



*The Benefits of Increased Dietary Protein,
Particularly at Breakfast, on Appetite Control &
Weight Management*



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Assembling the Pieces

Healthy Living

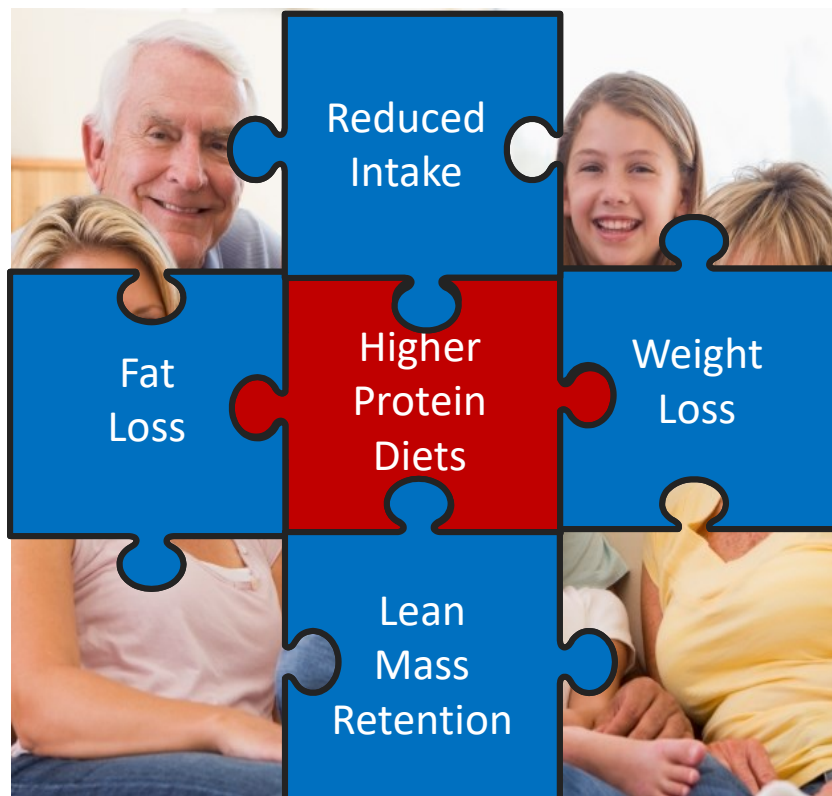


Proposed Benefits

- *Improve:*
 - Weight Management
 - Fitness/Performance
- *Reduce risk of:*
 - Sarcopenia
 - Type 2 Diabetes
 - Cardiovascular Disease
 - Obesity
 - Metabolic Syndrome

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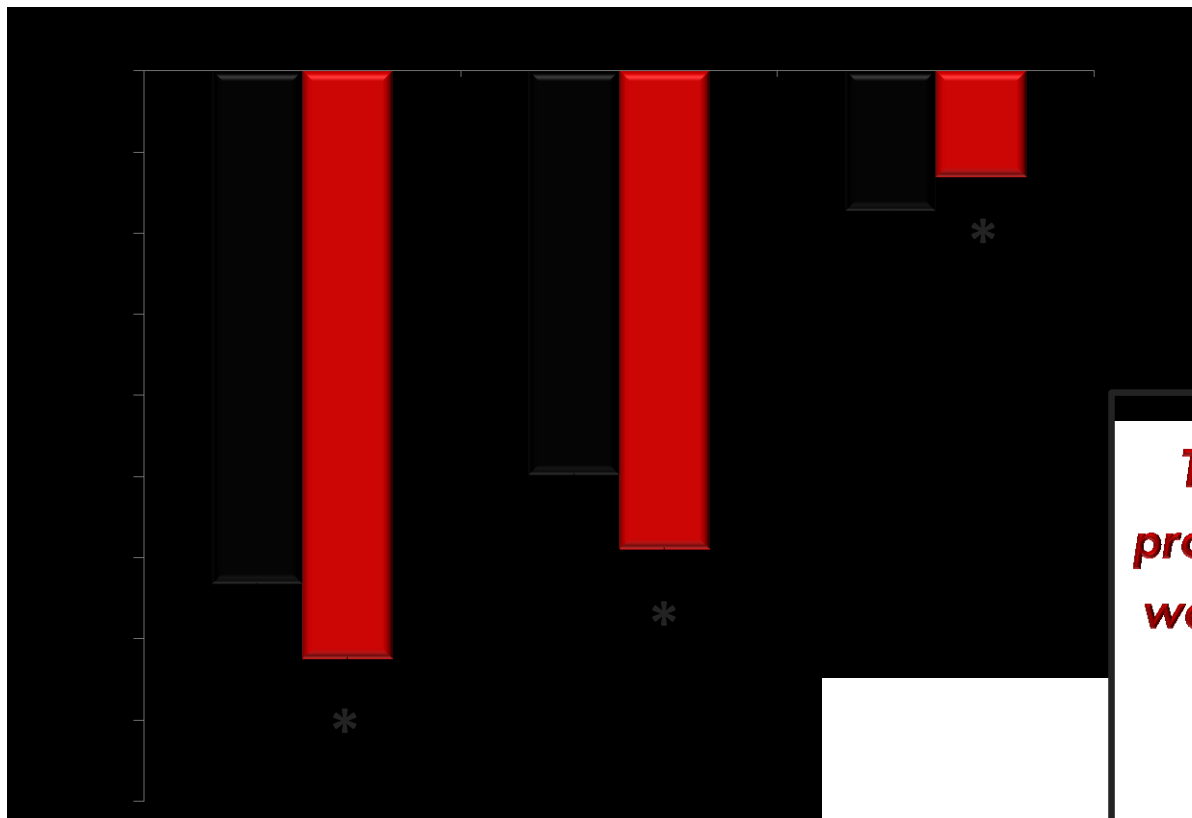


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High Protein Diets Promote Weight Management

