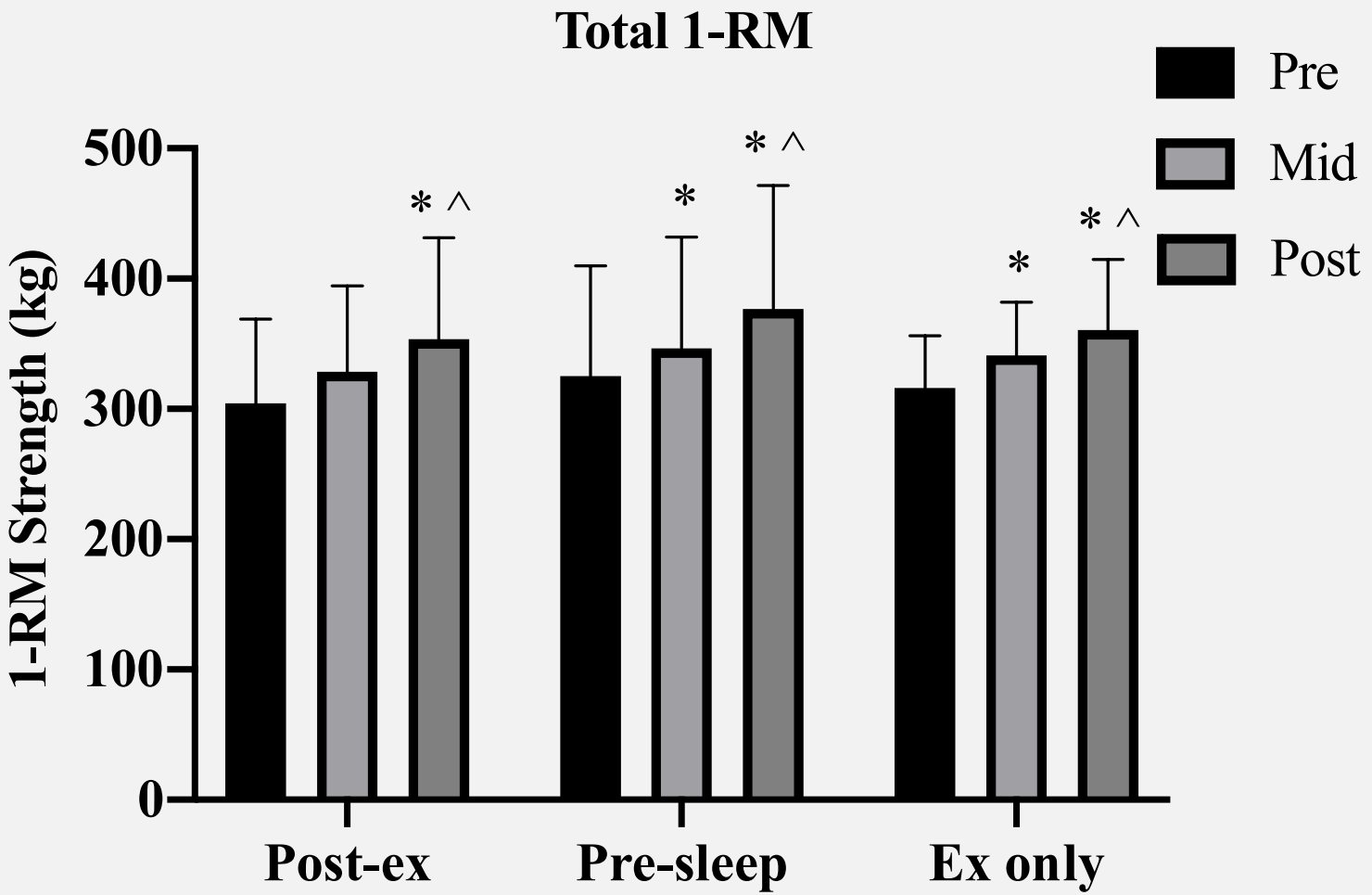


40g PRO or CHO Pre-sleep

Exercise time: 7:30-9 AM = NO BENEFIT

Apweiler et al. 2019

12 WEEKS OF POST-EX OR PRE-SLEEP PROTEIN IN OLDER MEN



40g PRO or CHO Pre-sleep

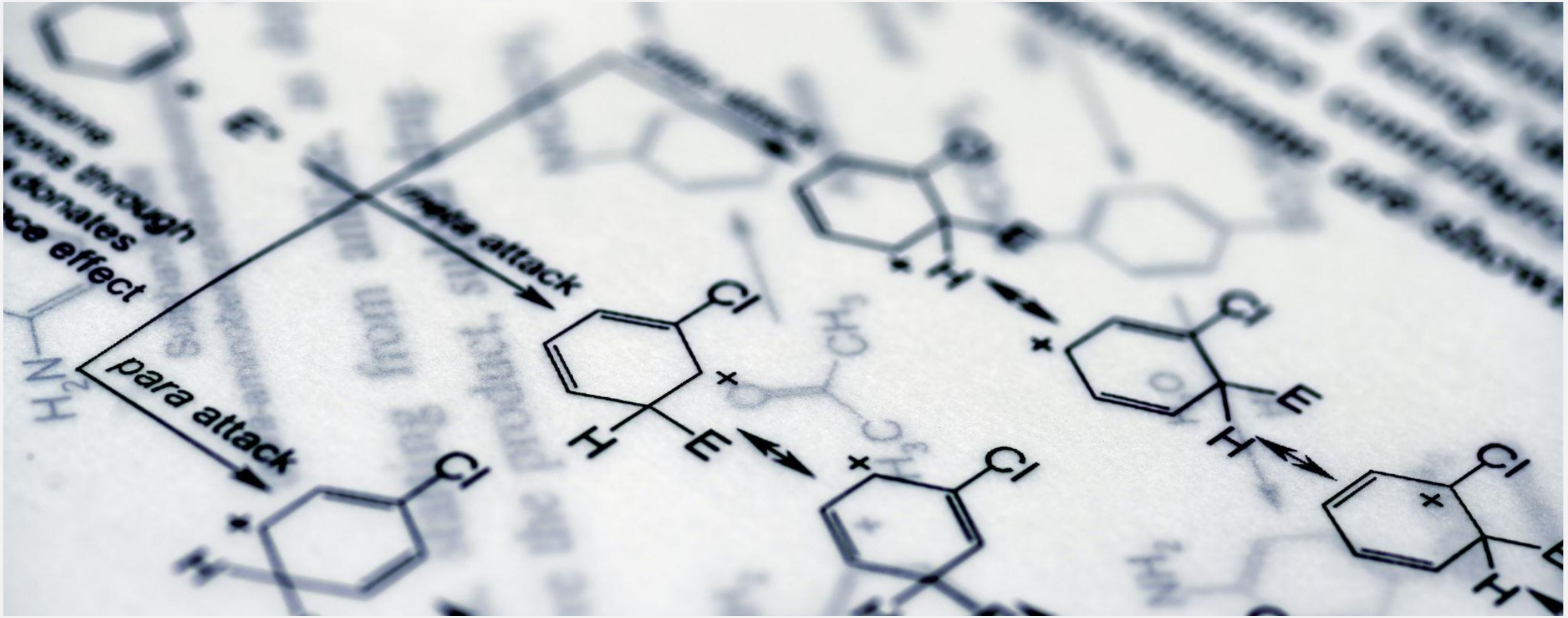
Exercise time:

