

# Establishing a dietary framework to maintain muscle in health and disease

**Douglas Paddon-Jones, Ph.D.**

*Professor, Nutrition and Metabolism  
The University of Texas Medical Branch*



# Disclosures

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- **Dr. Paddon-Jones is a Research Investigator with funding from the National Institute of Health (NIH), Dairy Research Institute and the National Space Biomedical Research Institute (NSBRI).**
- **Dr. Paddon-Jones is a member of the Scientific Advisory Board or Speaker's Bureau for the National Dairy Council, US Dairy Export Council, American Egg Board, Texas Beef Council and Abbott Nutrition.**

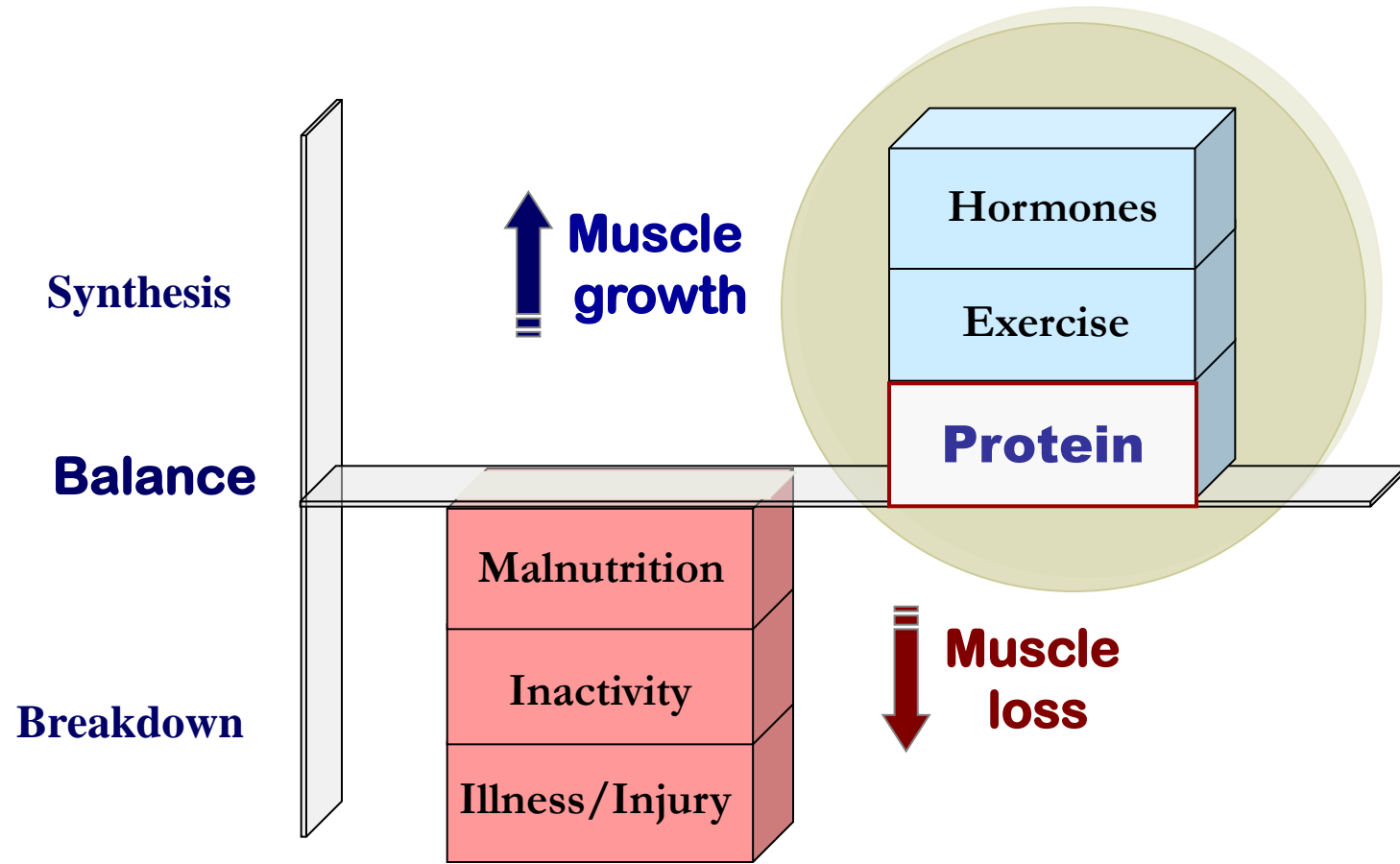
# Overview

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1. building muscle in response to protein
2. how much protein do we need – and when ?
3. protein distribution and daily recommendations
4. priority areas: what happens if you are injured or sick?
5. sarcopenia and a new approach to interventions



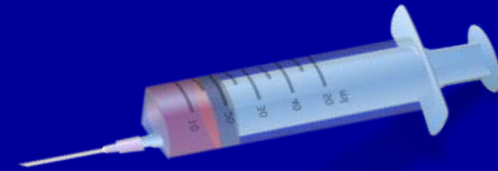
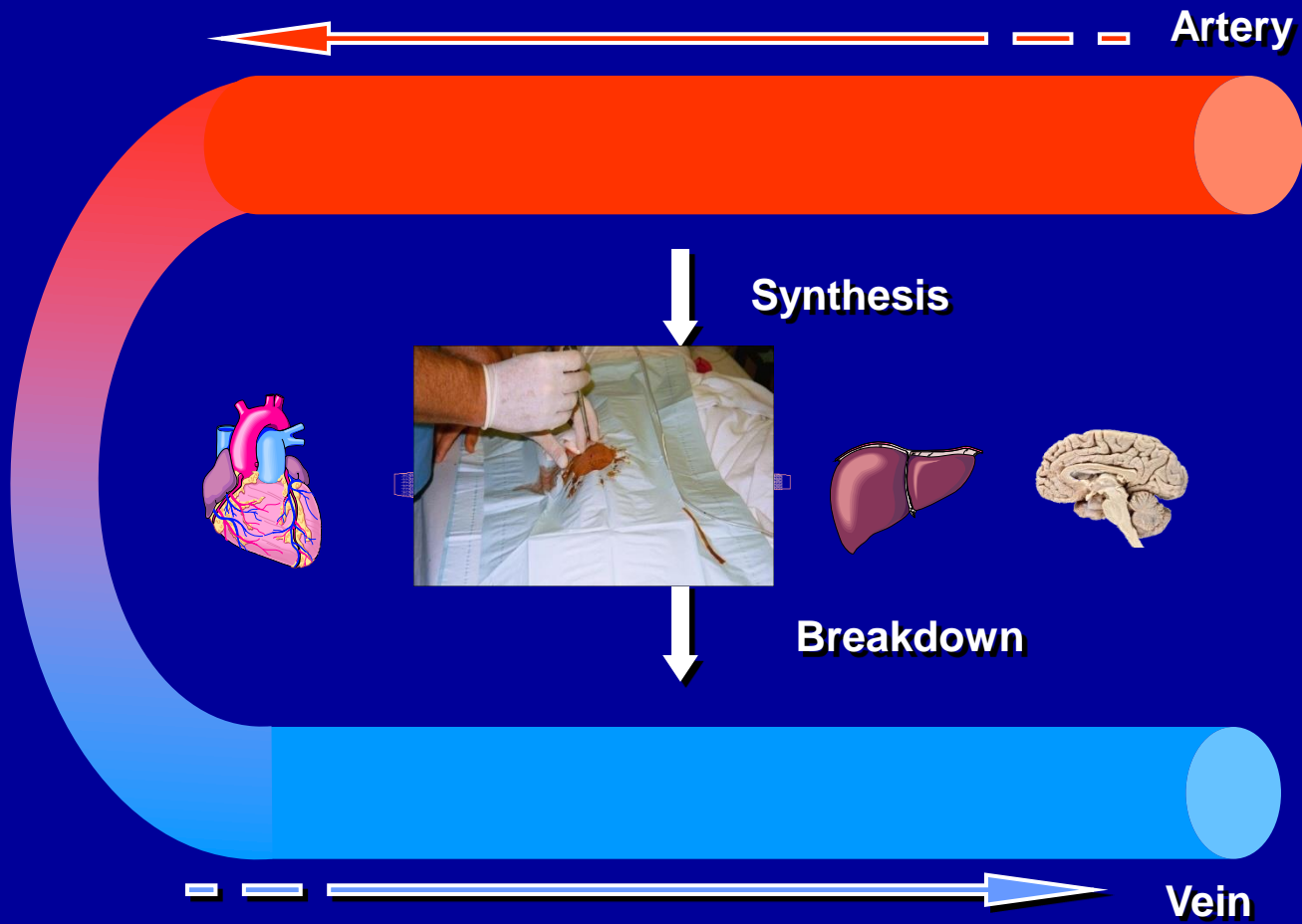
# Maintaining Muscle Mass and Function