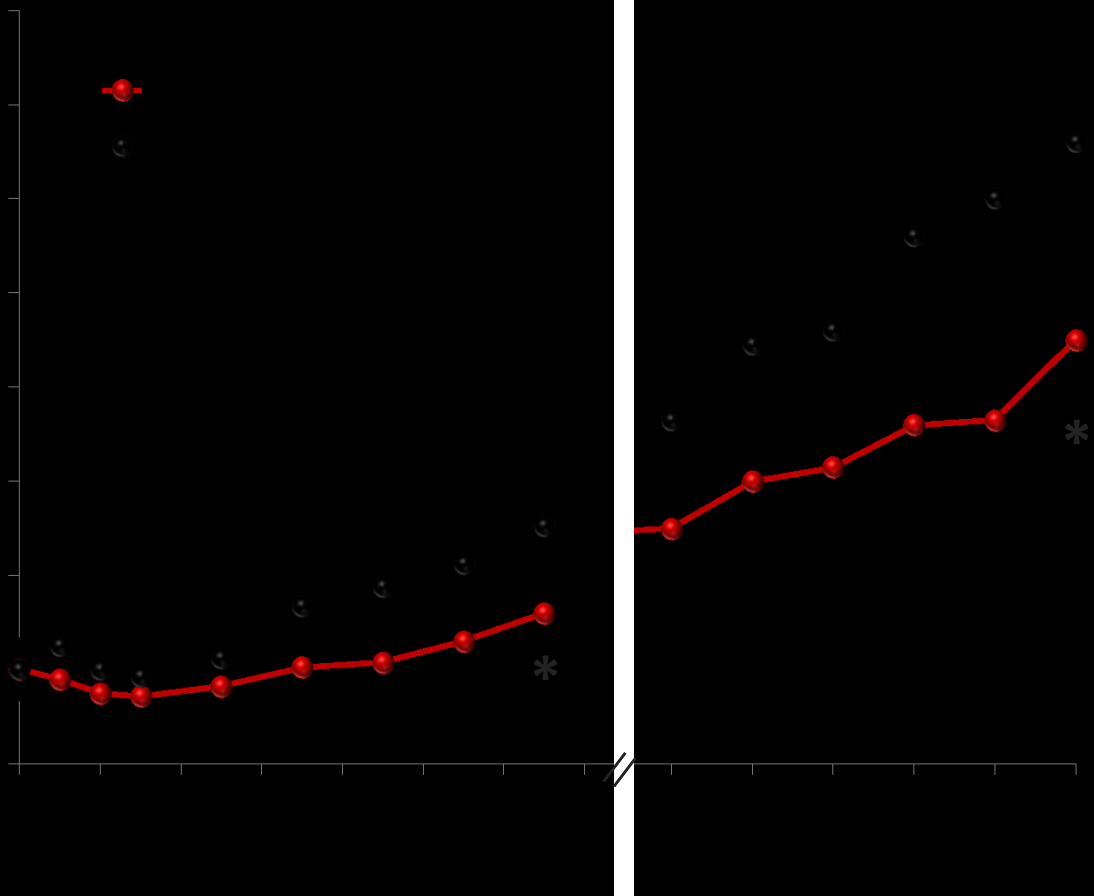
24 tightly-controlled weight loss trials of < 1 yr +1,000 adult
Normal Protein (18%) vs. High Protein Diets (30%)



Tightly-controlled higher protein diets lead to greater weight loss & fat loss, while preserving muscle, compared to standard protein diets

High Protein Diets Promote Weight Management

Diogenes Study – weight maintenance trial in ~1,000 adult
Normal Protein (13%) vs. High Protein (22%)