<12 noon = NO BENEFIT



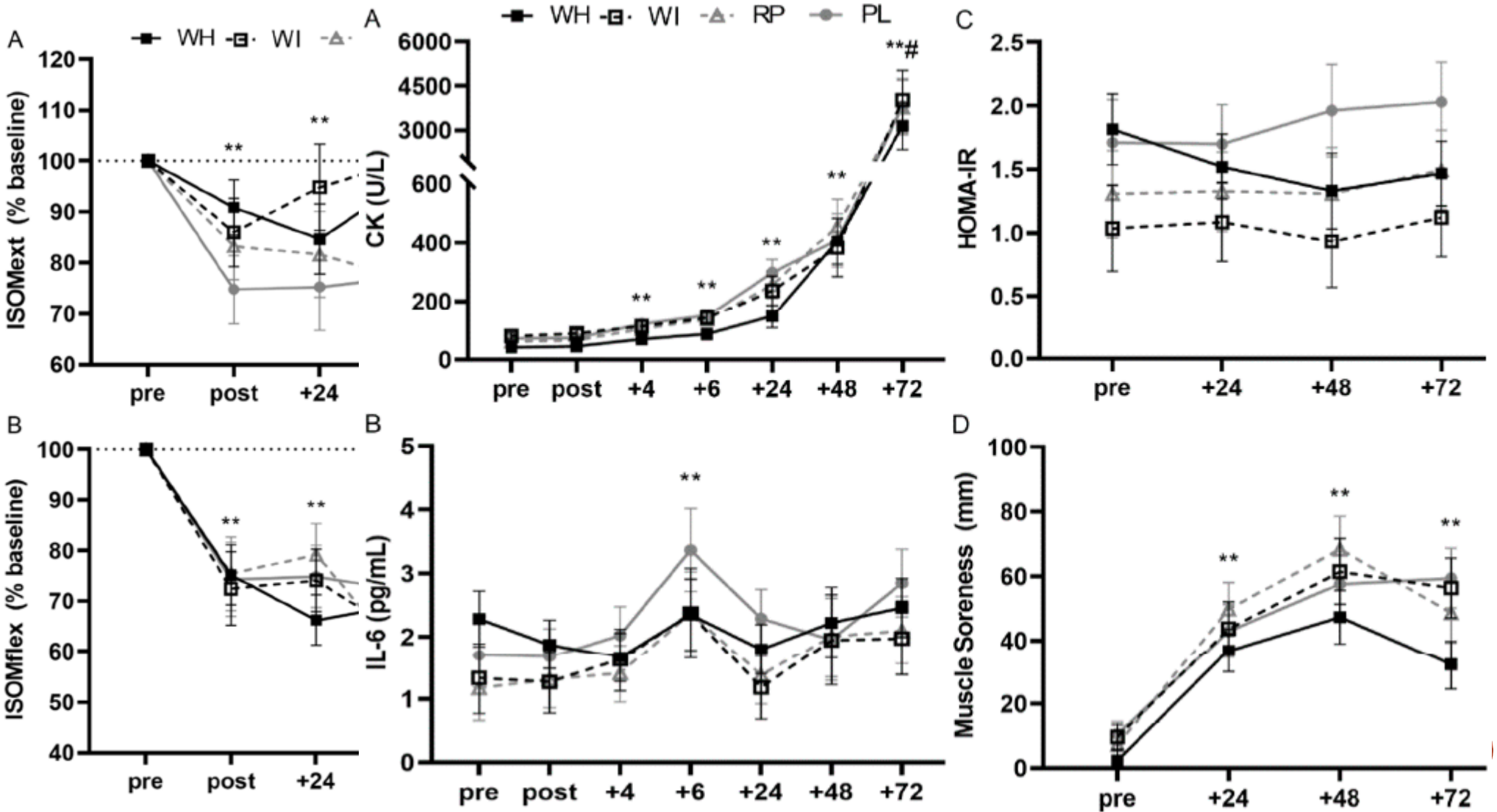
Klemp et al. 2025. JISSN

PLANT? WHEY? CASEIN?



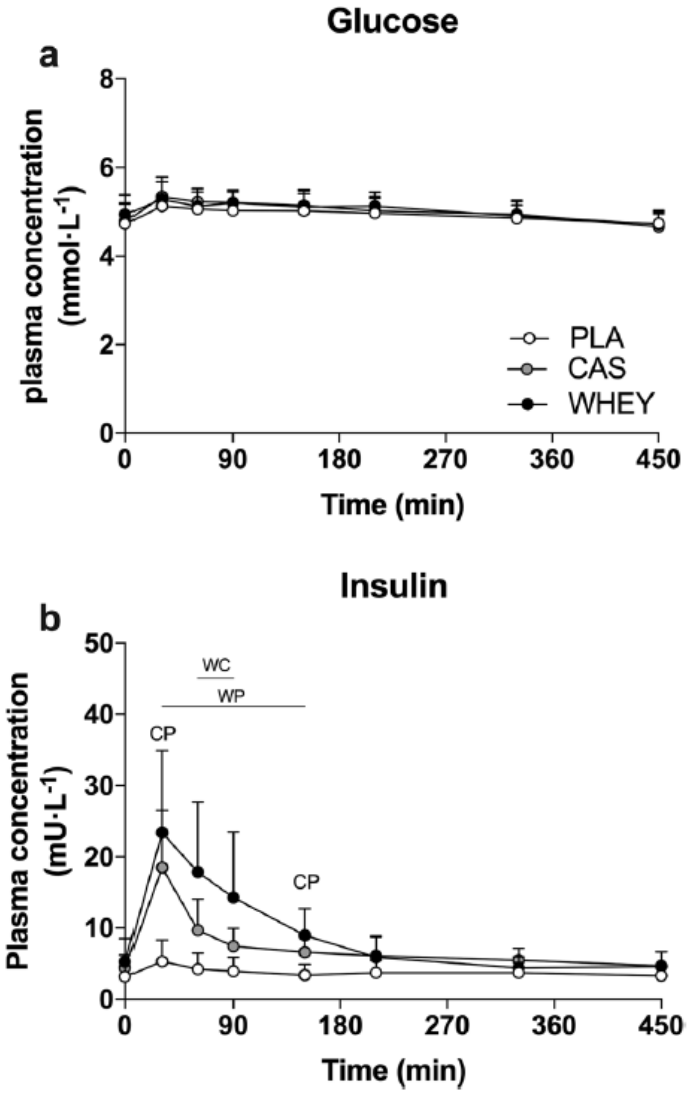
Effects of Pre-Sleep Whey vs. Plant-Based Protein Consumption on Muscle Recovery Following Damaging Morning Exercise

