

IWC
PARIS
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5th International Whey Conference

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High Protein Diets in Weight Reduction

Effects on fat mass, muscle mass and risk factors of the metabolic syndrome

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Goals for designing a high protein diet?

How much protein?

What is the purpose of more protein?

- ~ Outcomes:
 - è Satiety
 - è Thermogenesis
 - 4 é protein and nitrogen metabolism
 - 4 é protein turnover (a futile cycle)
 - è changes in body composition
 - 4 ê fat mass
 - 4 é muscle mass



Goals for designing a high protein diet?

How much protein?

What is the molecular mechanism?

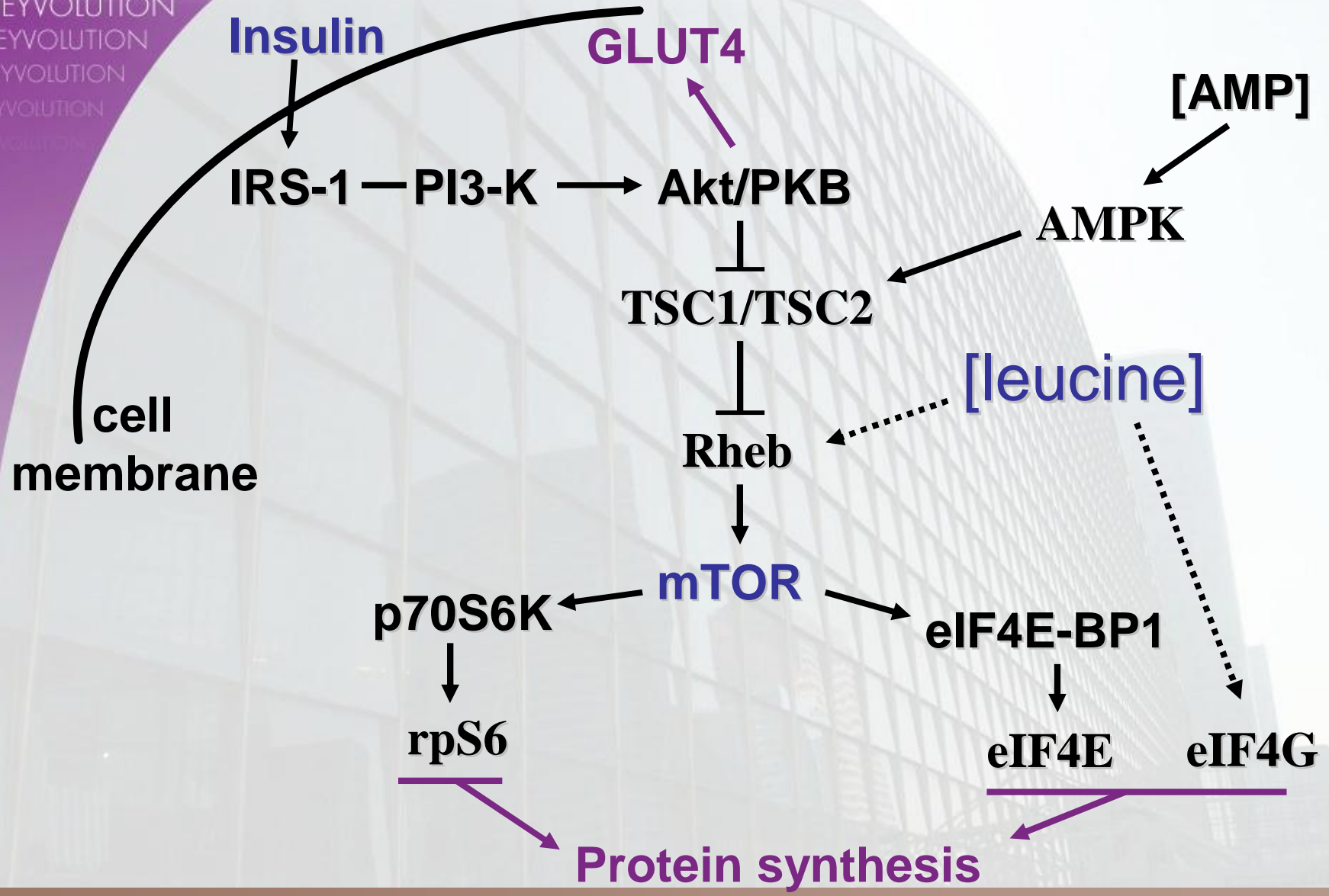
substrate concept = need for more essential amino acids
limiting amino acid: **lysine**