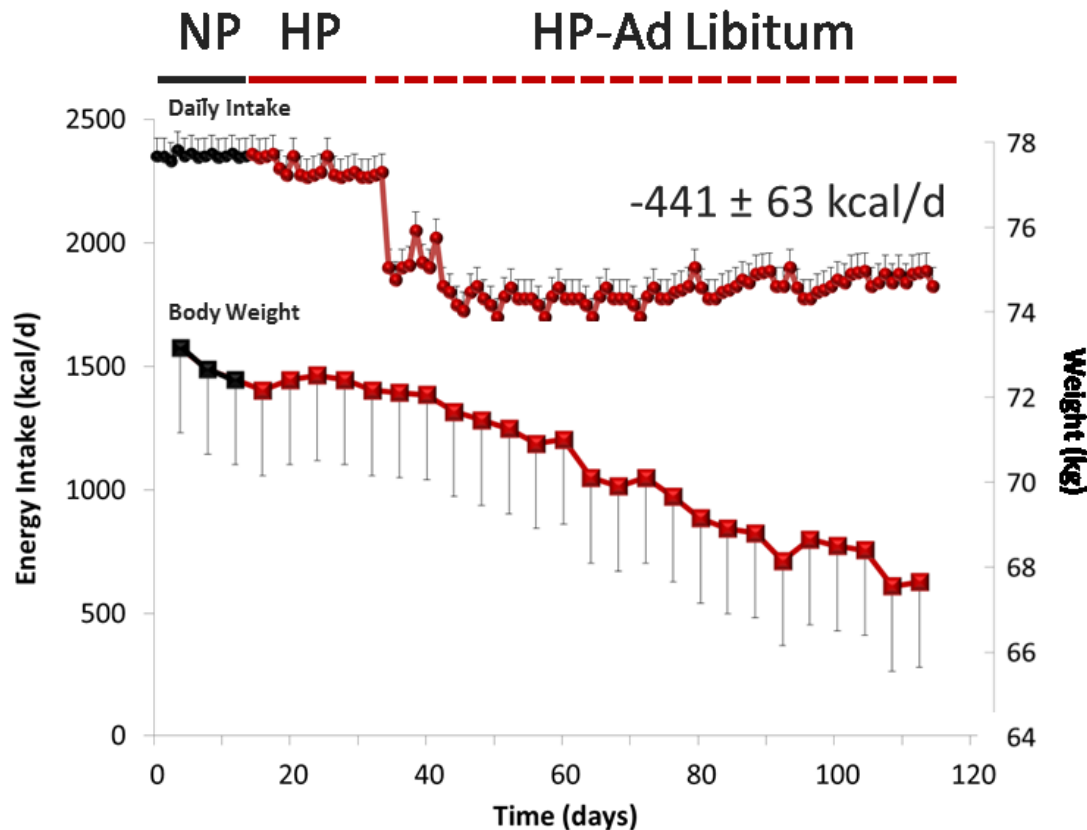


**Increasing protein
consumption
following weight
loss leads to less
weight re-gain**

High Protein Diets Reduce Daily Intake

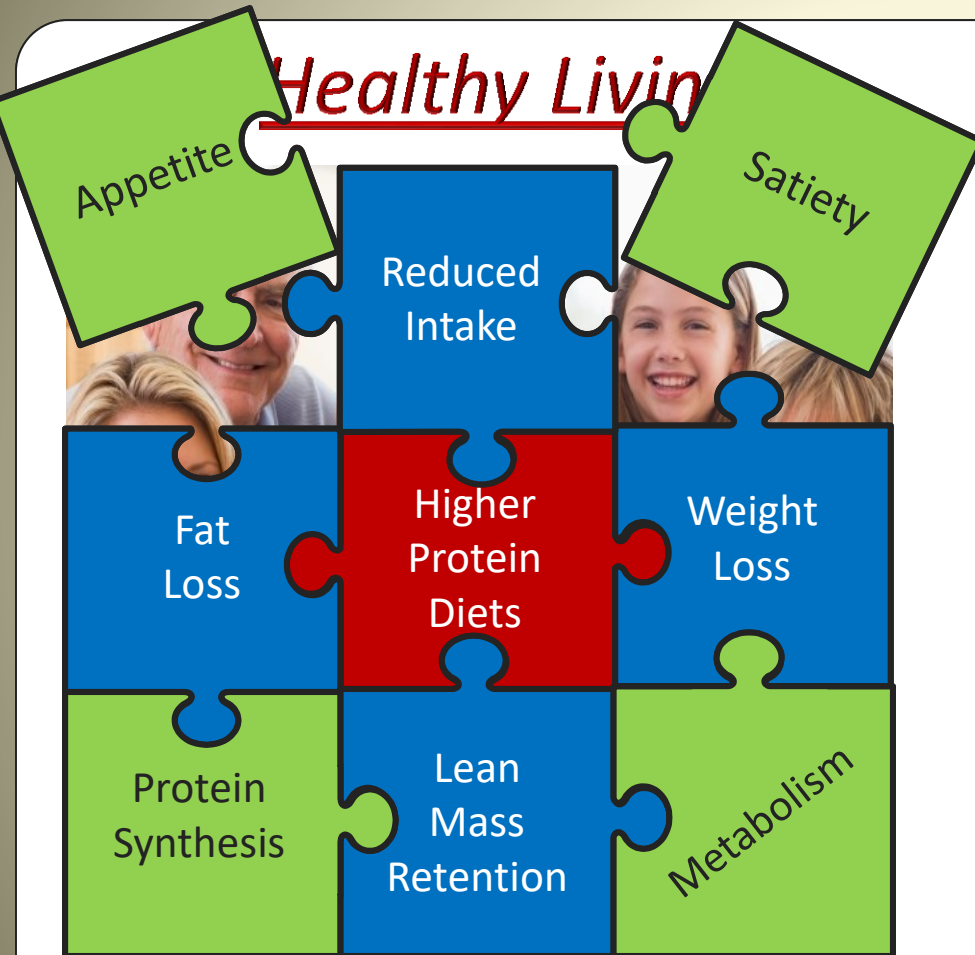
Free-living, Ad Libitum Feeding Trial

12 wks of a high protein diet (30%) with ad libitum energy



Increasing protein consumption leads to significant voluntary reductions in daily intake.

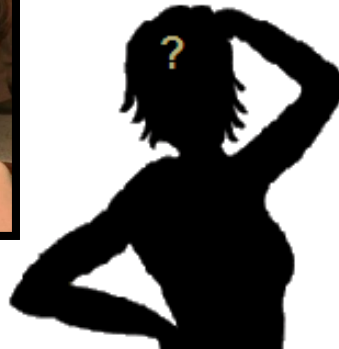
Assembling the Pieces



Proposed Benefits

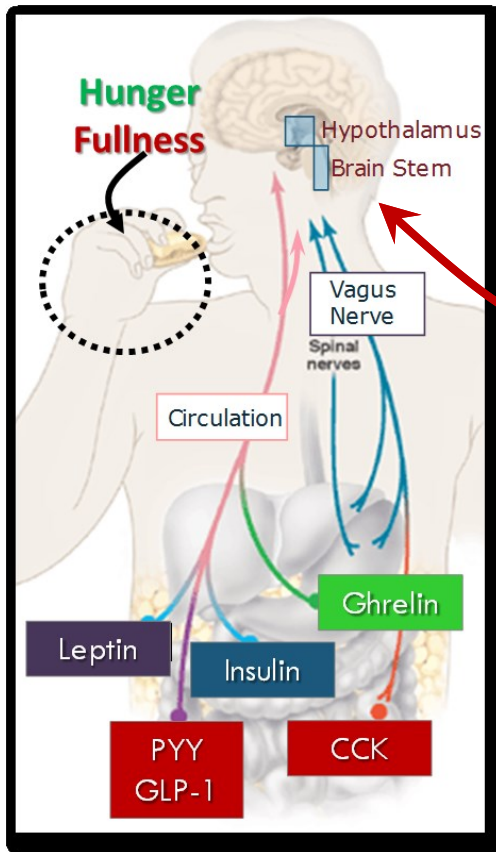
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Ingestive (Eating) Behaviors



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Appetitive sensations

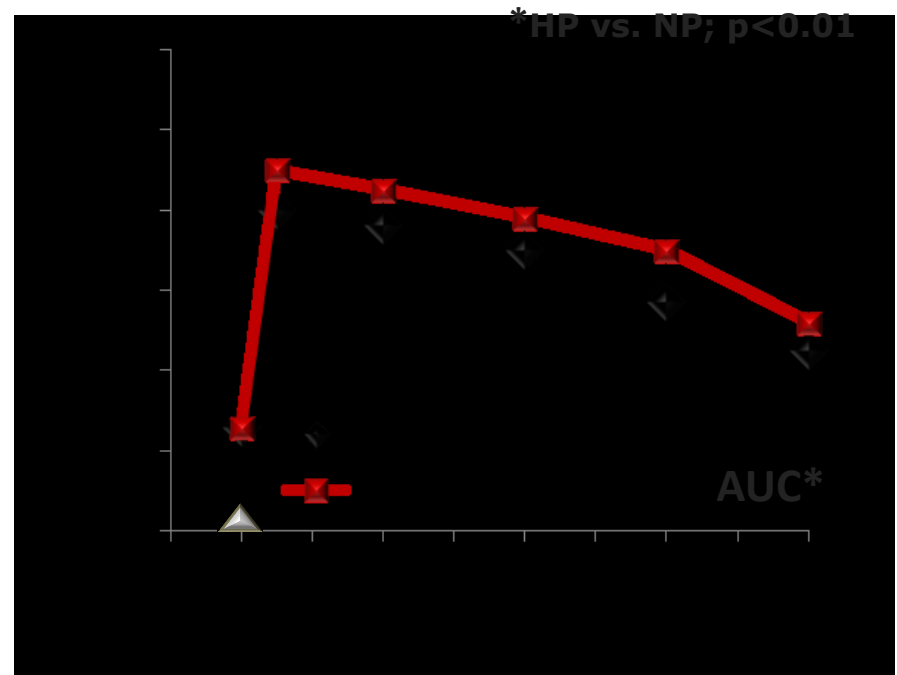
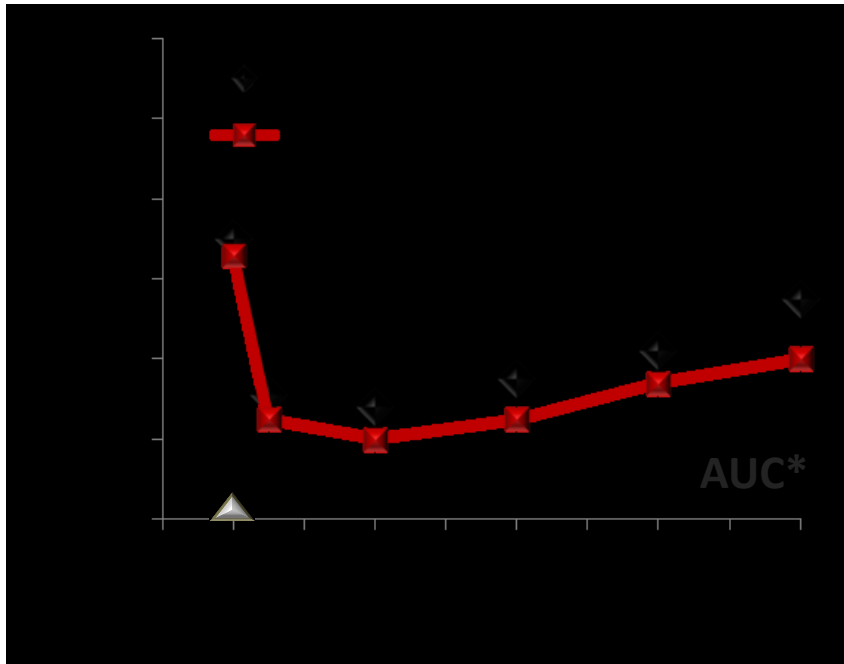