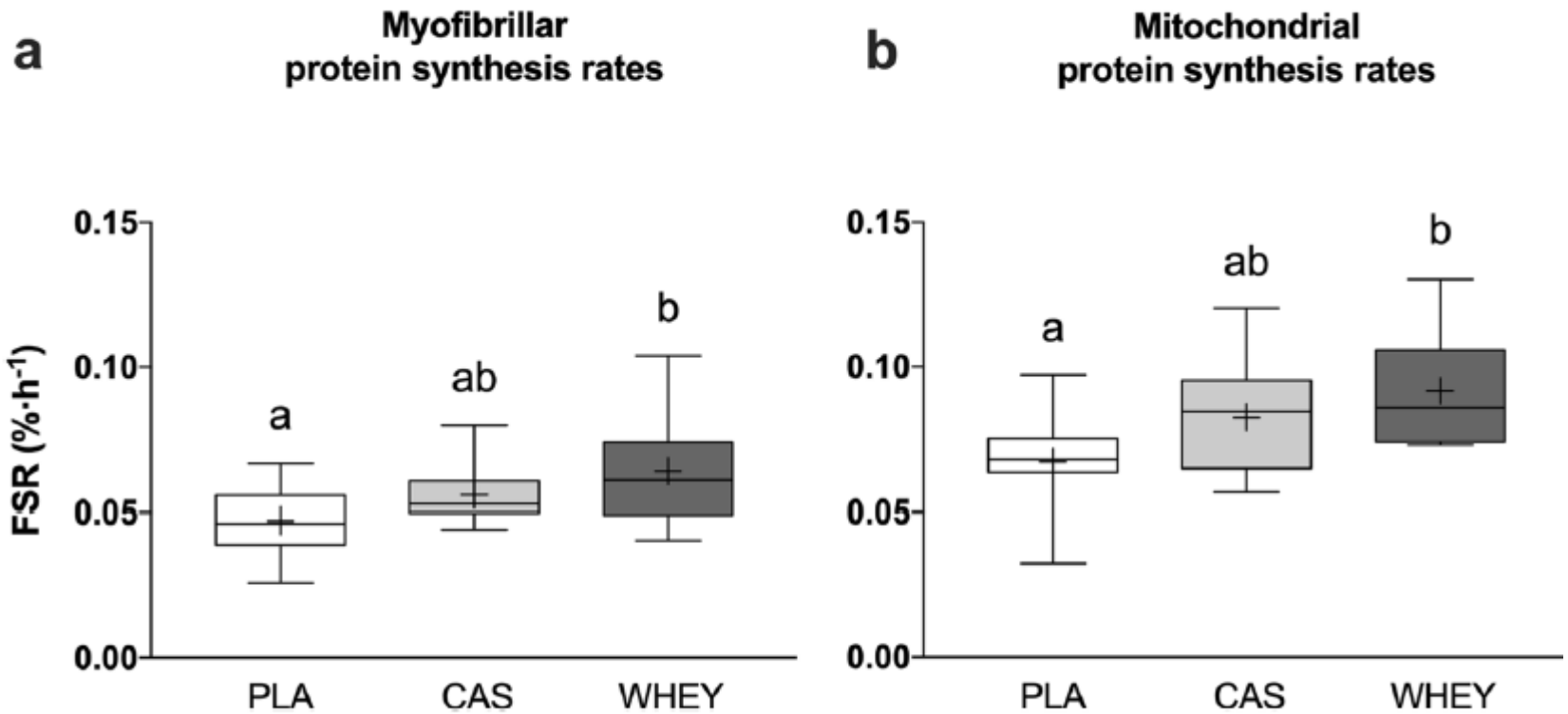




Saracino et al., *Nutrients,* 2020

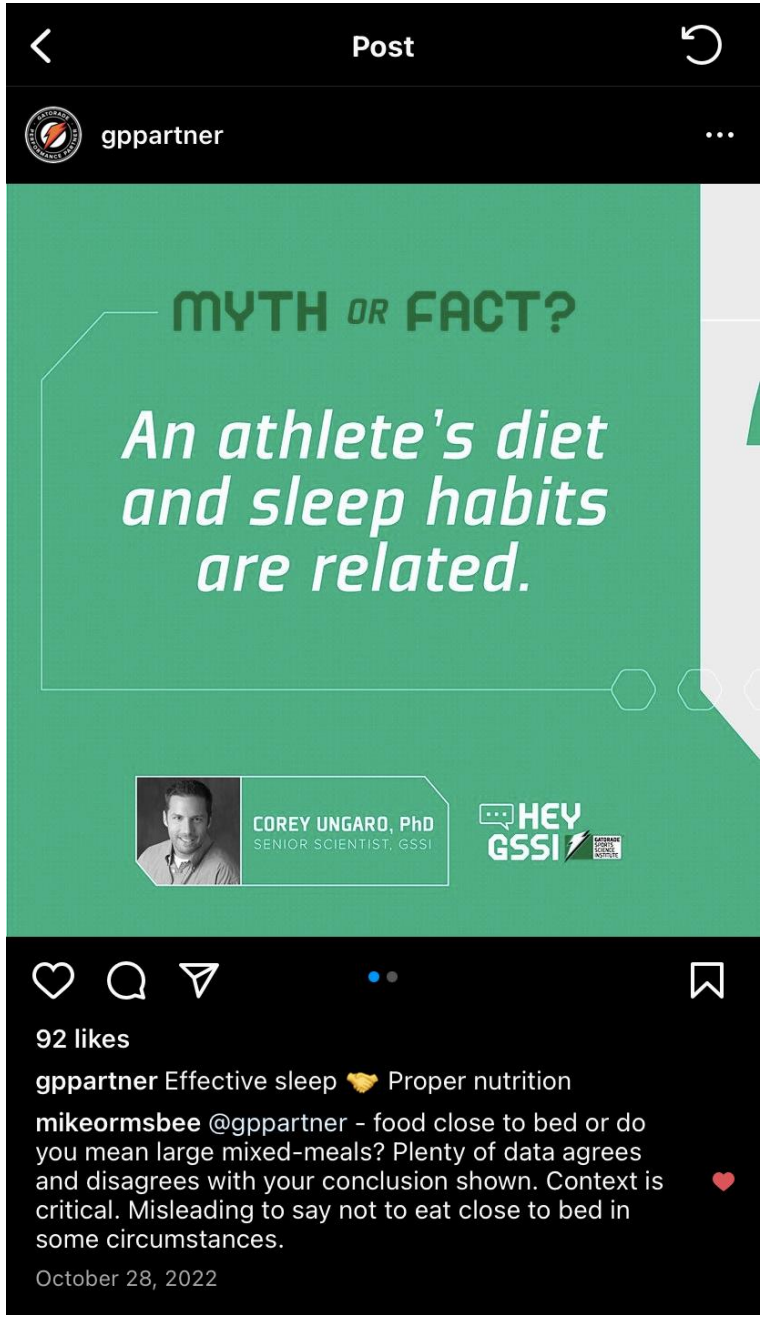
Pre-sleep Protein Ingestion Increases Mitochondrial Protein Synthesis Rates During Overnight Recovery from Endurance Exercise: A Randomized Controlled Trial