metabolic concept = signaling regulations
unique signal: **leucine**



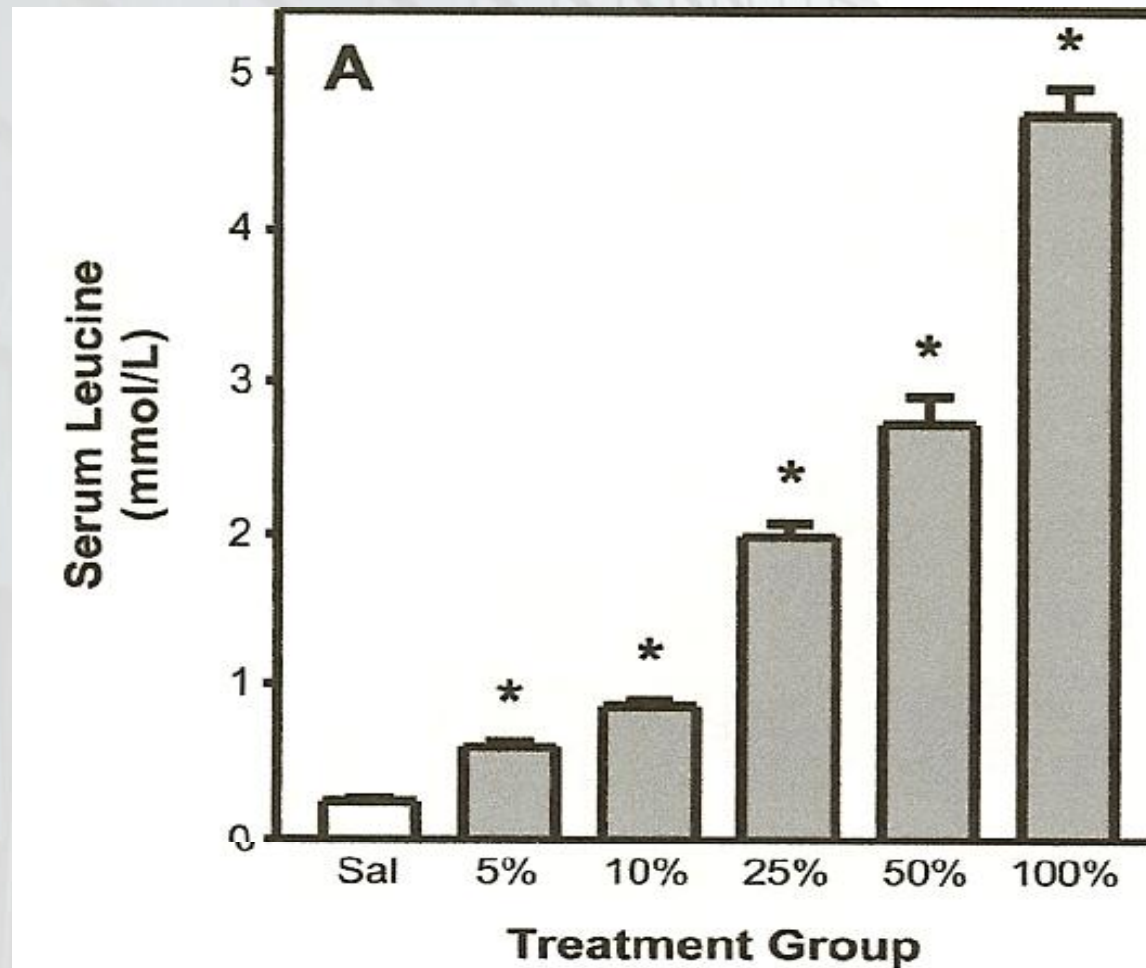
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Leucine as a nutrient signal