Homeostatic Signals



Appetite Control & Satiety

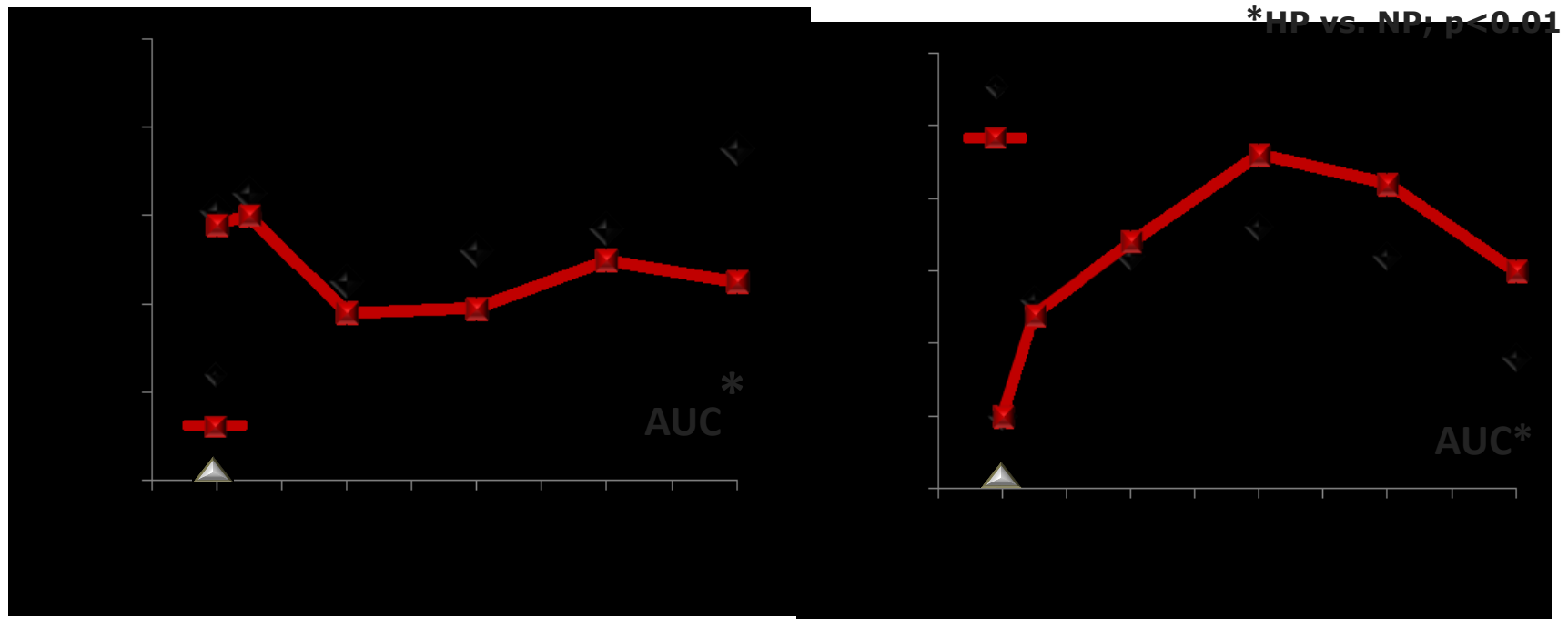
Acute meal studies in adults providing meals as
Normal Protein (NP): 13-20 g vs. High Protein (HP): 28-50 g



Increased protein consumption improves appetite control & satiety

Appetite Control & Satiety

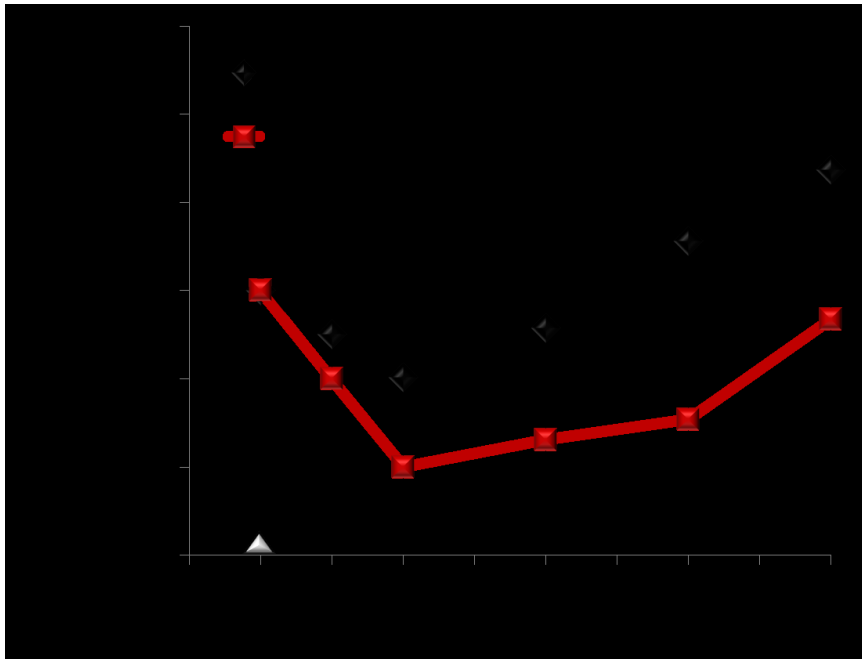
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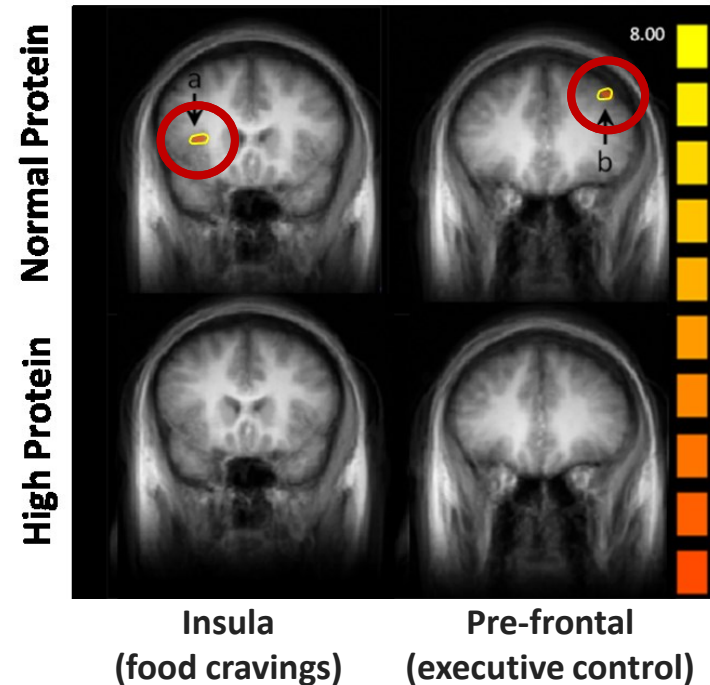
Increased protein consumption beneficially modulates the hormonal signals controlling ingestive (i.e., eating) behavior