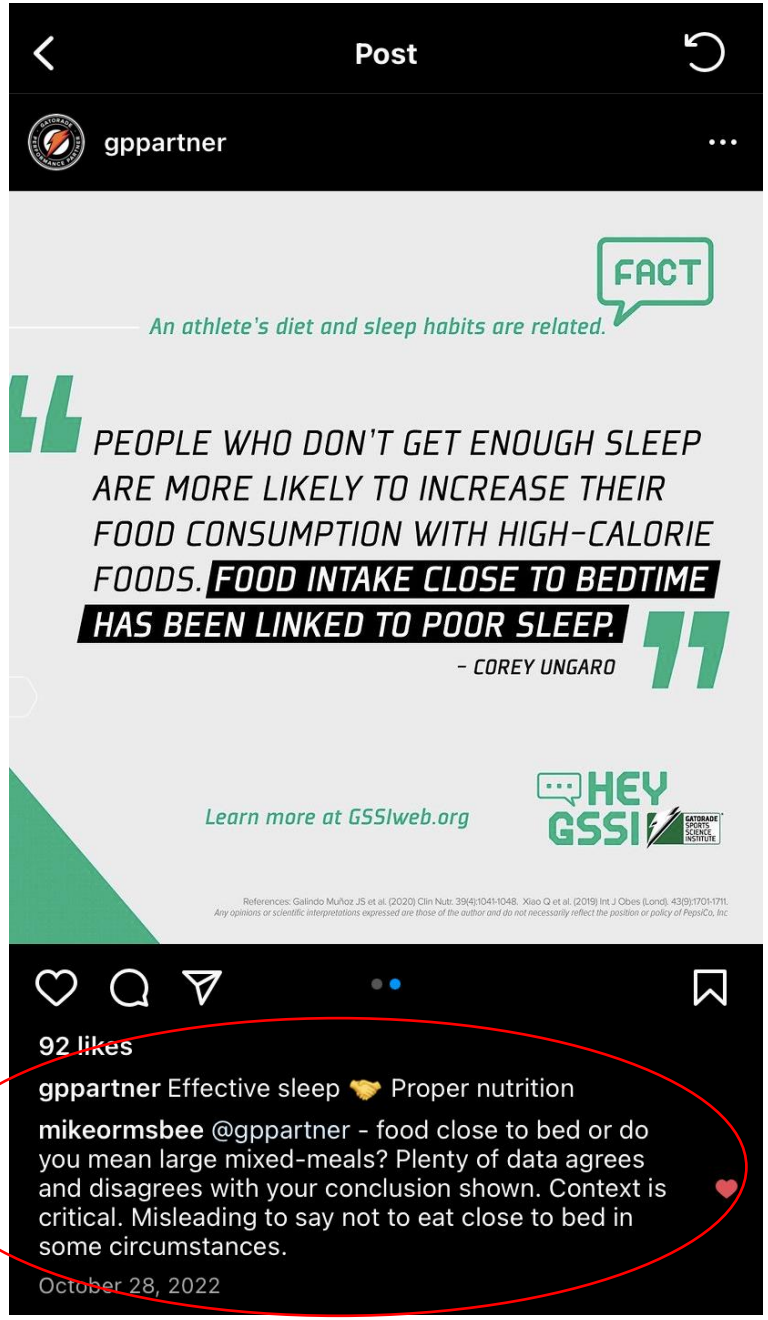




Trommelen et al. Sports Med. 2023

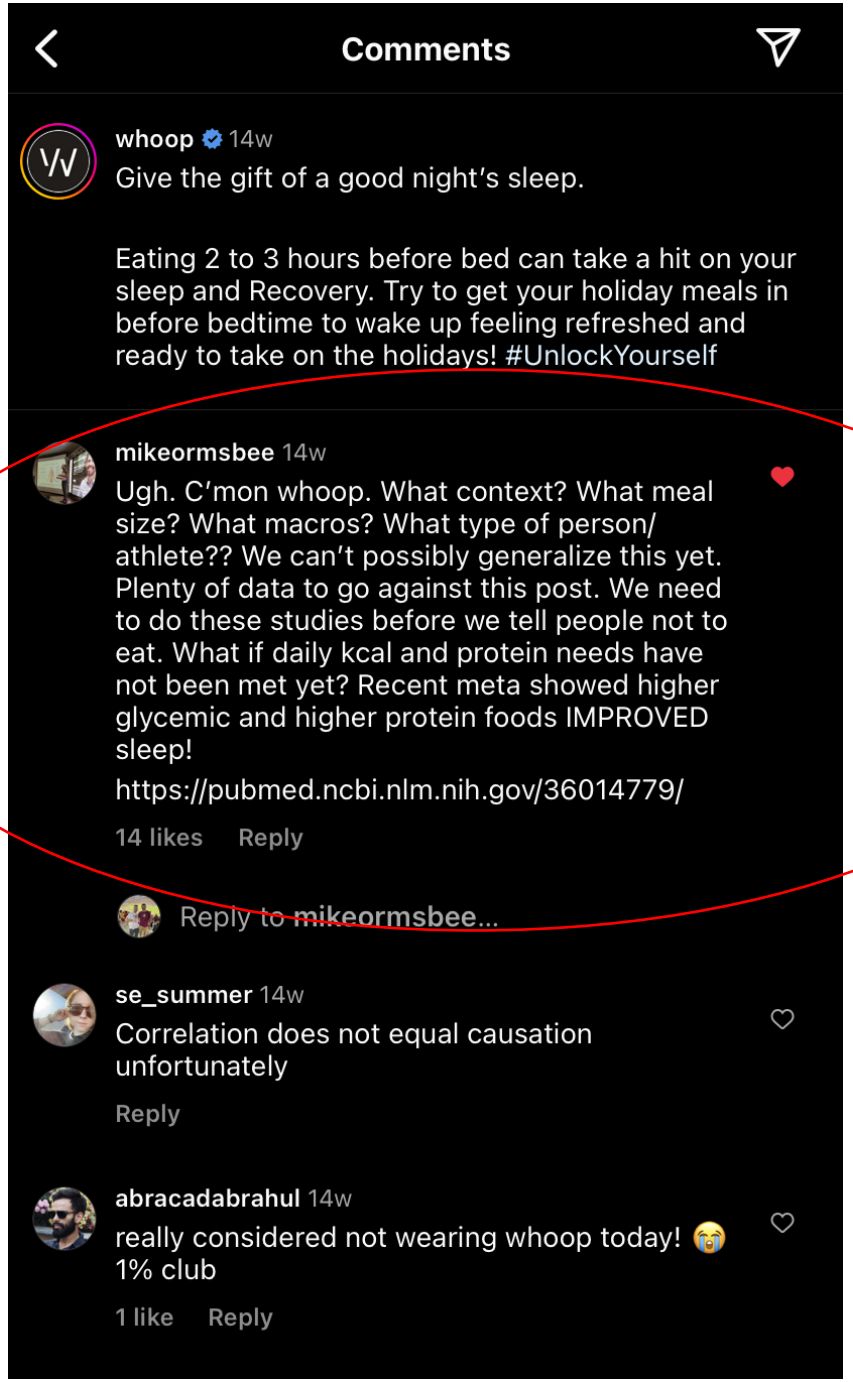

Sleep?
22:45


Post
gppartner
MYTH OR FACT?
An athlete's diet and sleep habits are related.
COREY UNGARO, PhD
SENIOR SCIENTIST, GSSI
HEY GSSI
92 likes
gppartner Effective sleep 🤝 Proper nutrition
mikeormsbee @gppartner - food close to bed or do you mean large mixed-meals? Plenty of data agrees and disagrees with your conclusion shown. Context is critical. Misleading to say not to eat close to bed in some circumstances.
October 28, 2022


Post
gppartner
FACT
An athlete's diet and sleep habits are related.
PEOPLE WHO DON'T GET ENOUGH SLEEP ARE MORE LIKELY TO INCREASE THEIR FOOD CONSUMPTION WITH HIGH-CALORIE FOODS. FOOD INTAKE CLOSE TO BEDTIME HAS BEEN LINKED TO POOR SLEEP.
- COREY UNGARO
Learn more at GSSIweb.org
HEY GSSI
92 likes
gppartner Effective sleep 🤝 Proper nutrition
mikeormsbee @gppartner - food close to bed or do you mean large mixed-meals? Plenty of data agrees and disagrees with your conclusion shown. Context is critical. Misleading to say not to eat close to bed in some circumstances.
October 28, 2022

2022


Photo
whoop
Holiday Hack
Limit Food 2-3 Hours Before Bedtime
Recovery decreases an average of 10% following late-night eating. Members also lose ~26 minutes of sleep, and get ~3% less REM sleep.