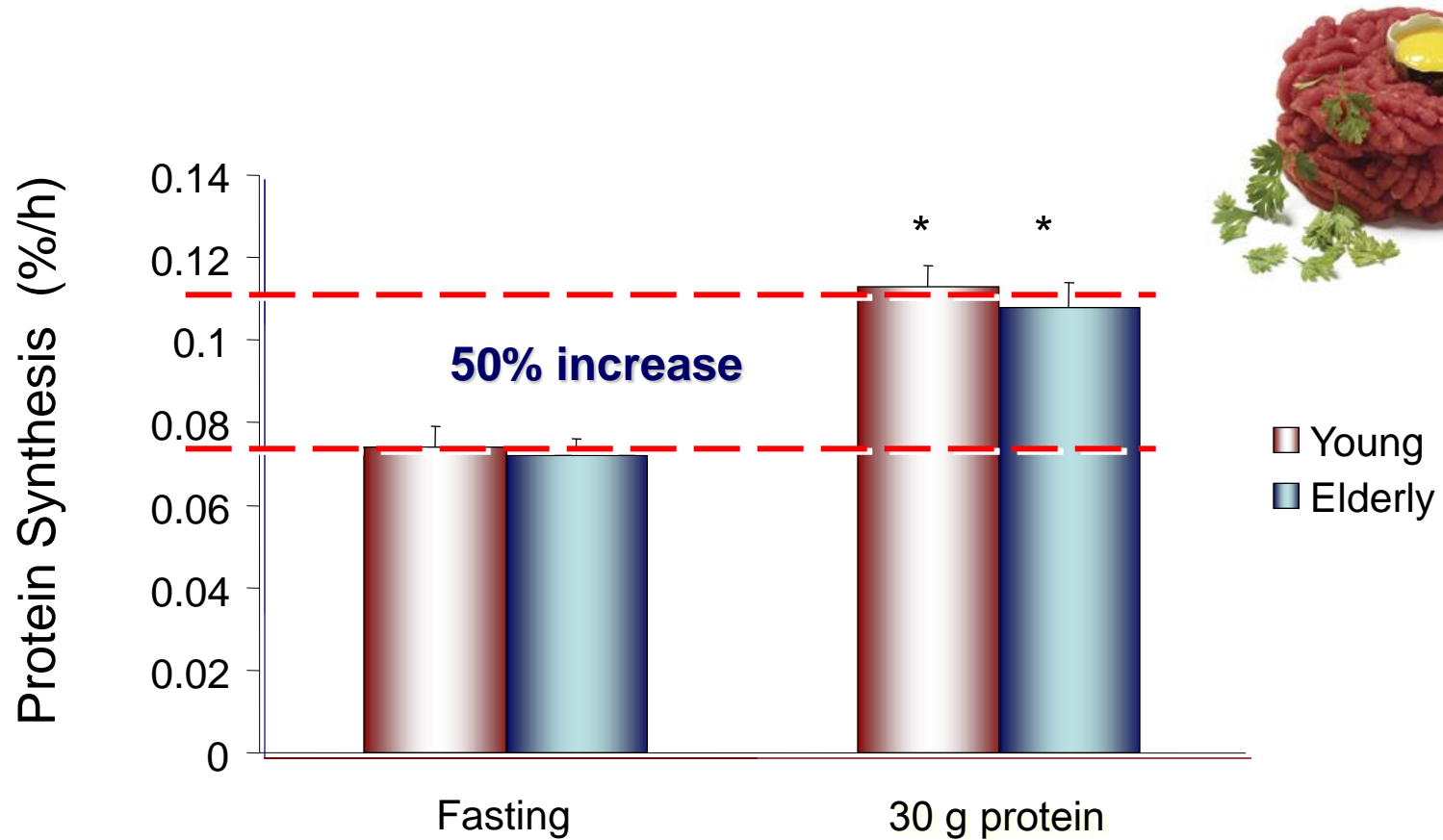
# 1. Building muscle in response to protein



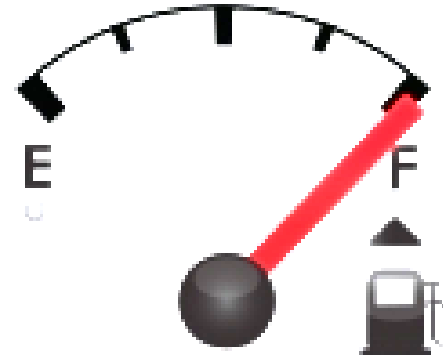
# Stable Isotope Methodology (*ring-<sup>13</sup>C<sub>6</sub>* - Phenylalanine)



# Stimulating Muscle Growth with Protein



## 2. How much protein do we need – and when ?



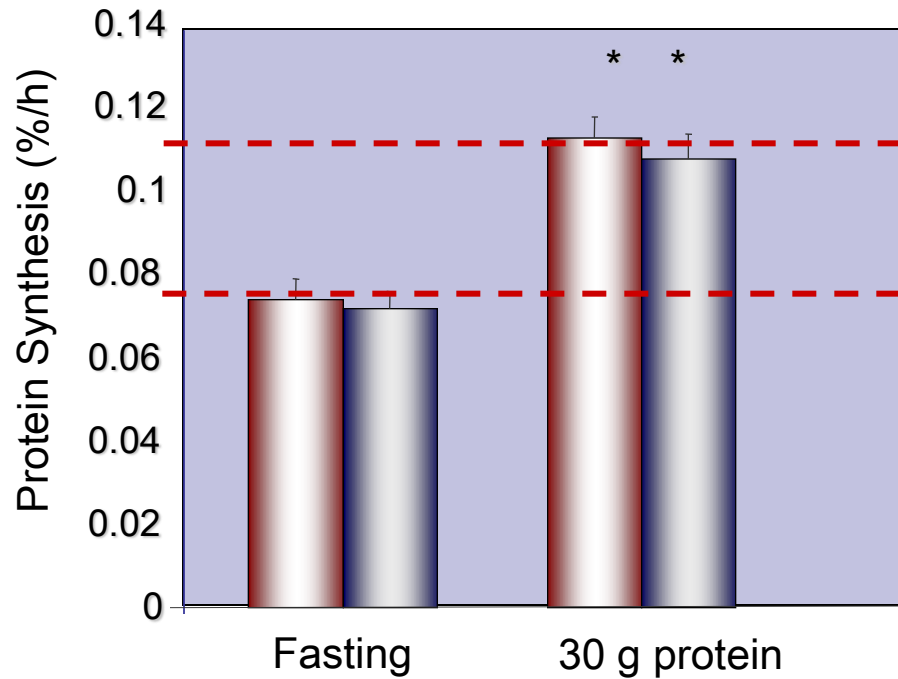


# How much protein do we need ?

- a message of moderation -

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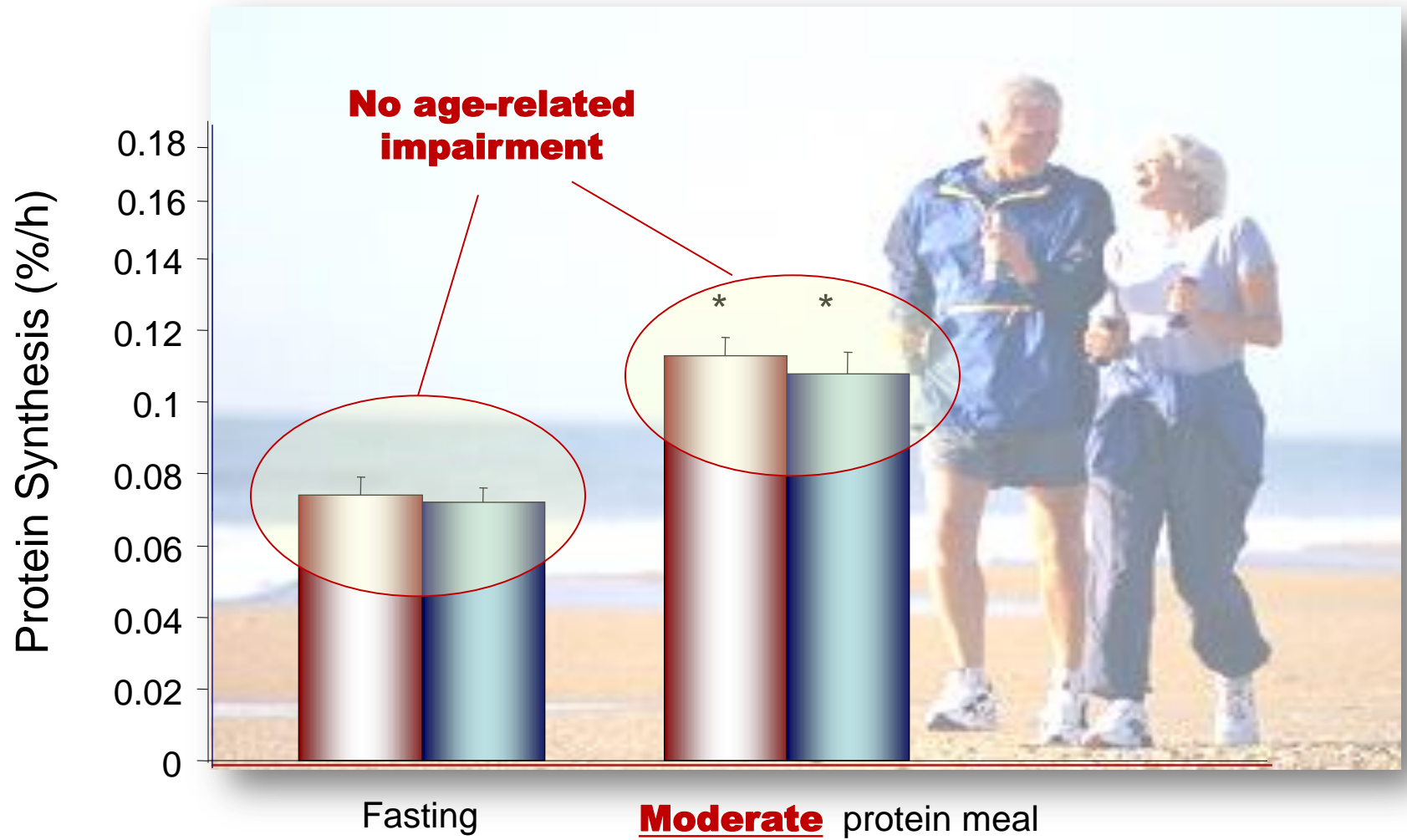
30 g protein