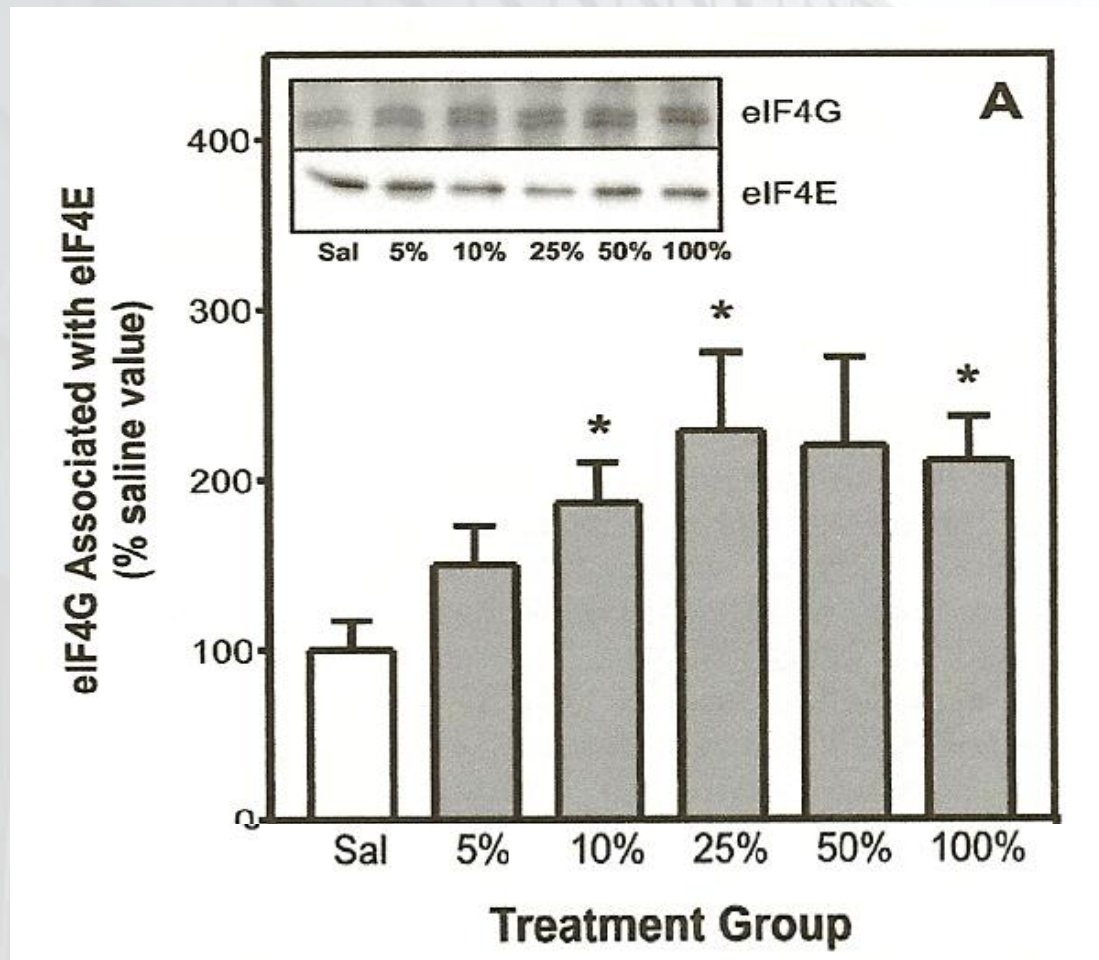
Serum responses to oral leucine doses





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Threshold for eIF4G - eIF4E binding