Food Cravings

Acute meal studies in adults providing meals as
Normal Protein (NP): 13-20 g vs. High Protein (HP): 28-50 g



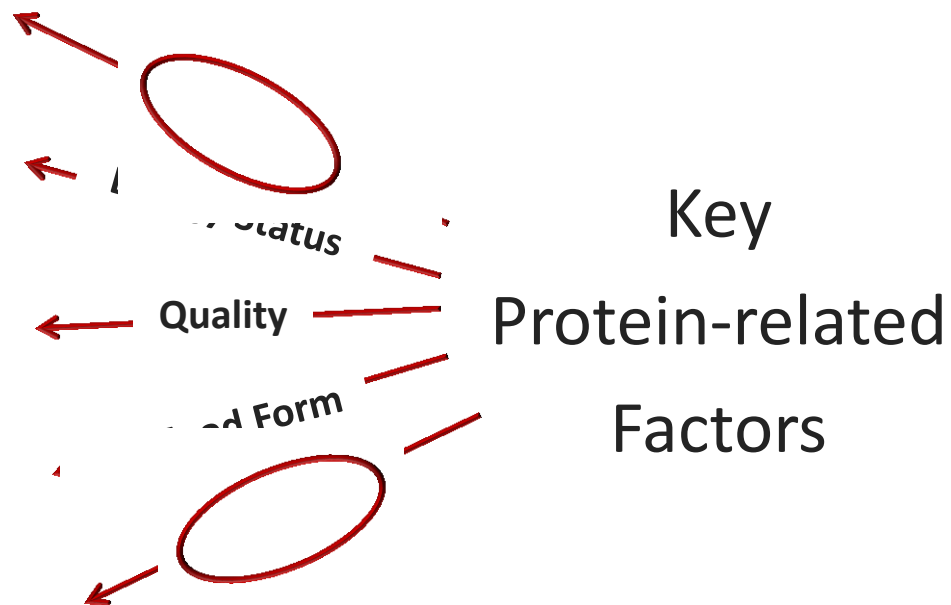
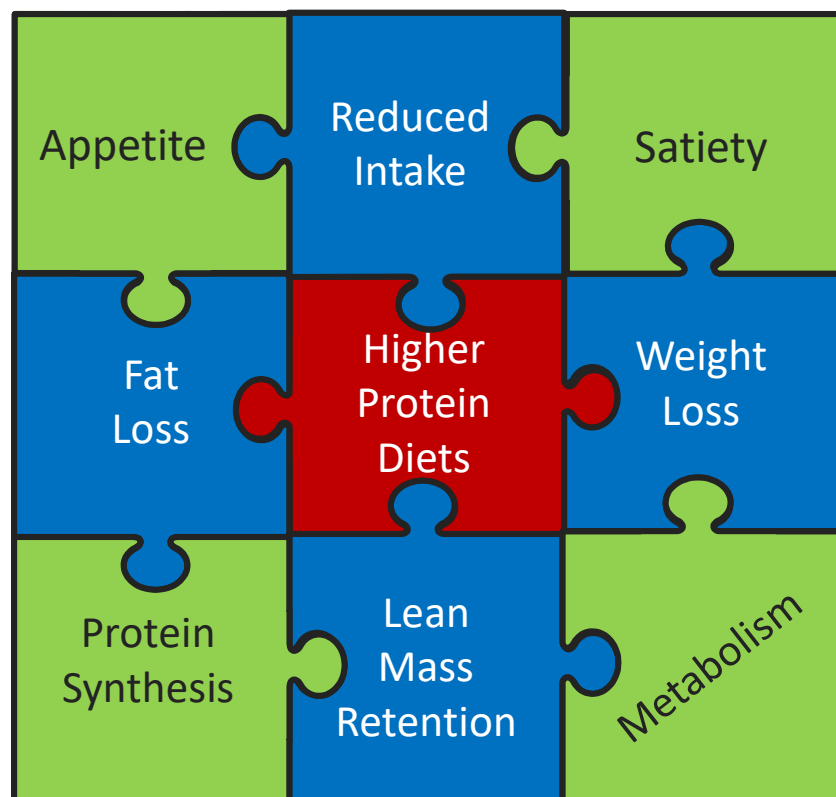
Post-meal Activation (NP > HP)