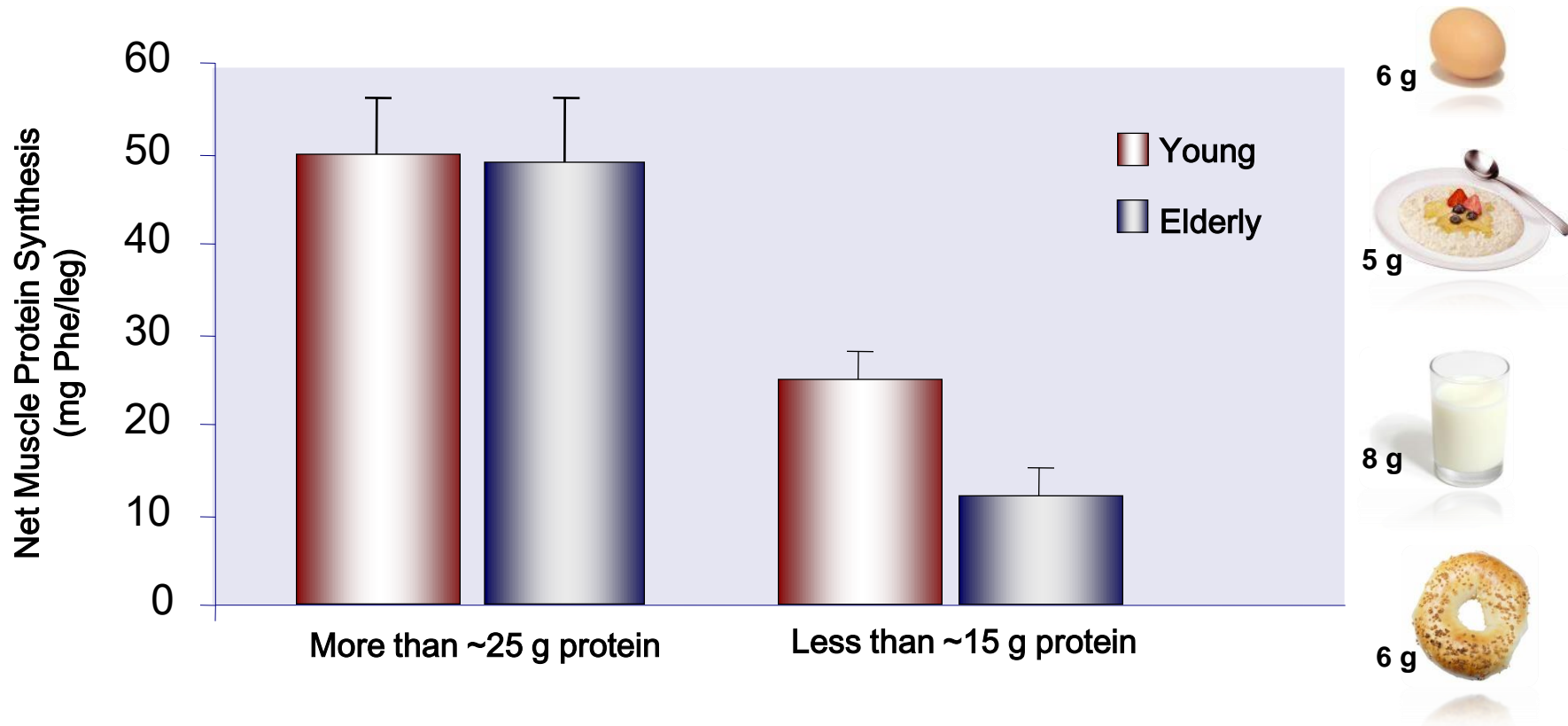
Symons et. al. AJCN, 2007

Symons et. al. JADA. 2009

# Key points



# Age-related dose-response



# Protein + Exercise

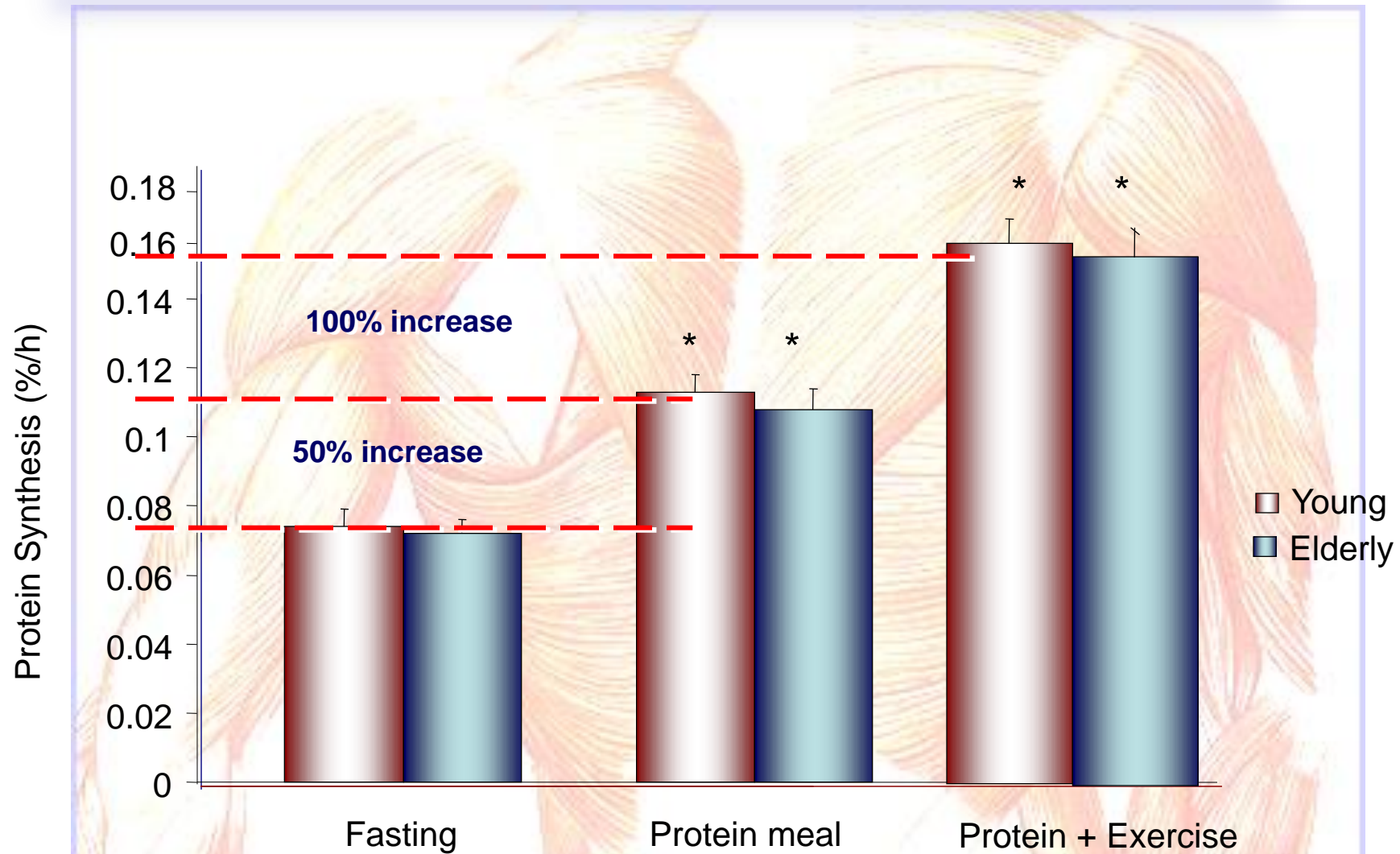
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# Additive Effect of Protein and Exercise



# Timing of Protein and Exercise

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<u>Meal</u>	<u>Appearance in plasma</u>	<u>Peak anabolic window</u>
Whey Protein Amino Acids	10-20 minutes	Consume 0-60 minutes <u>post</u> exercise
Intact Proteins (beef, fish etc.)	90 + minutes	Consume approx.. 60-90 minutes <u>before</u> exercise



# 3. Protein distribution and recommendations

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# How Much Protein Do We Eat?