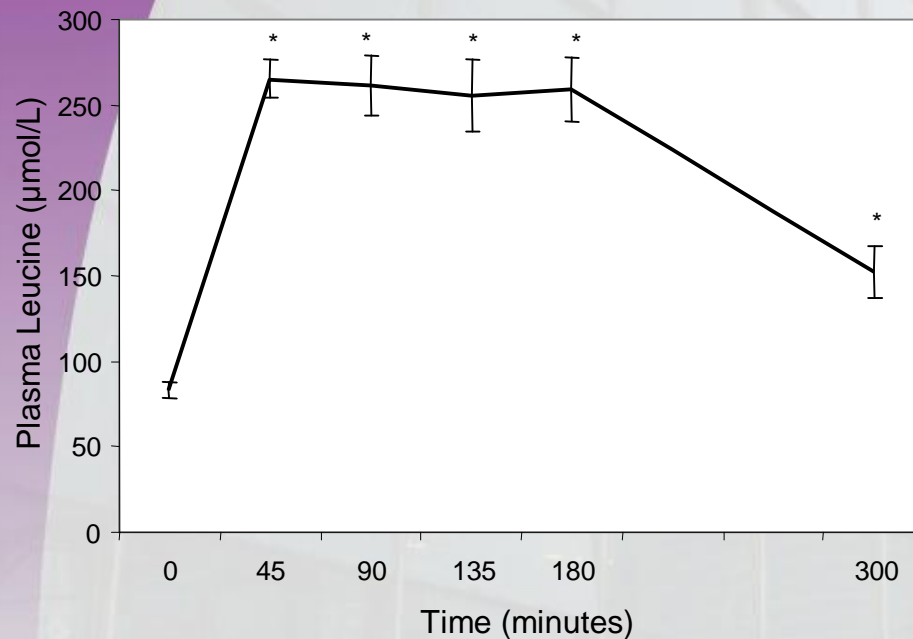


Leucine regulation of muscle protein synthesis in a complete meal

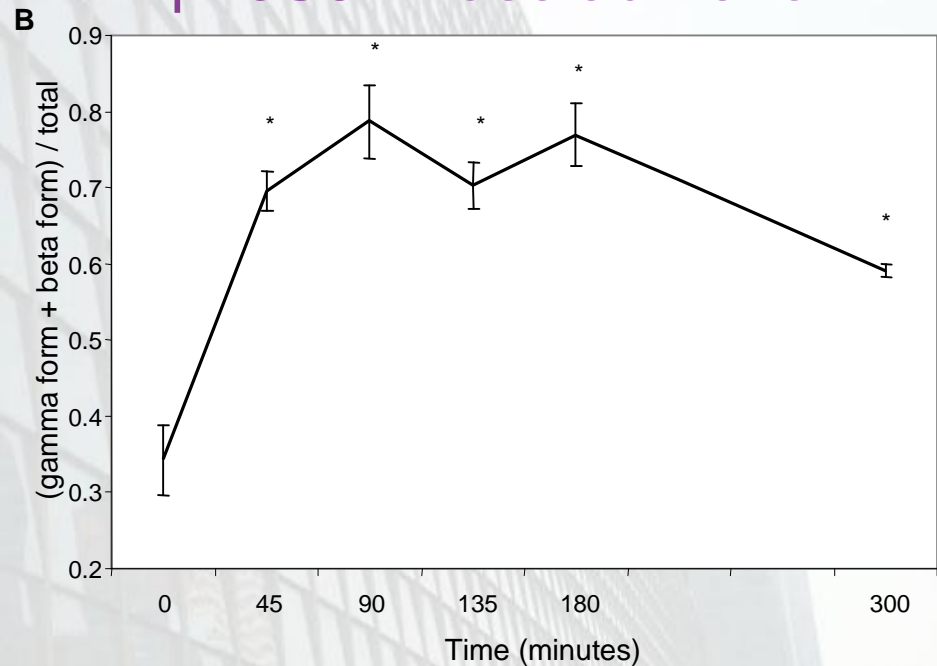
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*20% of kcal from whey protein:
breakfast meal 4 g diet (94 mg leu)*