Liked by amapp18 and 3,620 others
whoop Give the gift of a good night's sleep.
Eating 2 to 3 hours before bed can take a hit on your sleep and Recovery. Try to get your holiday meals in before bedtime to wake up feeling refreshed and ready to take on the holidays! #UnlockYourself


Comments
whoop 14w
Give the gift of a good night's sleep.
Eating 2 to 3 hours before bed can take a hit on your sleep and Recovery. Try to get your holiday meals in before bedtime to wake up feeling refreshed and ready to take on the holidays! #UnlockYourself
mikeormsbee 14w
Ugh. C'mon whoop. What context? What meal size? What macros? What type of person/ athlete?? We can't possibly generalize this yet. Plenty of data to go against this post. We need to do these studies before we tell people not to eat. What if daily kcal and protein needs have not been met yet? Recent meta showed higher glycemic and higher protein foods IMPROVED sleep!
https://pubmed.ncbi.nlm.nih.gov/36014779/
14 likes Reply
Reply to mikeormsbee...
se_summer 14w
Correlation does not equal causation unfortunately
Reply
abracadabrahul 14w
really considered not wearing whoop today! 😭
1% club
1 like Reply

2022

Presleep dietary protein-derived amino acids are incorporated in myofibrillar protein during postexercise overnight recovery