**HIGH PROTEIN  
DIETS**

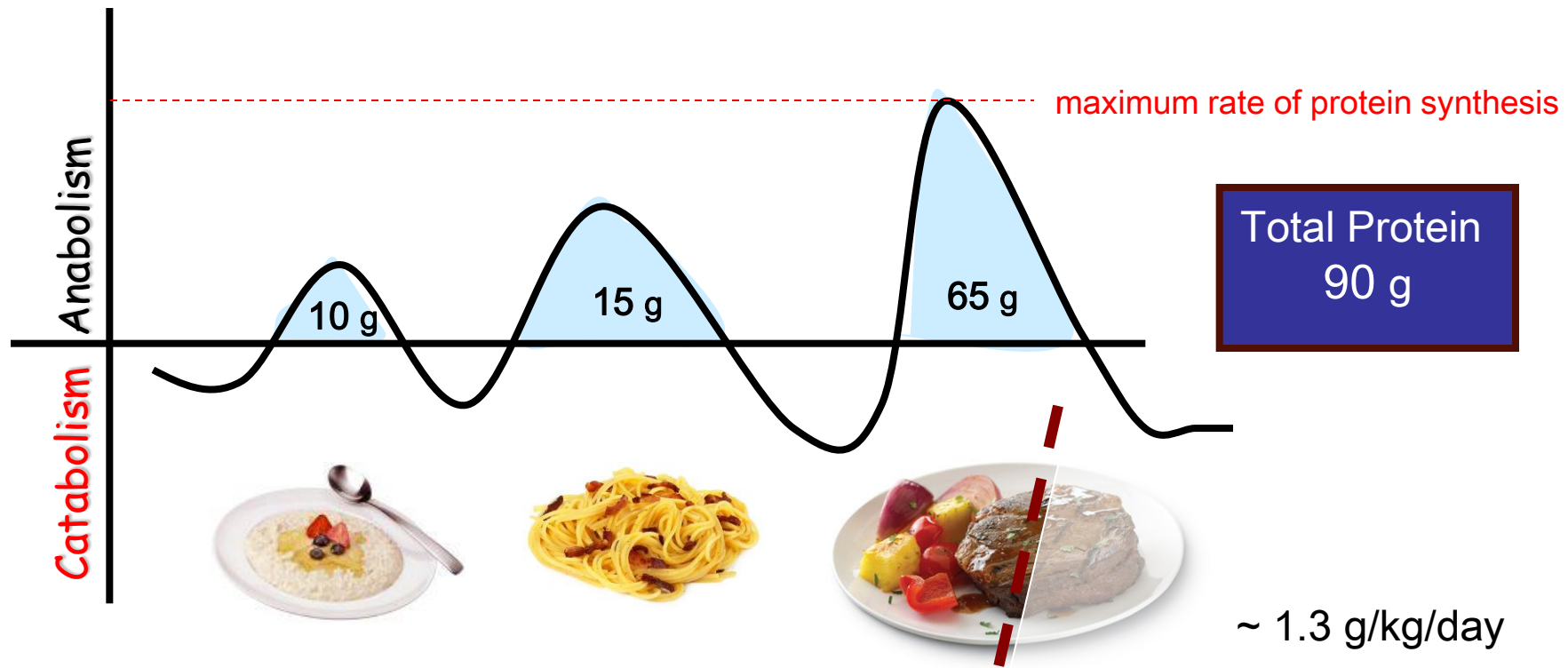
Protein consumed in Australia (grams per day)

Males	5 <sup>th</sup> %	50 <sup>th</sup> %	95 <sup>th</sup> %
19-30y	77	115	186
31-49y	79	107	155
50-69y	63	96	144
70+y	...good thing I moved		
Females			
19-30y	47	74	120
31-49y	50	73	107
50-69y	47	70	101
70+y	38	61	95

Source : NNS 95 (M. Noakes)

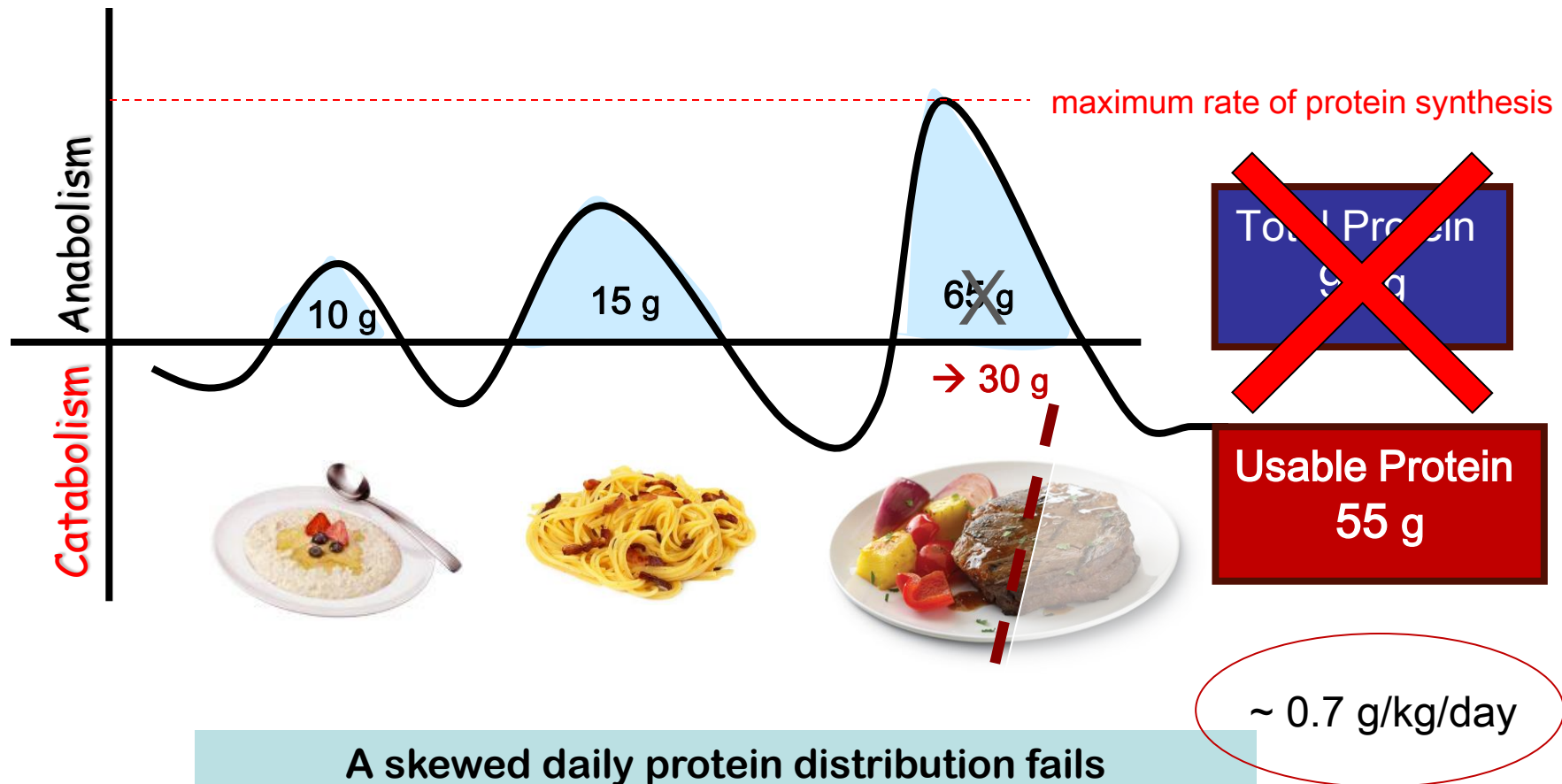


# Daily protein distribution - typical ? -



A skewed daily protein distribution fails to maximize potential for muscle growth

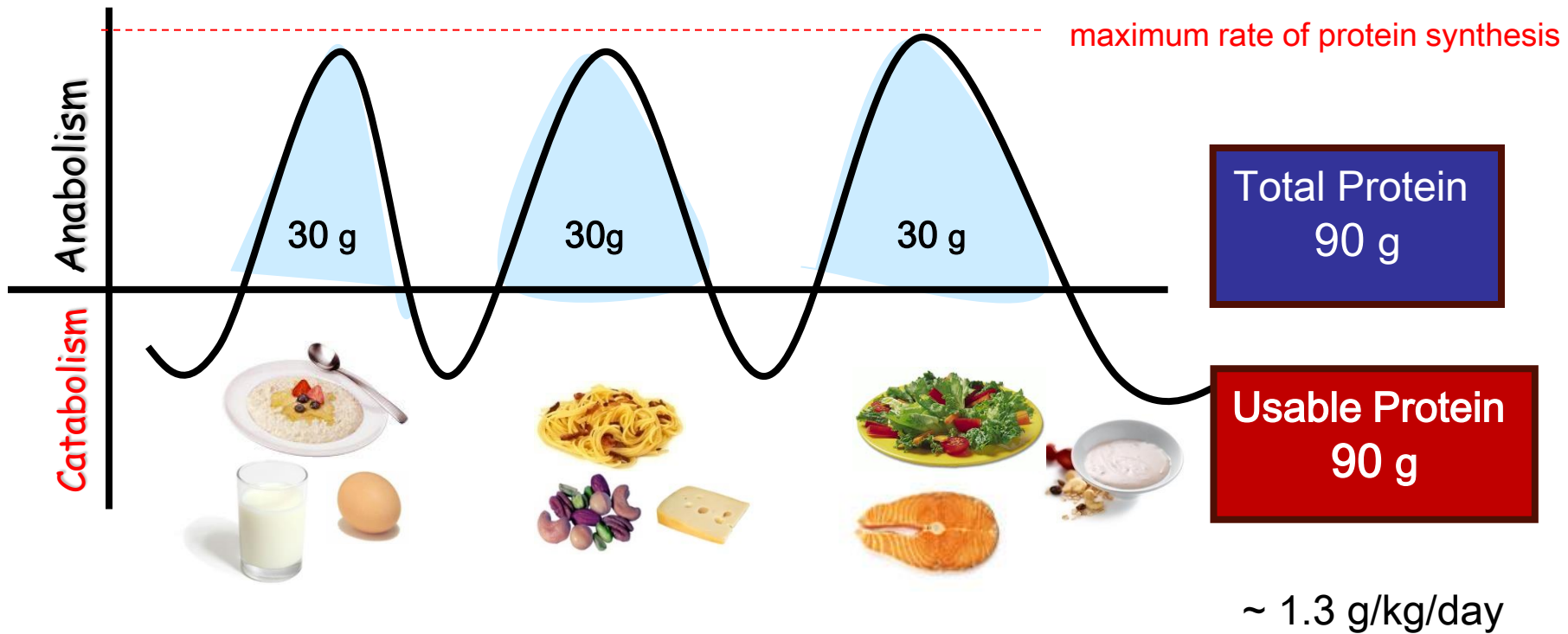
# Daily protein distribution - typical ? -