Plasma leucine



p70S6 kinase activation



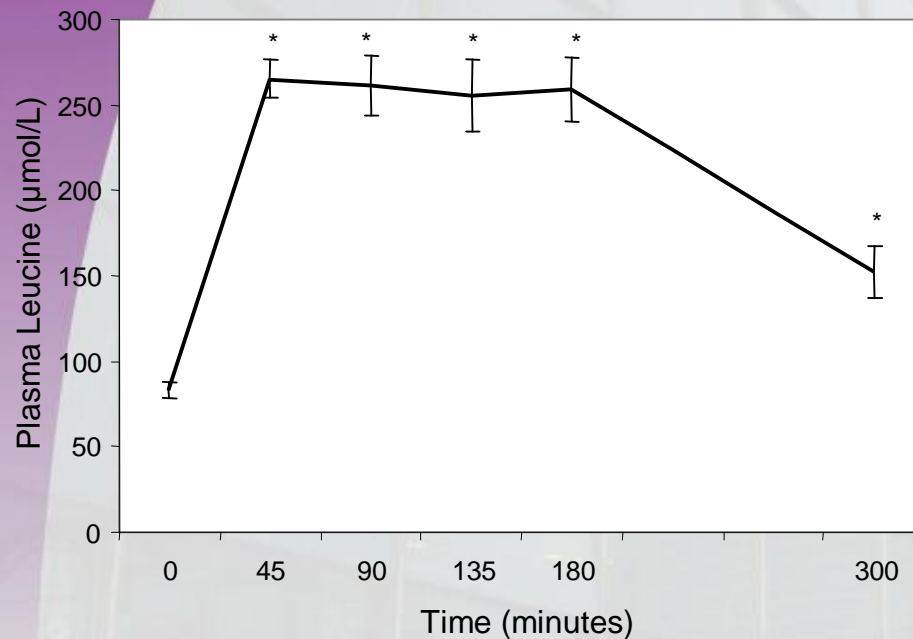


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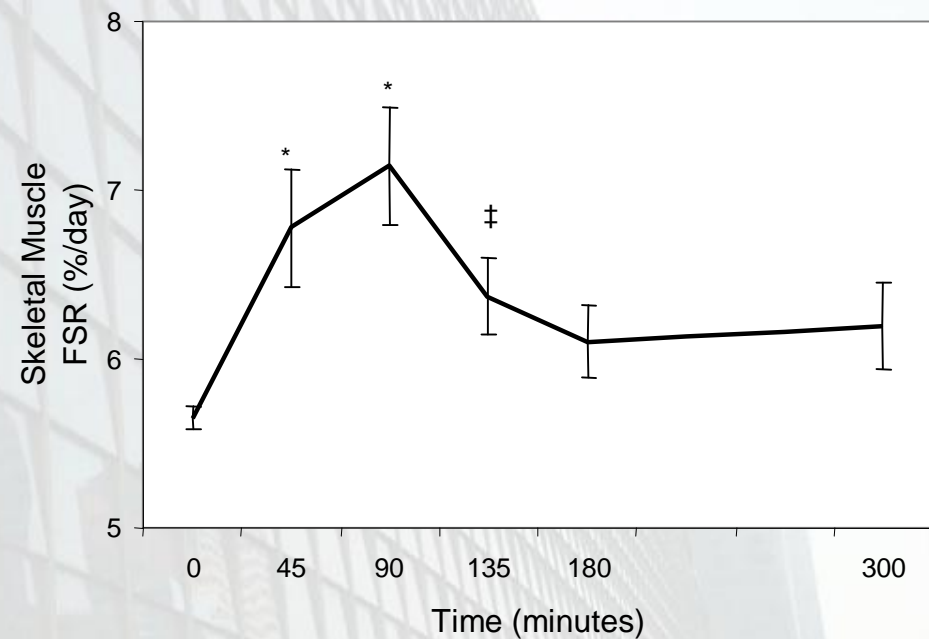
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Plasma leucine