Increased protein consumption reduces food cravings

Assembling the Pieces

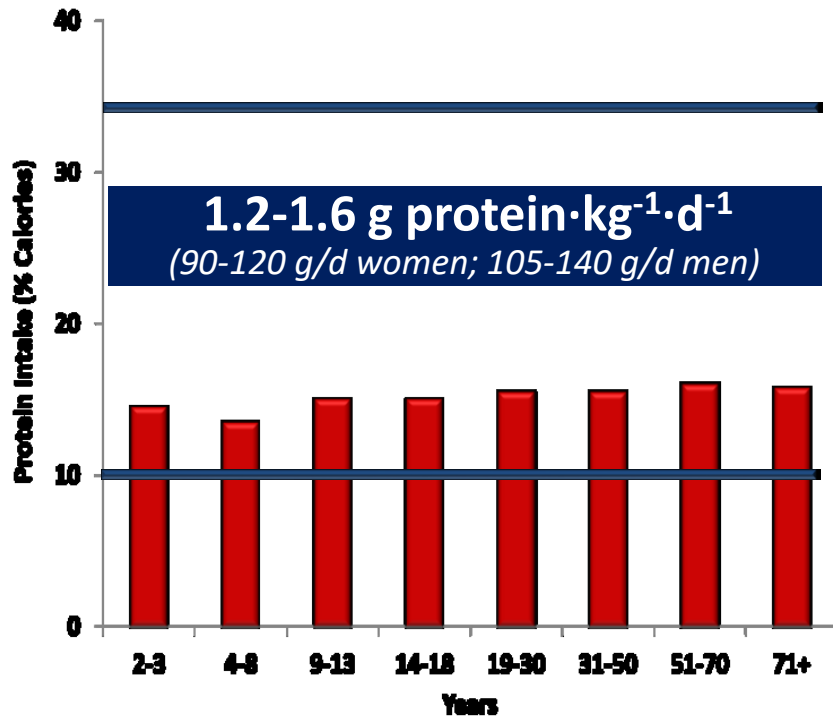
Healthy Living



Protein Quantity

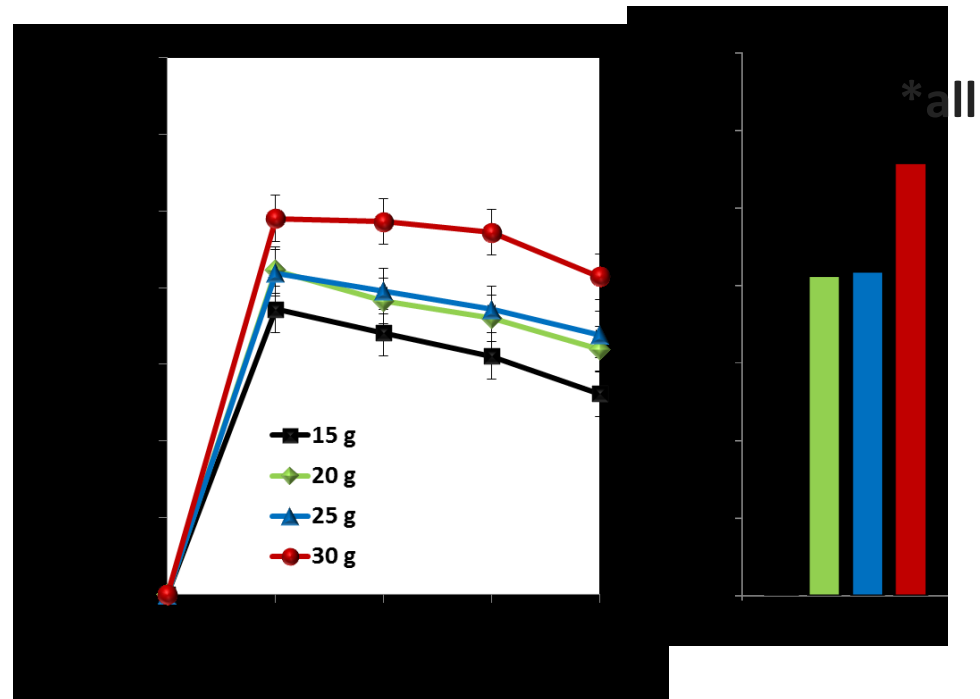
Diet-specific

NHANES data to identify
US protein consumption US



Meal-specific

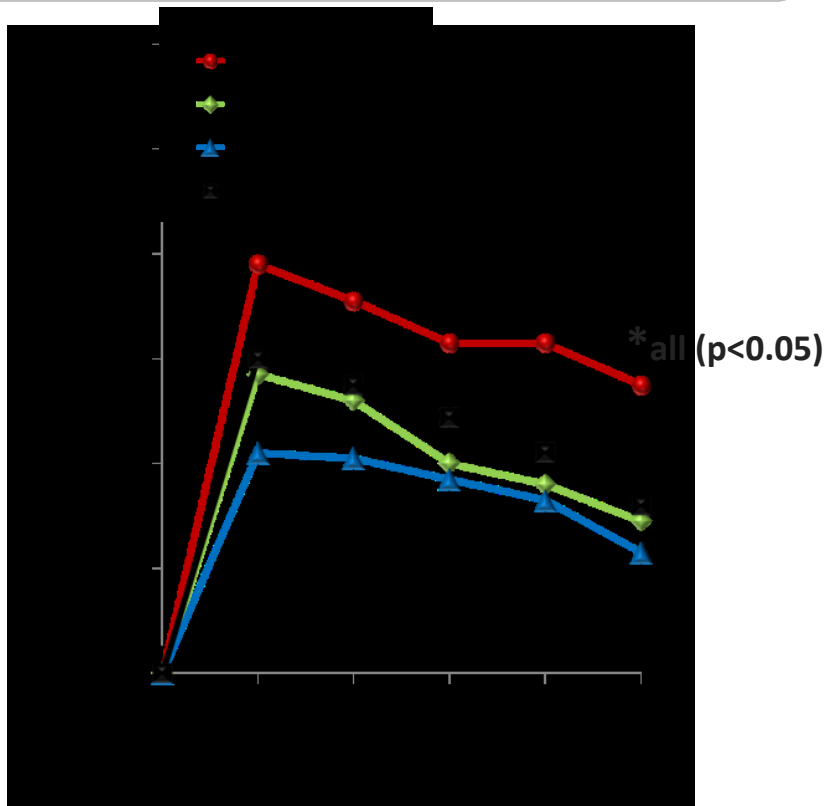
Fullness after 350 kcal meals
Containing 15-30 g protein



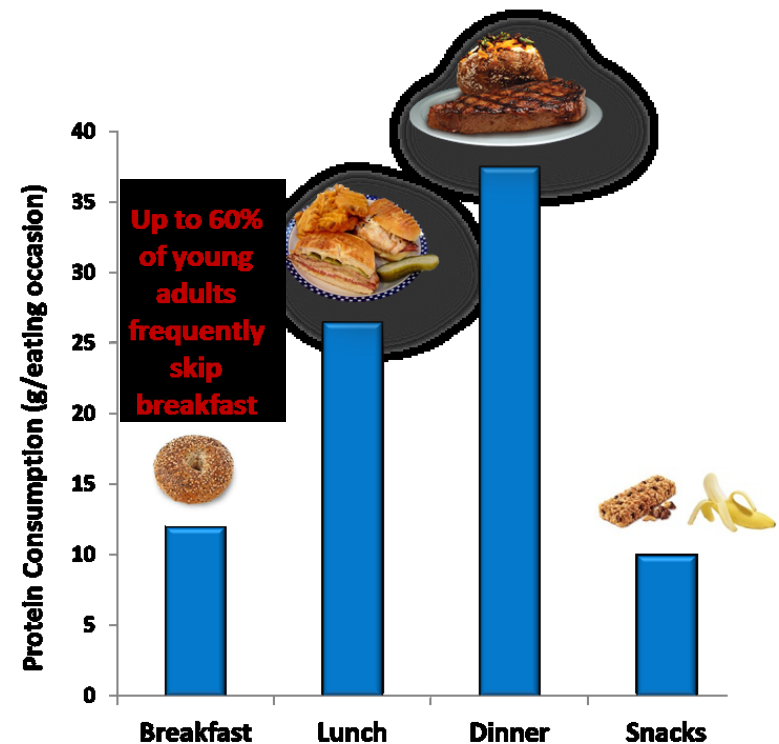
Meal-specific protein quantities may be important to achieve WM outcomes