A skewed daily protein distribution fails to maximize potential for muscle growth

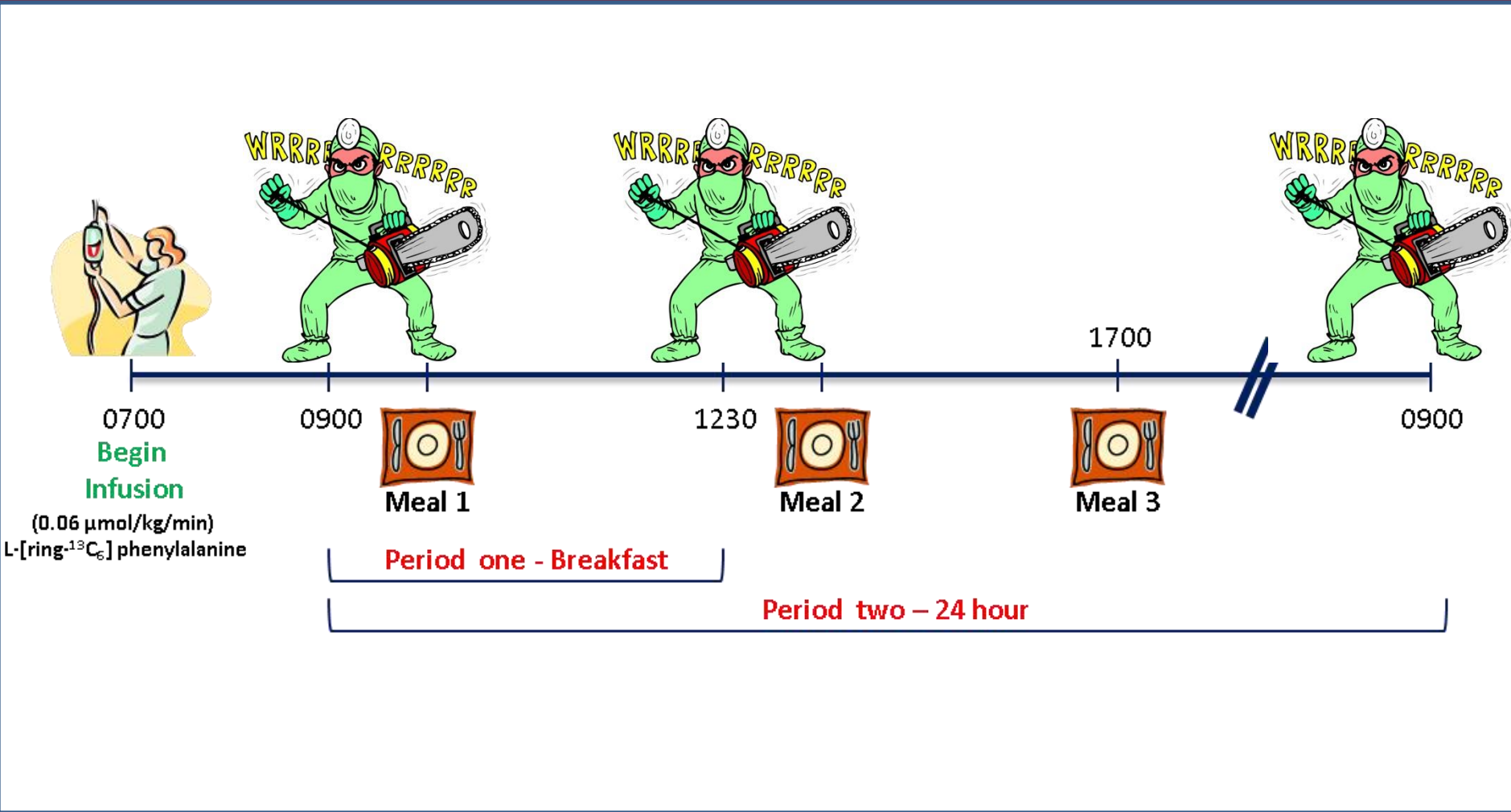
# Daily protein distribution

## - *Optimal* -



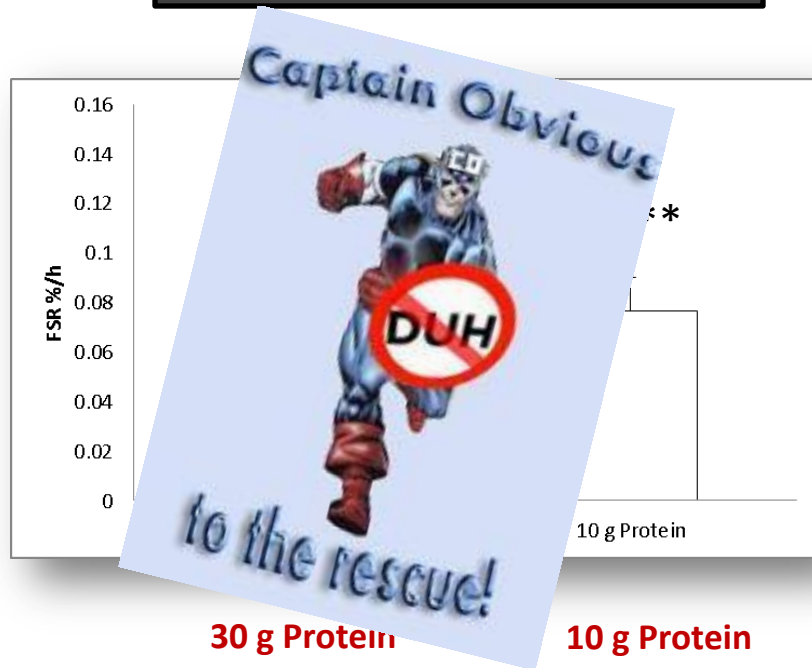
Repeated maximal stimulation of protein synthesis  
→ increase / maintenance of muscle mass

# Metabolic Study



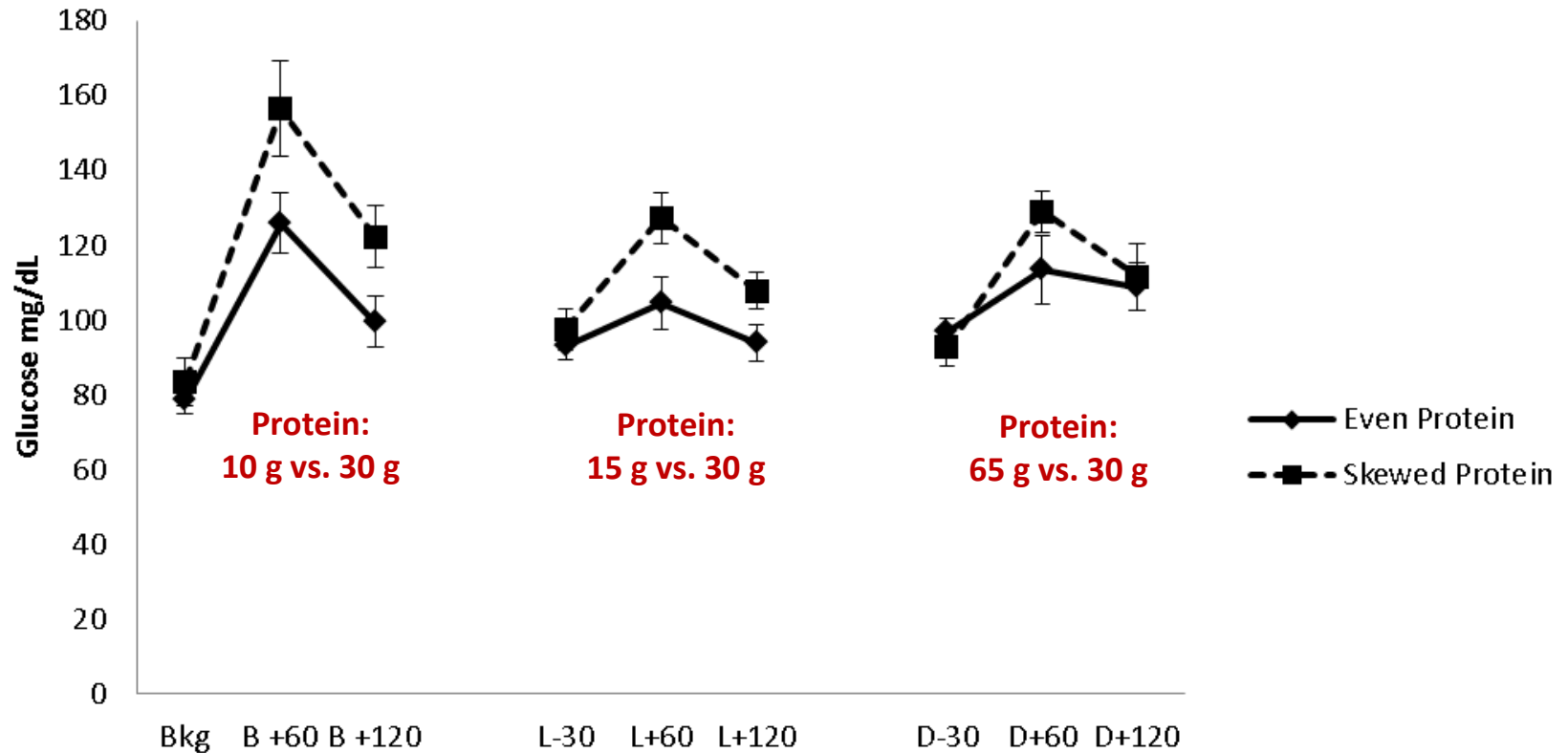
# 24 hr protein distribution impacts the potential for muscle growth and repair