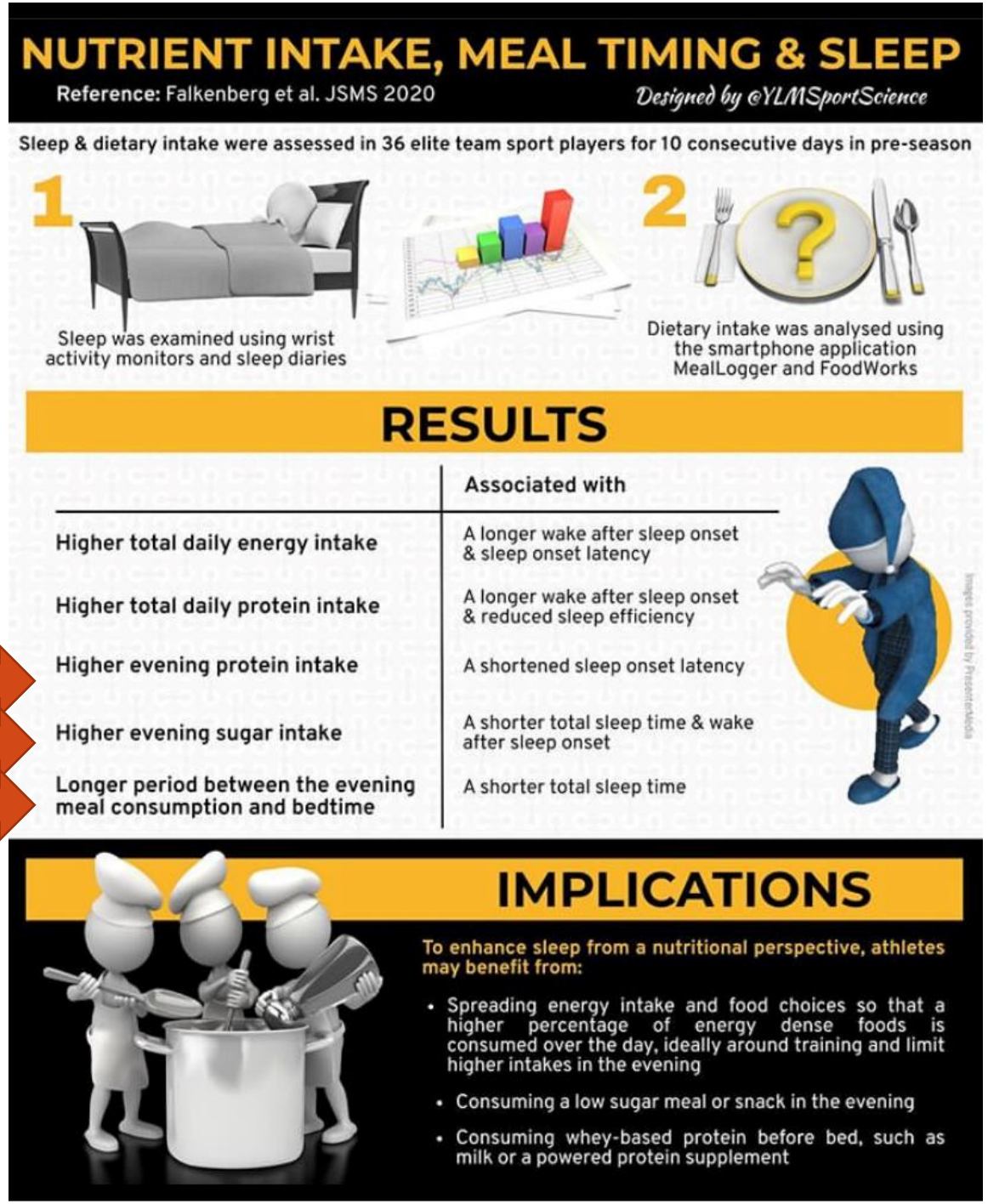
Jorn Trommelen,[1,2] Imre W. K. Kouw,[1,2] Andrew M. Holwerda,[1,2] Tim Snijders,[1] Shona L. Halson,[3] Ian Rollo,[2,4] Lex B. Verdijk,[1,2] and Luc J. C. van Loon[1,2]

Table 2. *Sleep analysis data*

	PLA	PRO	PRO+leu	*P*
n	11	12	11	
Sleep time, h:min	0:02 ± 0:05	23:57 ± 0:06	23:59 ± 0:03	0.849
Wake time, h:min	6:52 ± 0.08	6:53 ± 0:07	6:51 ± 0:04	0.951
Sleep onset latency, h:min	0:09 ± 0:02	0:11 ± 0.02	0:12 ± 0:04	0.830
Sleep duration, h:min	5:56 ± 0:08	6:00 ± 0:11	6:06 ± 0:06	0.770
Time awake/light sleep, h:min	0:26 ± 0:05	0:30 ± 0:08	0:24 ± 0:03	0.789
Sleep efficiency, %	87 ± 3	87 ± 3	89 ± 2	0.772
Wake bouts	12 ± 2	11 ± 2	11 ± 2	0.911

Values are means ± SE. Data were analyzed with one-way ANOVA.

Trommelen et al., 2018.



WHOOP®

Sport technology, Health, and Performance Enhancement (SHAPE): Using Technology to Determine Female Athlete Physiology and Recovery



Only 7g of protein is included in evening snack

Gillen et al., IJSNEM, 2017



WHOOP®

Pre-sleep feeding, sleep quality, and markers of recovery in division I NCAA female soccer players

GREENWALT ET AL. 2023.

Casey E. Greenwalt[a], Elisa Angeles[a], Matthew D. Vukovich[b], Abbie E. Smith-Ryan[c], Chris W. Bach[d], Stacy T. Sims[e], Tucker Zeleny[d], Kristen E. Holmes[f], David M. Presby[g], Katie J. Schiltz[a], Marine Dupuit[a,h], Liliana I. Renteria[a] and Michael J. Ormsbee[a,i]

NO CHANGE IN:
SLEEP Quantity or Quality
Any WHOOP Measure

PRACTICAL APPLICATION

Sports with the highest metabolic cost (soccer, cross country, swimming) ate the most before sleep.
However, female athletes tend to under-consume protein before sleep.

Meals prior to bed primarily consisted of:

Carbohydrate	46.2 g	(50%)
Fat	12 g	(38%)
Protein	7.6 g	(12%)

Current data suggest athletes should consume 30-40 g of protein before bed to improve muscle recovery.

FLORIDA STATE UNIVERSITY
ISSM
Institute of Sports Sciences and Medicine

The effect of α-lactalbumin consumption on sleep quality and quantity in female rugby union athletes: a field-based study