Muscle protein synthesis

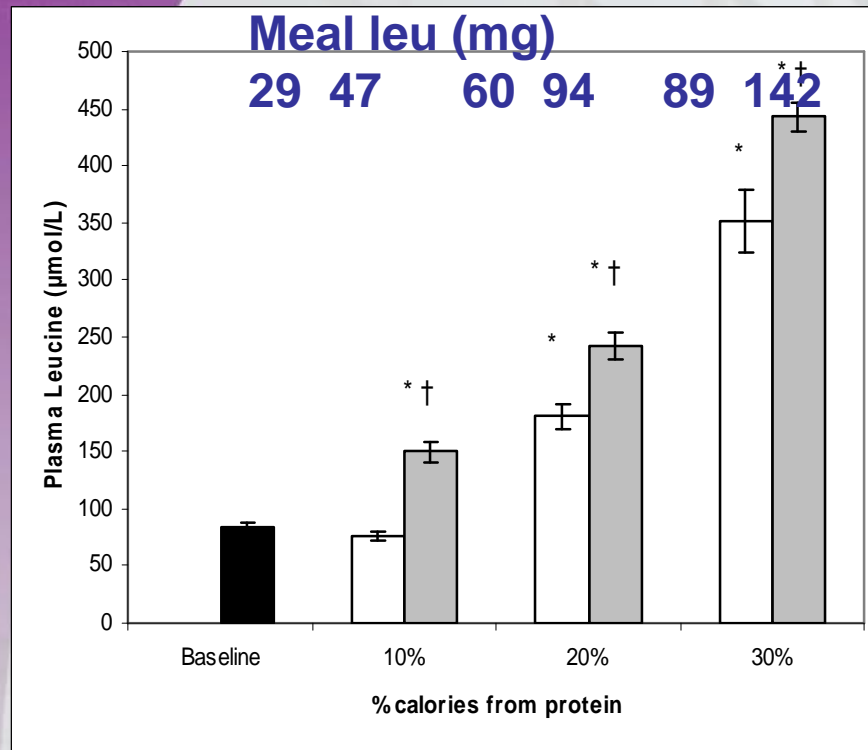




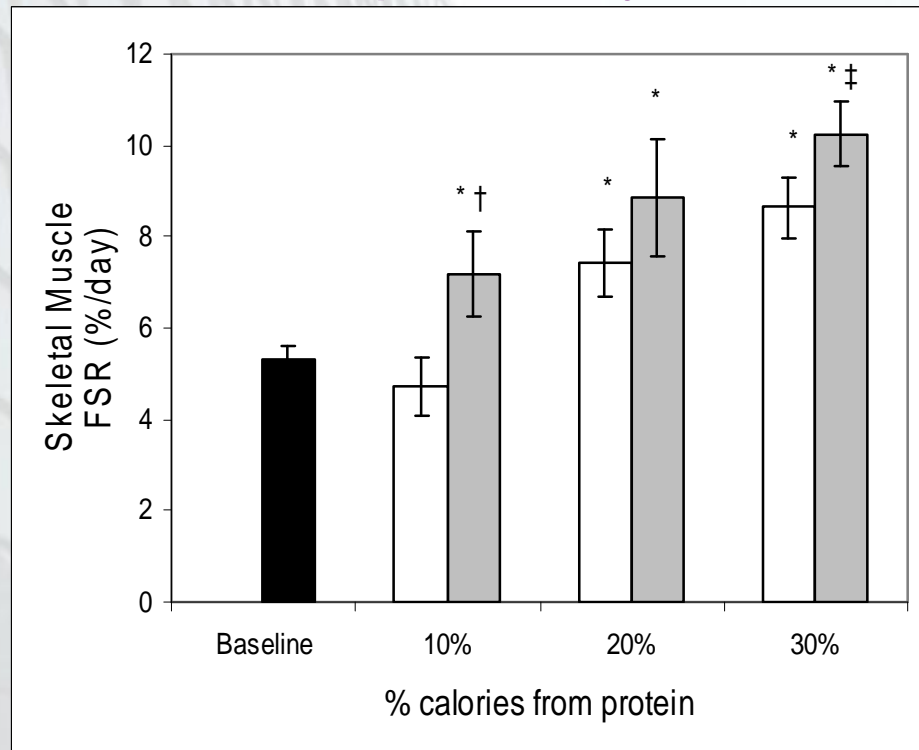
Comparison of whey vs. wheat proteins for stimulation of muscle protein synthesis



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Plasma leucine



Muscle protein synthesis



 whey protein
 wheat protein

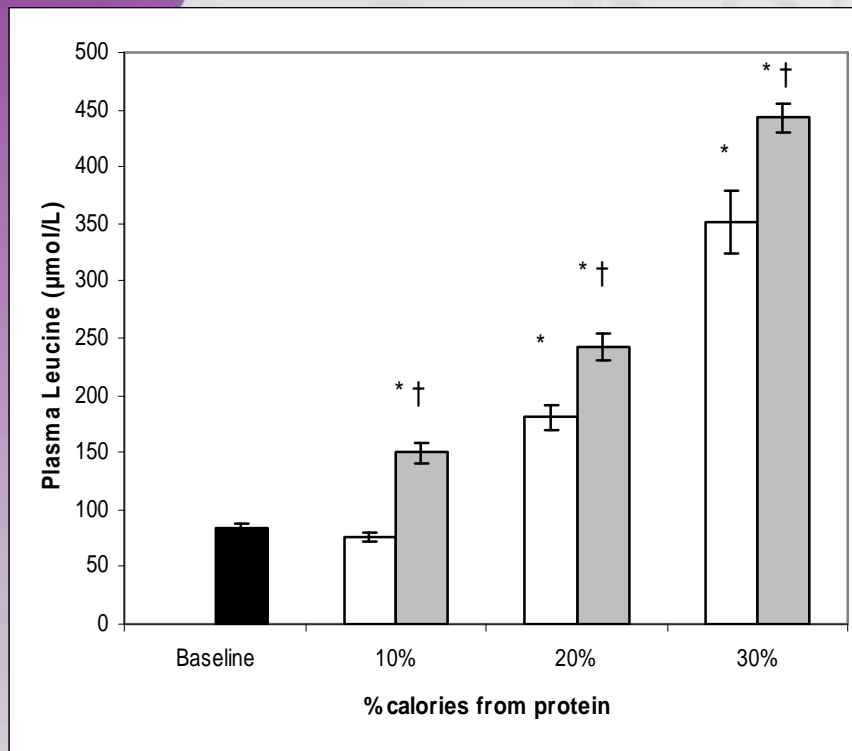
Norton et al. (submitted for publication)