Timing of Protein Consumption-Breakfast

Fullness following high protein breakfast, lunch, vs dinner meals



Breakfast Consumption
NHANES Data assess protein distribution



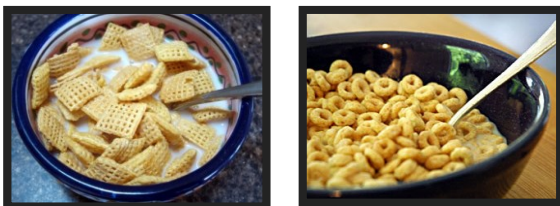
Protein at breakfast appears to be a good target to increase protein intake

Benefits of a High Protein Breakfast

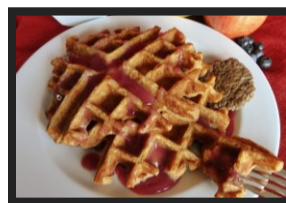
Studies in Overweight 'Breakfast-skipping' Young Adults Normal Protein vs. High Protein Breakfasts

Meal Characteristics	Breakfast Skipping	Normal Protein	High Protein
Meal Type	N/A	RTECs	Prepared
Energy Content (kcal)	0	350	350
CHO/Protein/Fat (%)	0	65/15/20	40/40/20
Total Protein (g)	0	13	35
CHO (g)	0	57	35
Fat (g)	0	8	8

NP Breakfast



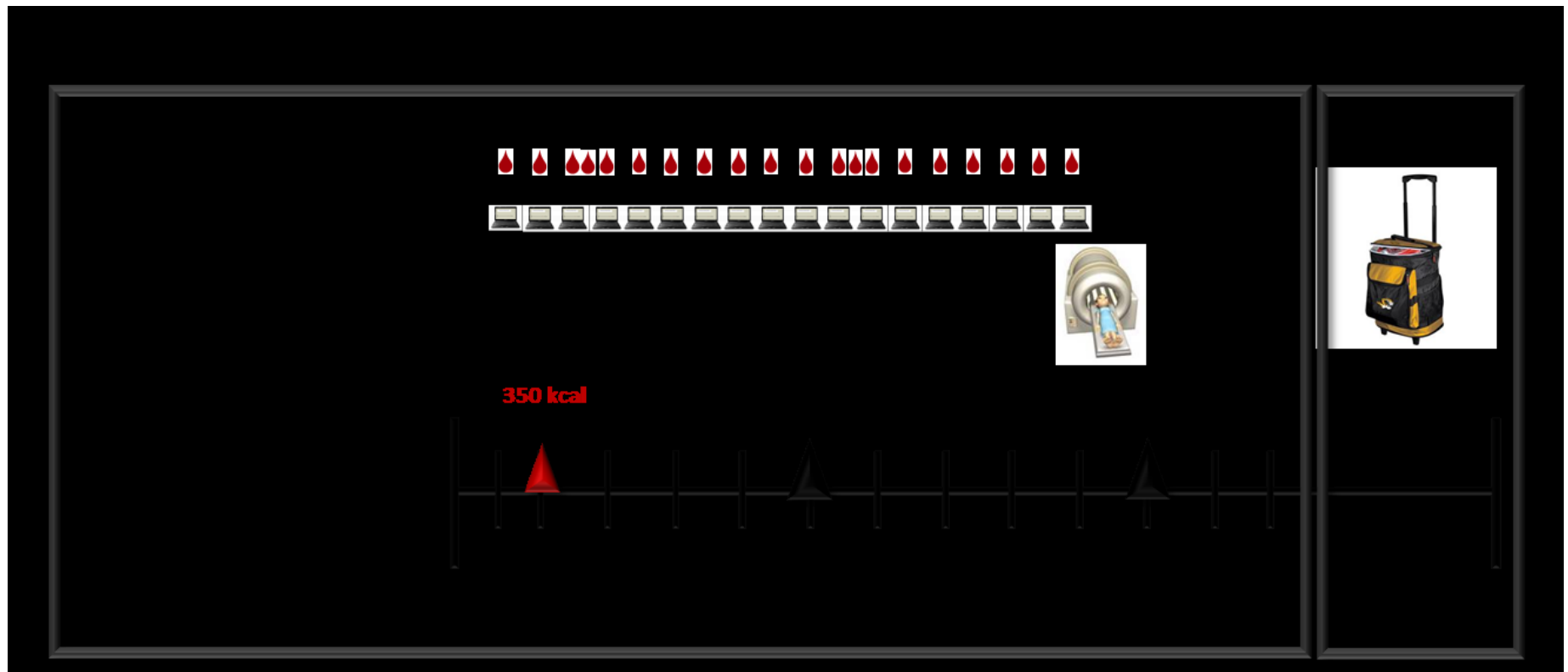
HP Breakfast



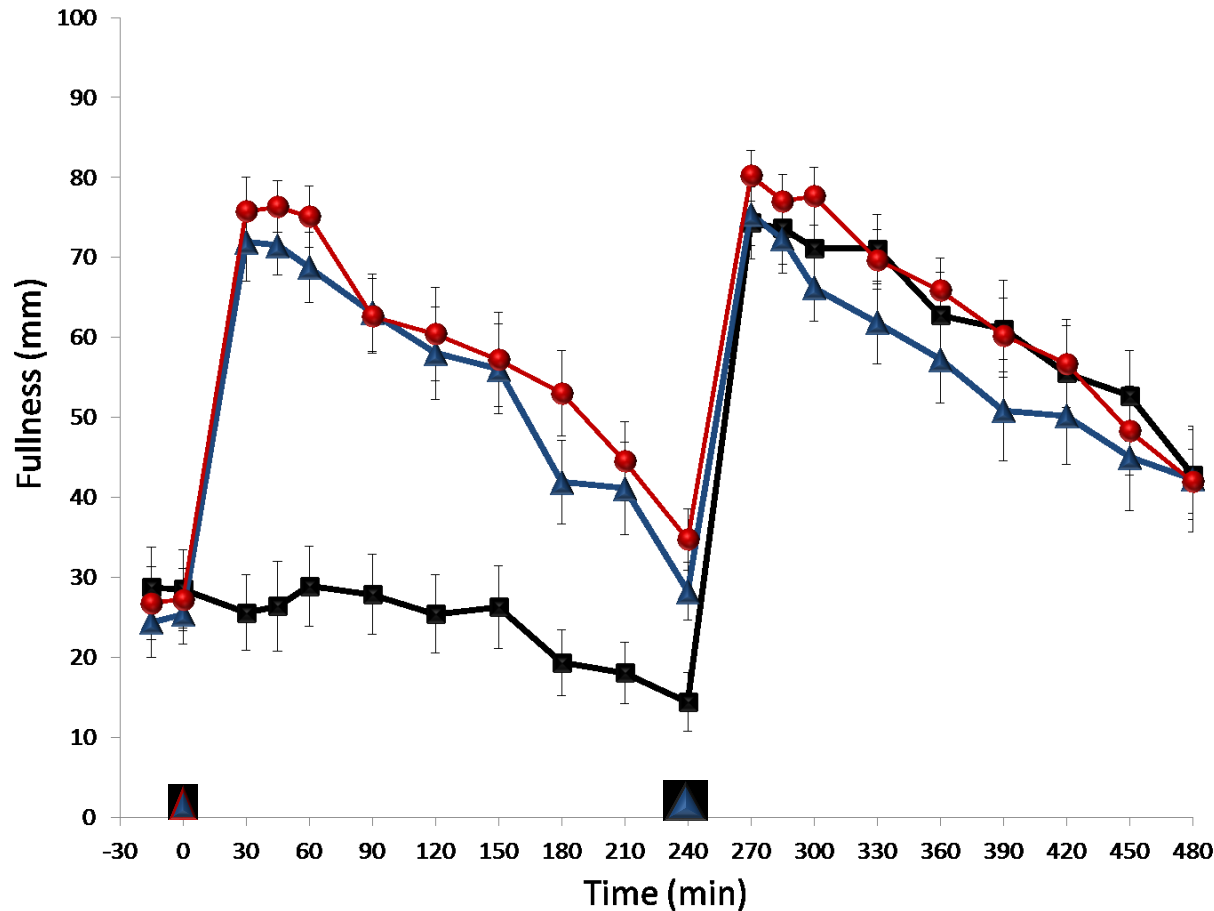
2 oz lean meat;
2 servings eggs
1 ½ servings of dairy