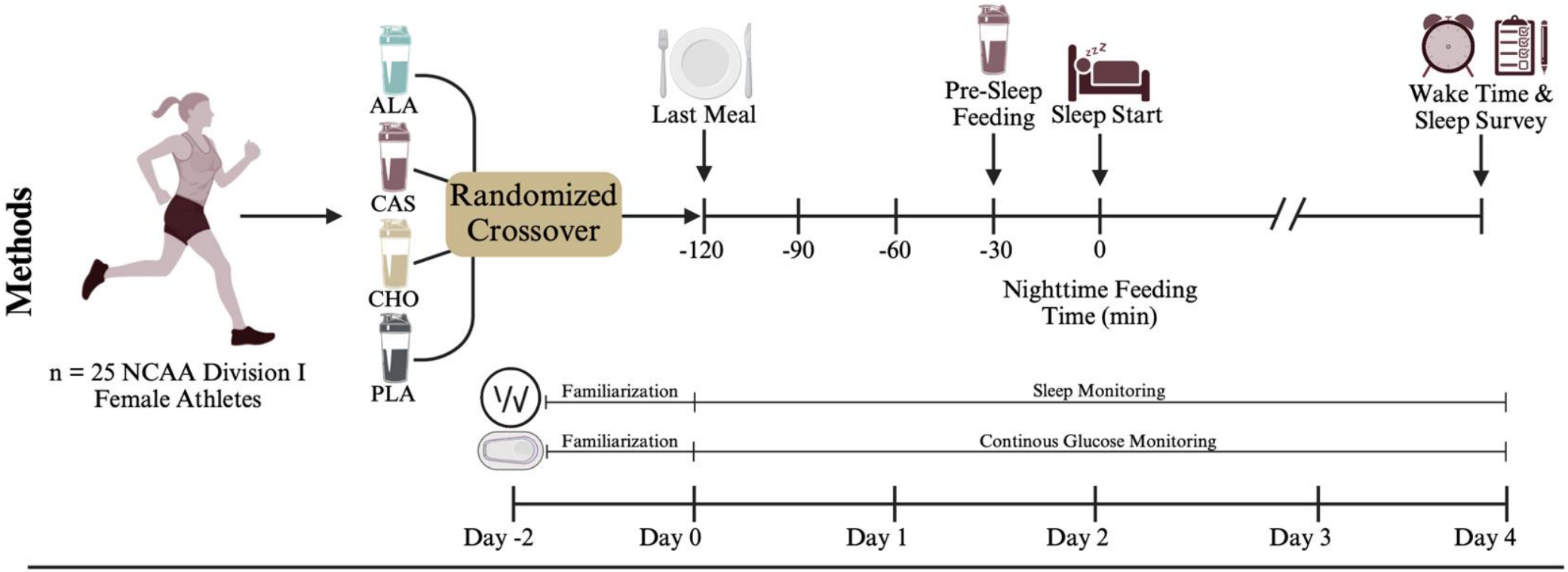
Gratwicke et al. 2023

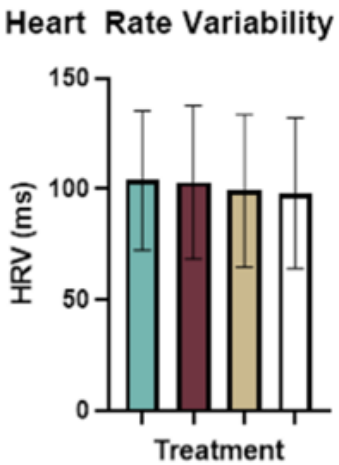
Pre-sleep α-lactalbumin consumption improved SOL in a semi-professional female team-sport cohort. Thus, α-lactalbumin could be utilised by athletes to support sleep during a competitive season.

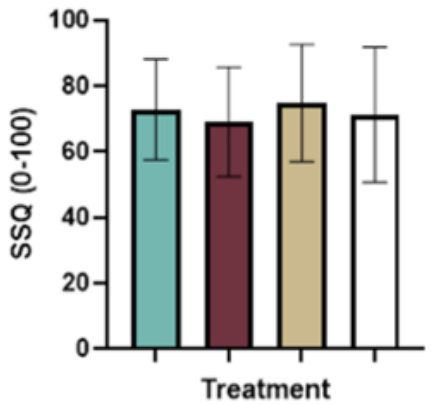
α-Lactalbumin Improves Sleep and Recovery after Simulated Evening Competition in Female Athletes

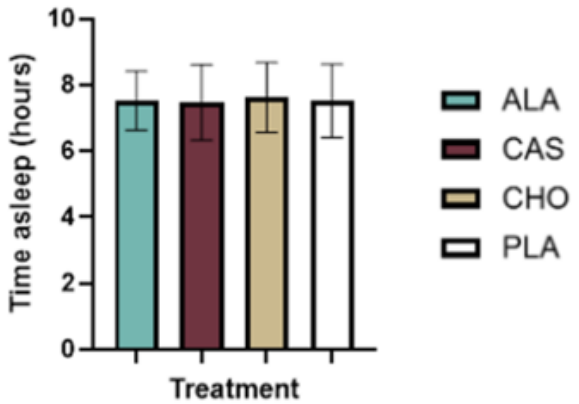
Miles et al. 2021

The findings indicate that A-LAC supplementation may be useful for retaining some sleep characteristics after evening competition, leading to improved physical performance in female athletes