## Breakfast Response

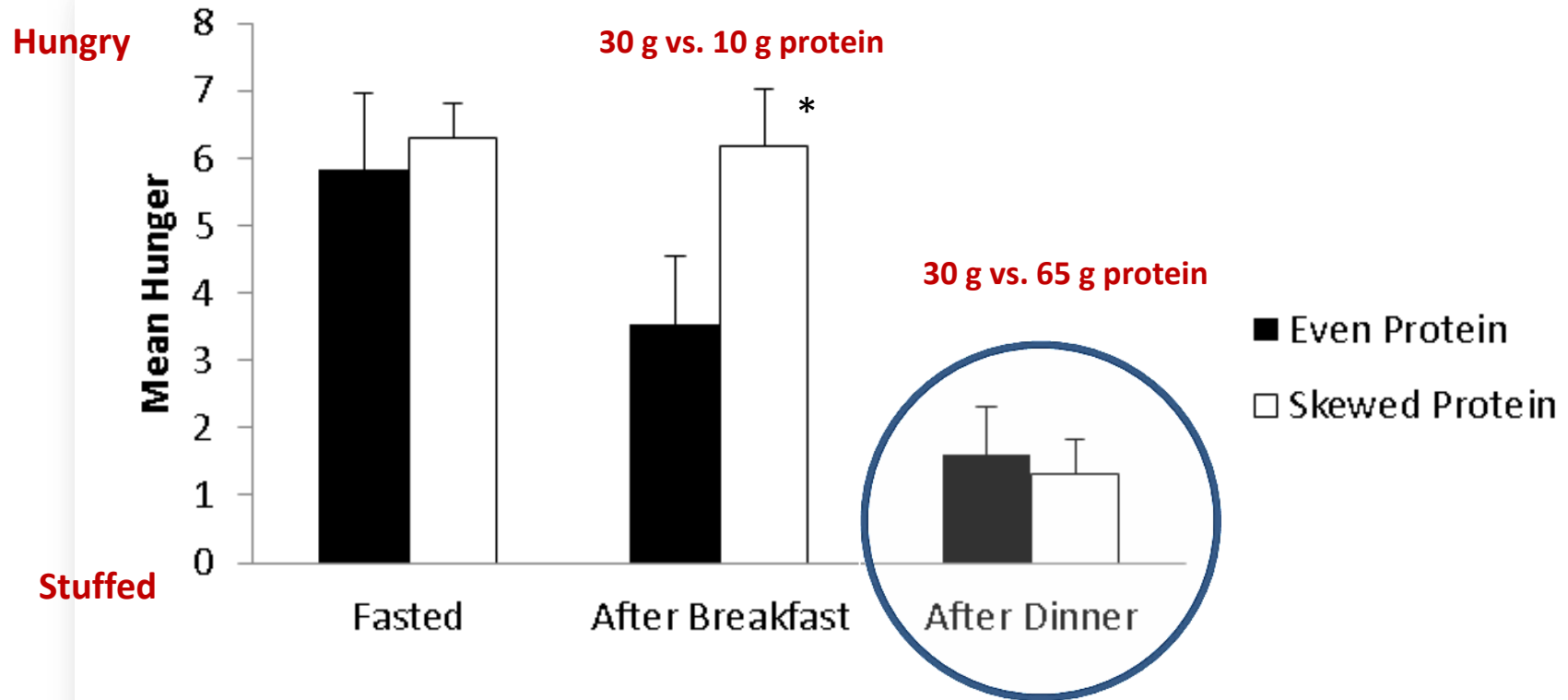


Mamerow, et.al. 2012

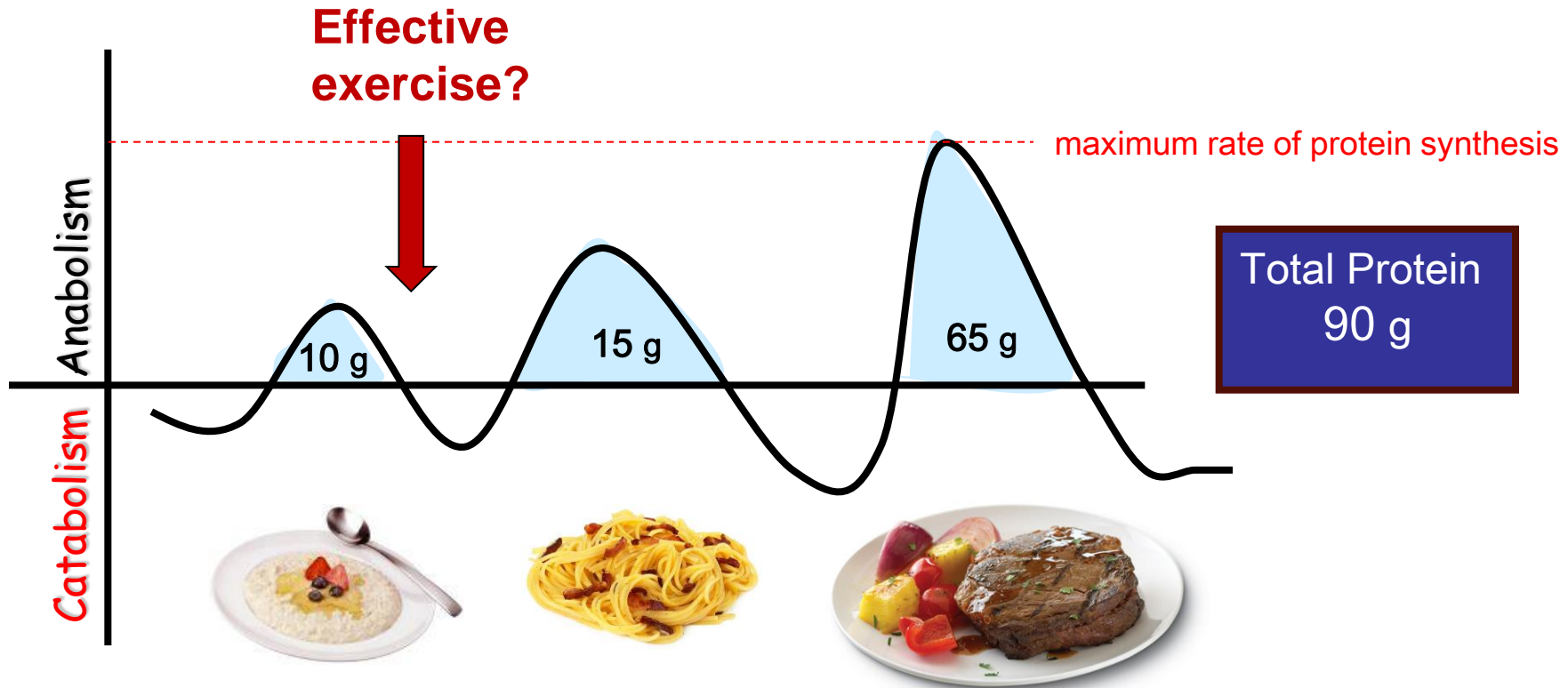
# Protein Distribution: Glucose Response