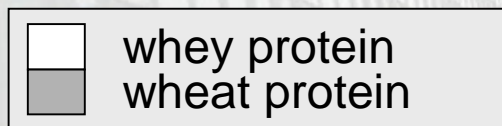
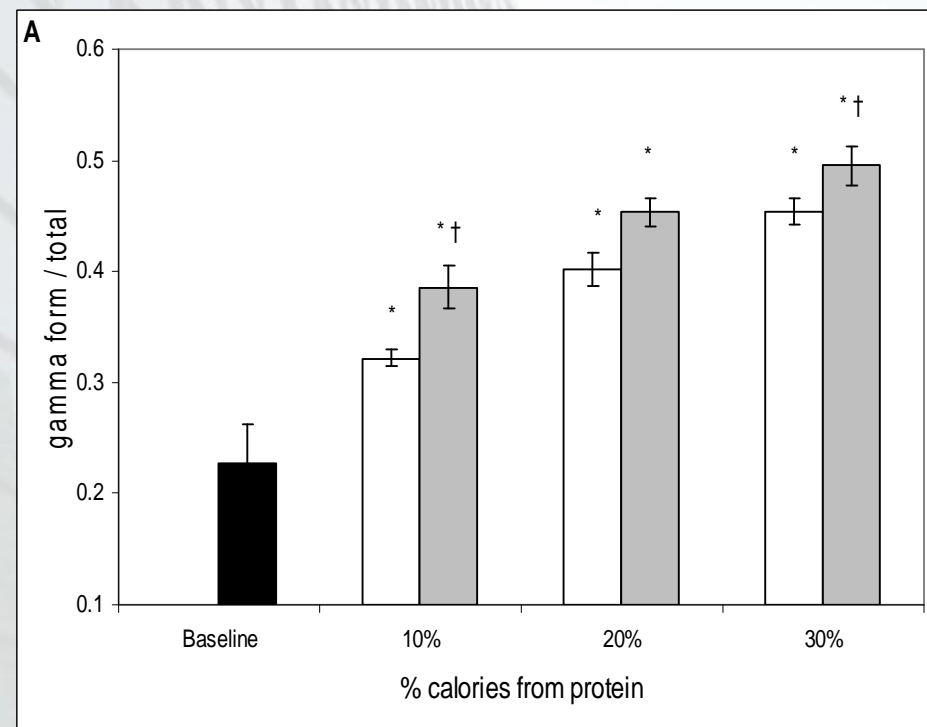
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Plasma Leucine



p70S6 kinase activation



Norton et al. (submitted for publication)



Protein goals for adult weight loss ...

2.5 g of leucine @ 3 meals/day

≥ 30 g of protein @ 3 meals/d

~ 1.5 g protein/kg body weight

Diet key for adults is correcting BREAKFAST



High protein weight loss studies

- ~ **Study 1.** 10 wk diet study, prepared meals
- ~ **Study 2.** 16 wk study, diet and diet + exercise restricted menus, highly supervised
- ~ **Study 3.** 16 month diet study, free-living subjects weekly meeting with weigh-in and 3-day weighed food records



Overview of weight loss diets

diets with: 1600 kcal/day

PRO diet: protein (> 1.5 g/kg.d)
carbohydrates (< 150 g/day)
fat $\sim 30\%$ of kcals

Diets as percent of energy intake:

PRO group:

40% carbohydrates, 30% protein, 30% fat

CHO group:

55% carbohydrates, 15% protein, 30% fat



Exercise Treatments

no EX: < 100 min/wk of walking

EX: > 210 min with 5 days/wk walking
and 2 days resistance training

Treatment Groups: (n = 12)

PRO, PRO + Ex, CHO, CHO + EX



Changes in Body Weight and Composition

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Diet effects

Groups

Body weight (kg)
Fat mass (kg)
Lean mass (kg)

CHO Groups

-7.3
-5.3
-1.9

PRO

-9.3*
-7.3*
-1.2

Exercise effects

Body weight (kg)
Fat mass (kg)
Lean mass (kg)

EX

-8.3
-7.2*
-0.7

no EX

-8.3
-5.5
-2.4*

* $P < 0.05$



Changes in Blood Lipids (mg/dL)