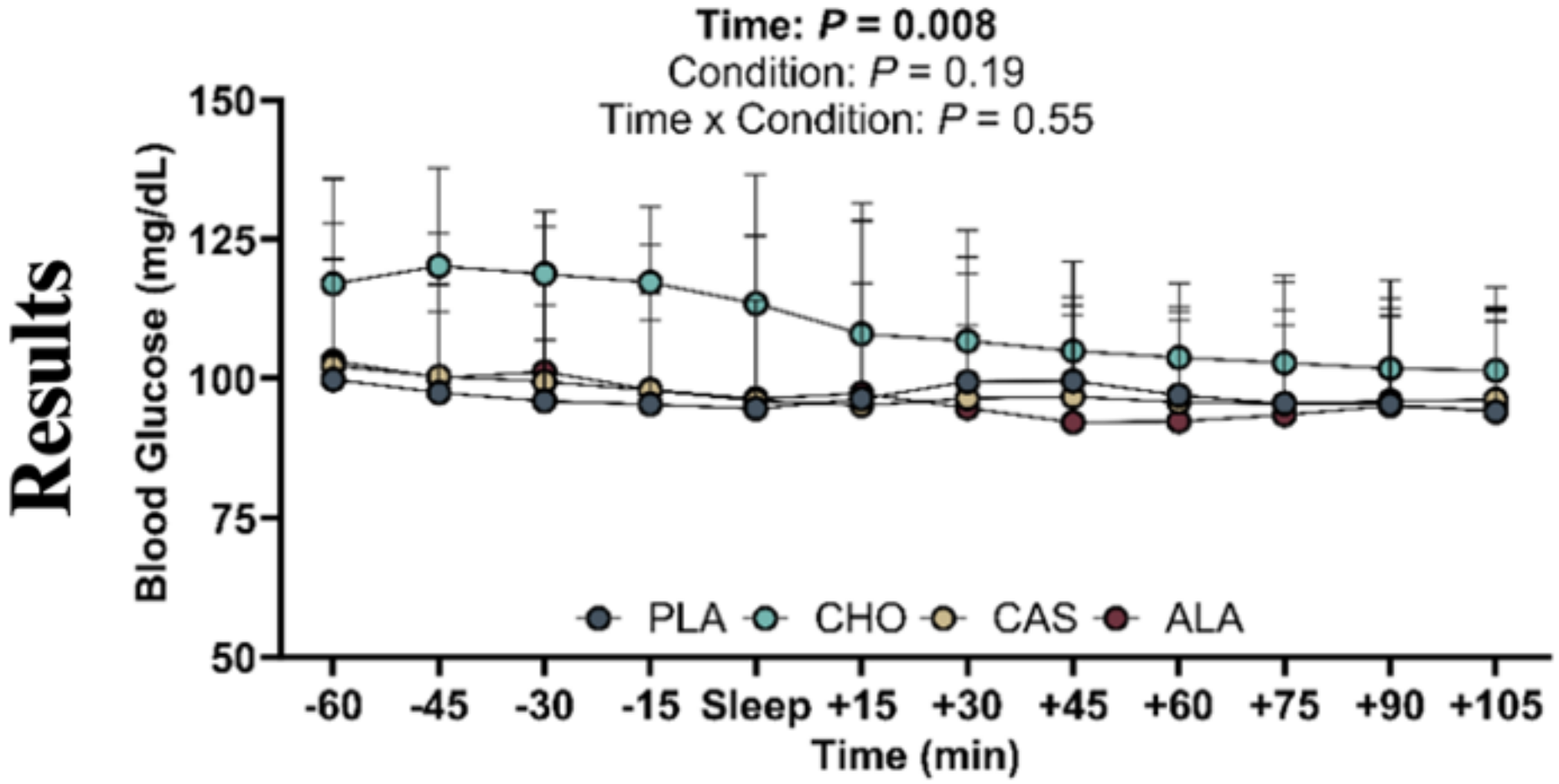




Paterson, K.P. et al. JISSN 2026 (in press)

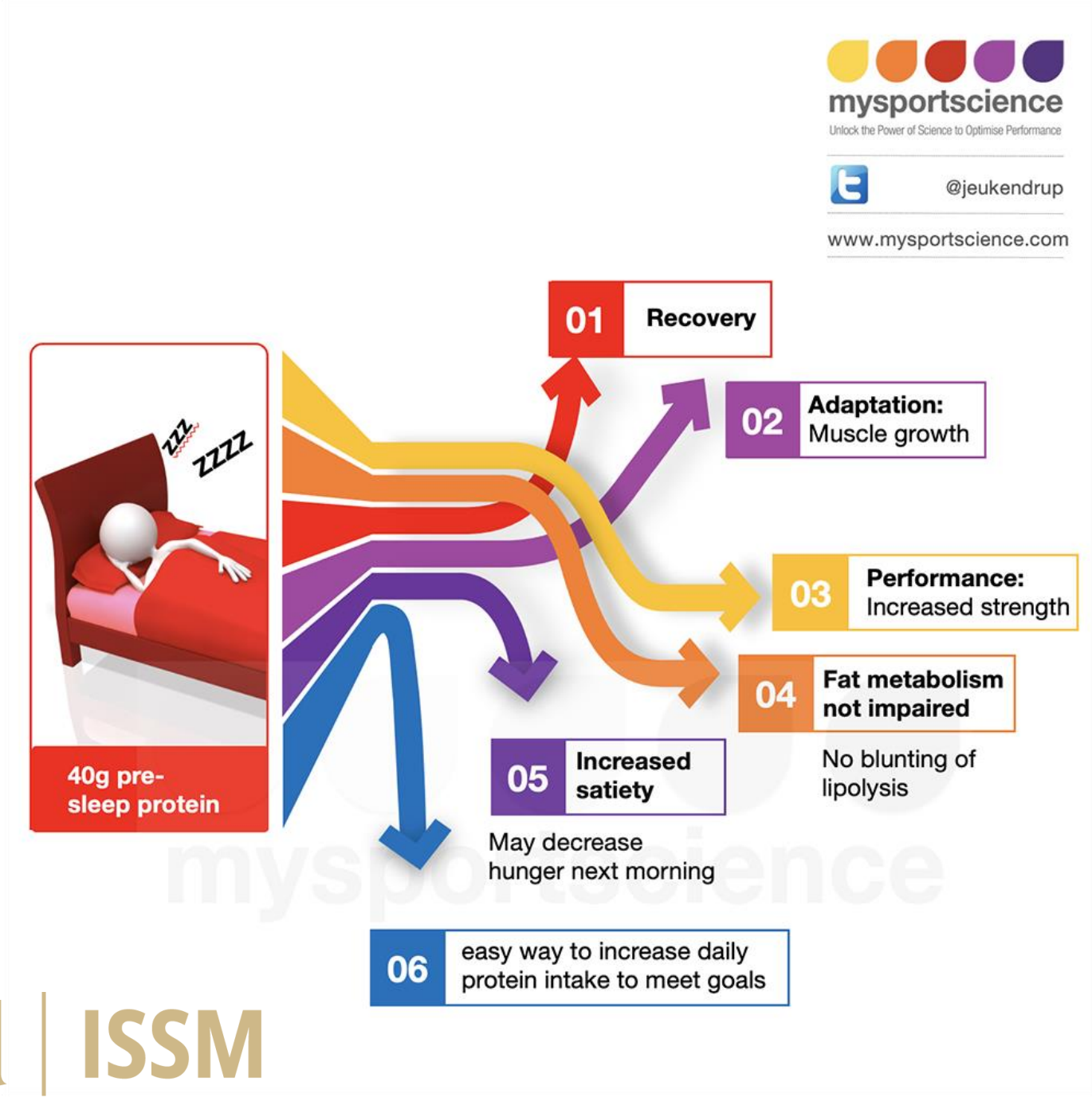
Pre-sleep Milk-derived Proteins Do Not Impair Sleep or Recovery in Elite Female Athletes.

Results





Paterson, K.P. et al. JISSN 2026 (in press)



SUMMARY

@MikeOrmsbee
@FSUISSM

FSU | ISSM



Summary: Night Fuel - Protein

FLORIDA STATE UNIVERSITY
ISSM
Institute of Sports Sciences and Medicine

Presleep feeding is not off limits; helps to increase total daily protein intake

40g appears to be the optimal dose; Type of protein may not matter

Time of day for exercise may matter

More work needed for impact on sleep (including novel products)

FSU | ISSM

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INSTITUTE OF SPORTS SCIENCES & MEDICINE

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mormsbee@fsu.edu

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