# Self-reported hunger: 30 g/meal may be enough

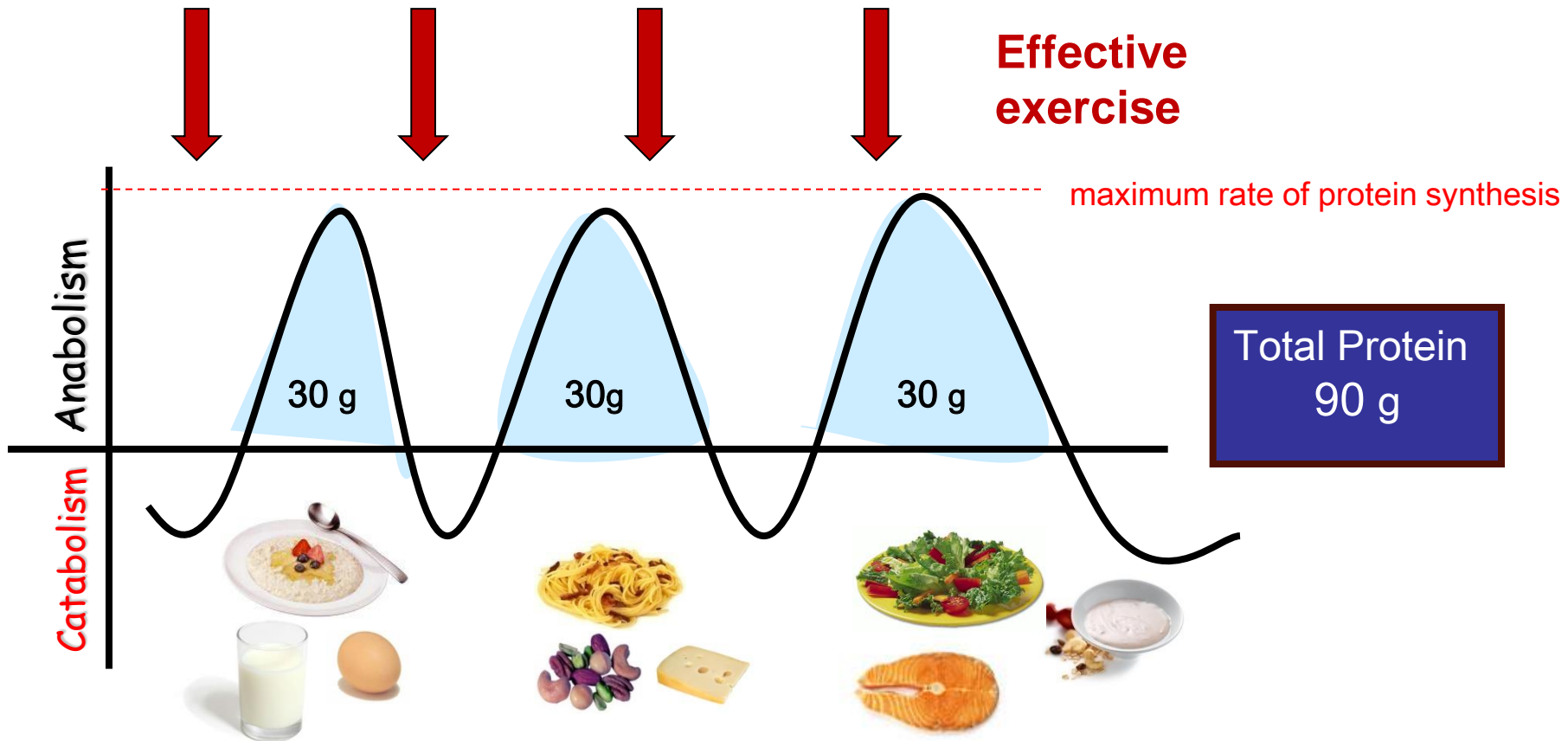


# Exercise and protein distribution





# Exercise and protein distribution



## 30-gram protein breakfast ideas

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**Breakfast #1:** Smoothie with 1 scoop vanilla whey protein powder + 1 cup milk +  $\frac{1}{2}$  cup strawberries + 1 English muffin

**Breakfast #2:** 2 scrambled eggs + 1 slice toast + 1 cup coffee (1/2 milk) +  $\frac{1}{2}$  cup yogurt/melon

**Breakfast #3:**  $\frac{1}{2}$  cup cottage cheese with  $\frac{1}{2}$  cup peaches + 1 cup coffee (1/2 milk) + 1 slice toast with peanut butter

**Breakfast #4:**  $\frac{1}{2}$  cup high-protein oatmeal with 1 T. walnuts +  $\frac{1}{2}$  cup Greek yogurt with 1 cup coffee (1/2 milk) + 1 ham slice

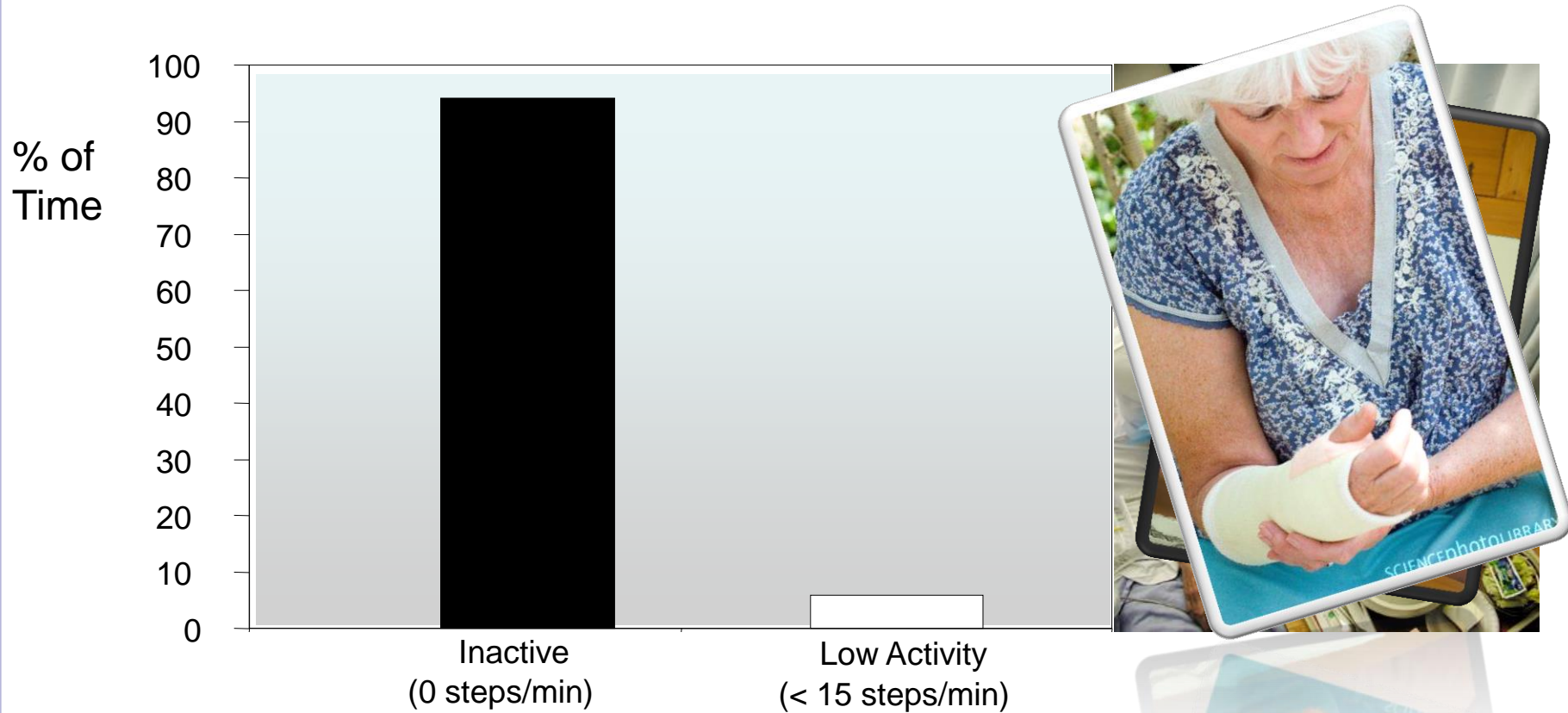
**Breakfast #5:** 1 egg, Canadian bacon, and cheese muffin sandwich + 1 cup milk or chocolate milk