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Diet Effects

total cholesterol
LDL-C
HDL-C
TAG

CHO Groups

-19.7
-14.7*
- 3.1
-19.5

PRO Groups

- 8.1
- 3.1
+0.4*
-63.8*

Exercise effects

Total cholesterol
LDL-C
HDL-C
TAG

EX

-12.8
- 8.1
- 0.4
-50.5

no EX

-15.1
-10.1
- 2.3
-32.8

* $P < 0.05$



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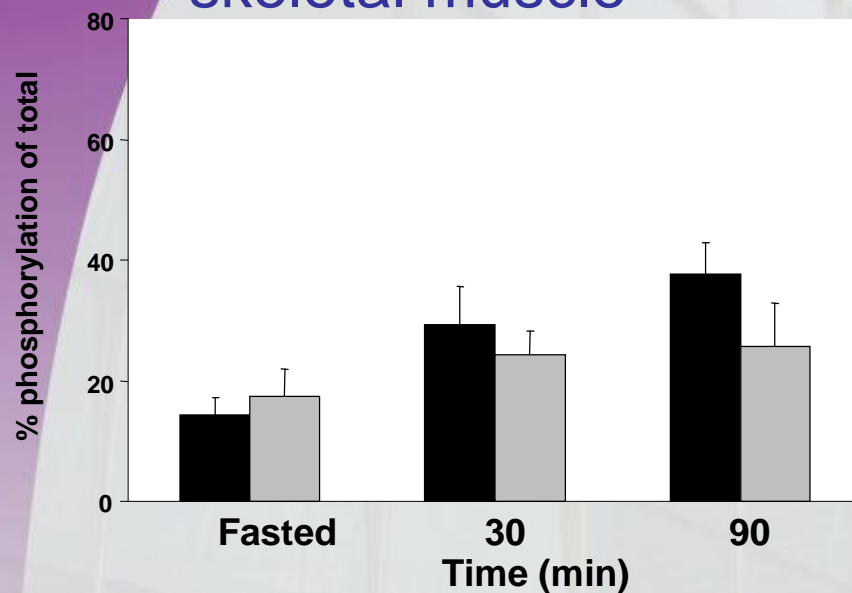
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Muscles and adipose Akt after meal

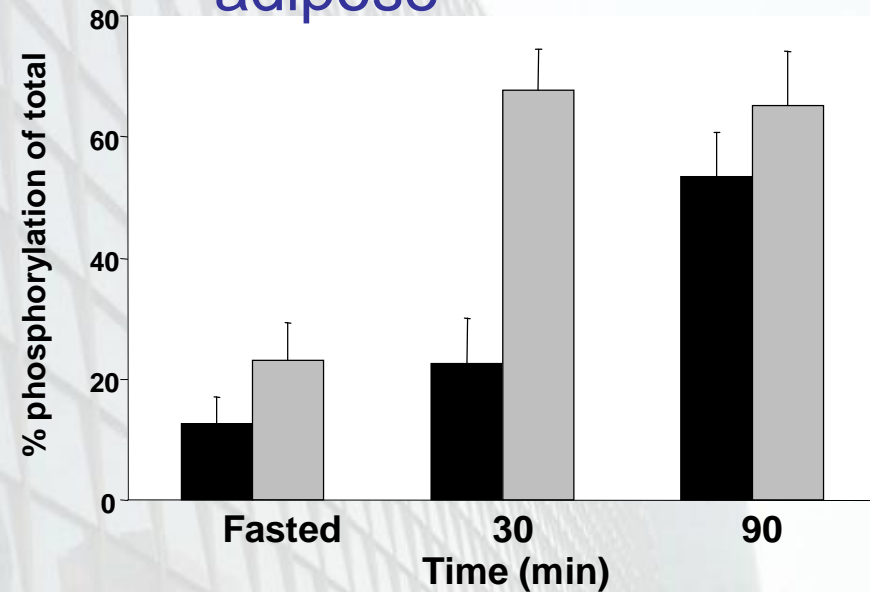
PRO = 30% of kcal

CHO = 15% of kcal

skeletal muscle



adipose



■ PRO

■ CHO



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Body
composition

Metabolic

è weight loss

é loss of body fat

é protein sparing

è TG (VLDL)

é HDL

é glycemic control

Metabolic Syndrome

Outcomes with high protein, low Carb diets