Benefits of a High Protein Breakfast

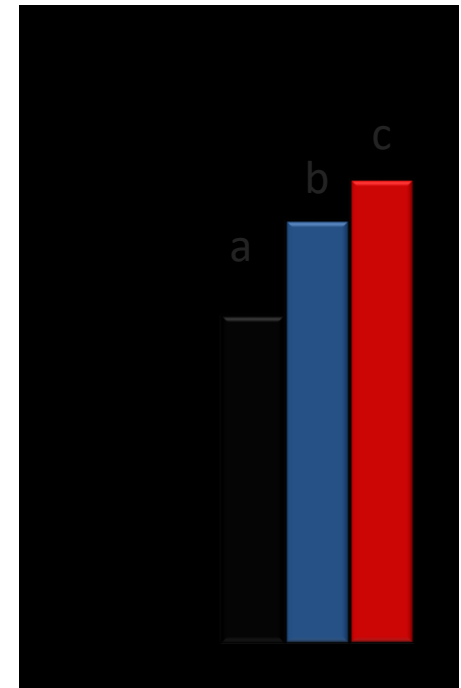
Studies in Overweight 'Breakfast-skipping' Young Adults
Normal Protein vs. High Protein Breakfasts



Satiety Following a High Protein Breakfast



Different letters denote sig.,
 $p < 0.05$



Breakfast improves daily fullness but more so when it's high protein

Appetite & Food Cravings

Compared to Skipping Breakfast &/or consuming a NP breakfast, a HP breakfast:

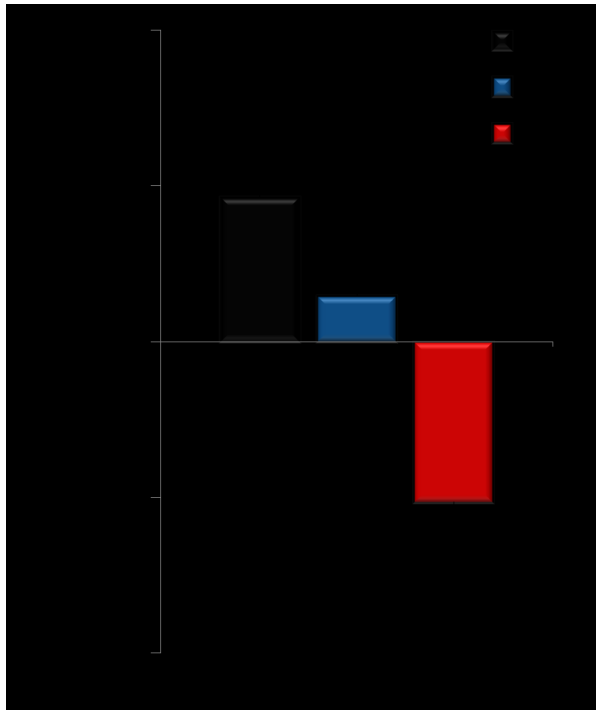
- Curbed daily hunger and desire to eat
- Increased PYY (satiety) & decreased ghrelin (hunger)
- Decreased evening brain-driven food cravings
- ***Decreased unhealthy evening snacking on high fat/sugar foods – by ~ 200 kcals***



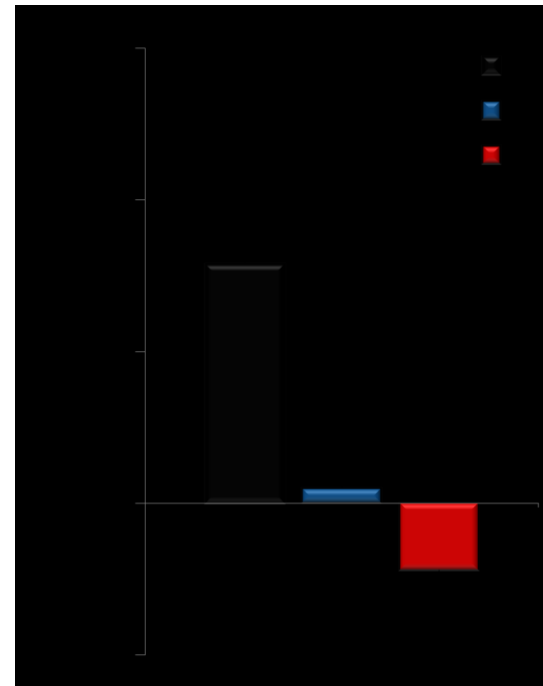
Weight Management with High Protein Breakfast

Extended the previous work to complete a 12-wk RCT comparing Breakfast Skipping (BS), Normal Protein (NP), & High Protein Groups

Changes in Daily Intake



Changes in Fat Loss



High protein breakfast improves intake & weight management

Summary

- A diet rich in protein ($1.2\text{-}1.6\text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$) appears to be an optimal strategy to improve body weight management.
- Potential mechanisms include increased appetite control and satiety, while reducing food cravings and unhealthy snacking behavior.
- Unique benefits surrounding the consumption of a protein-rich breakfast for satiety & weight management in habitual 'breakfast skippers.'

Many Thanks

Co-investigators:

Kevin Maki, PhD

Chief Science Officer

*Midwest Center for Metabolic
& Cardiovascular Research*

John Thyfault, PhD

*Associate Professor
KUMC*

Cary Savage, PhD

*Professor
KUMC*



Investigator-Initiated Funding:

Egg Nutrition Center

The Beef Checkoff

The Pork Checkoff

Kellogg

NIH

Grad/Med/Undergrad Students:

Heather Hoertel

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Adam Zino

Lindsey Bauer

Kelly Higgins

Steve Douglas

Connor Roenfeldt

Ammar Alwattar

Leryn Reynolds