#### 4. priority areas: dealing with injury or illness

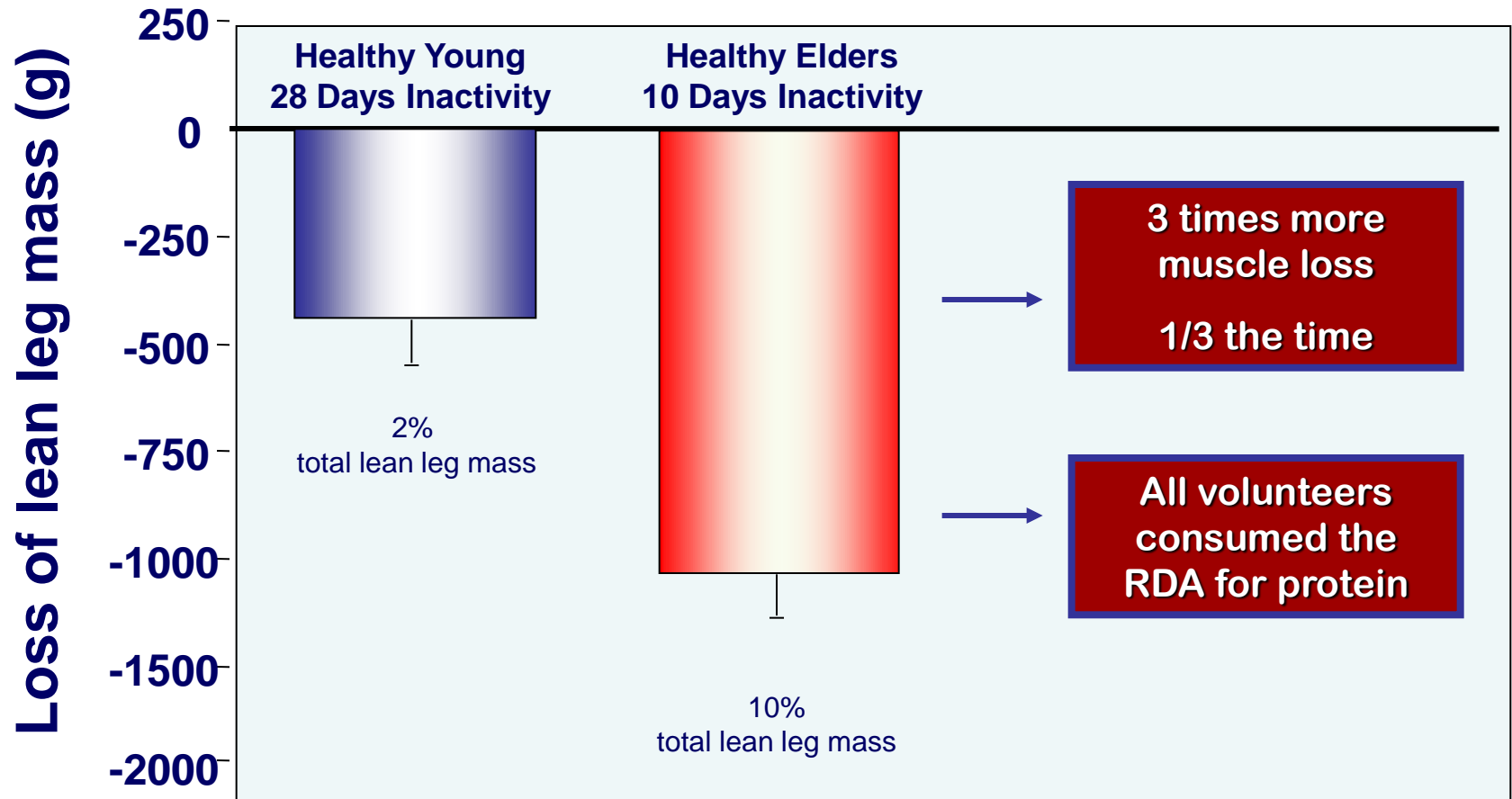


# Bed rest is a defacto treatment modality

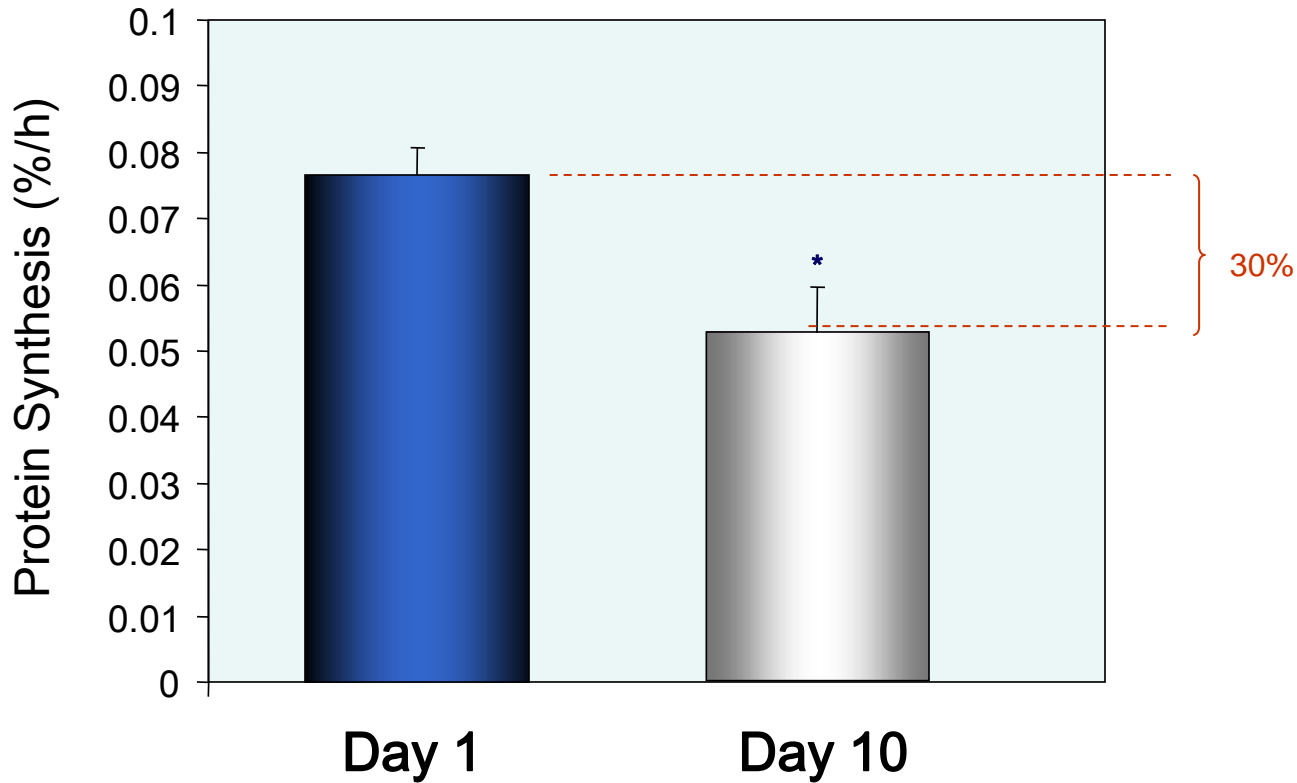
*- if you're hospitalized you become inactive -*



# Inactivity and Aging Muscle

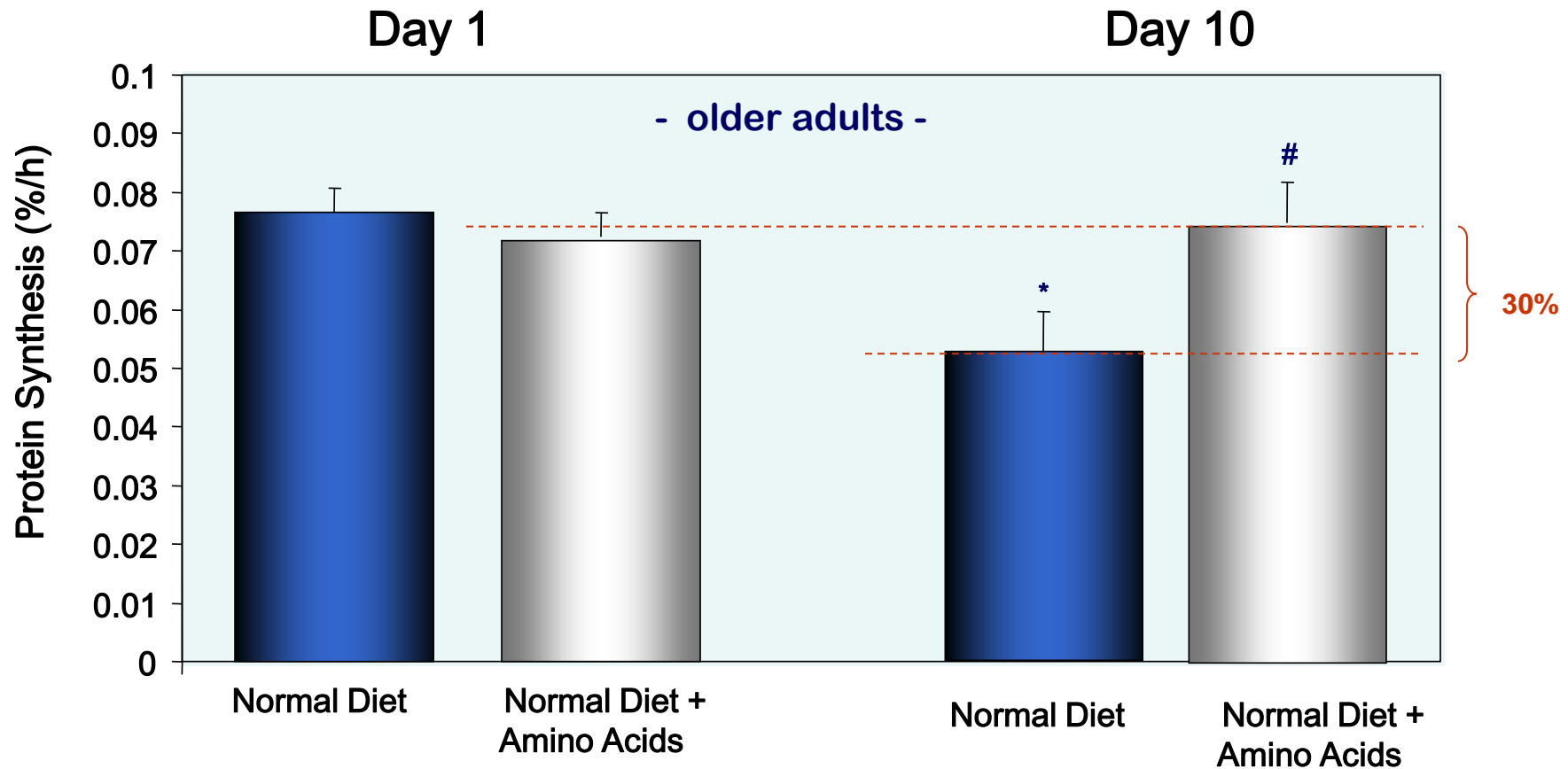


# Inactivity reduces muscle protein synthesis

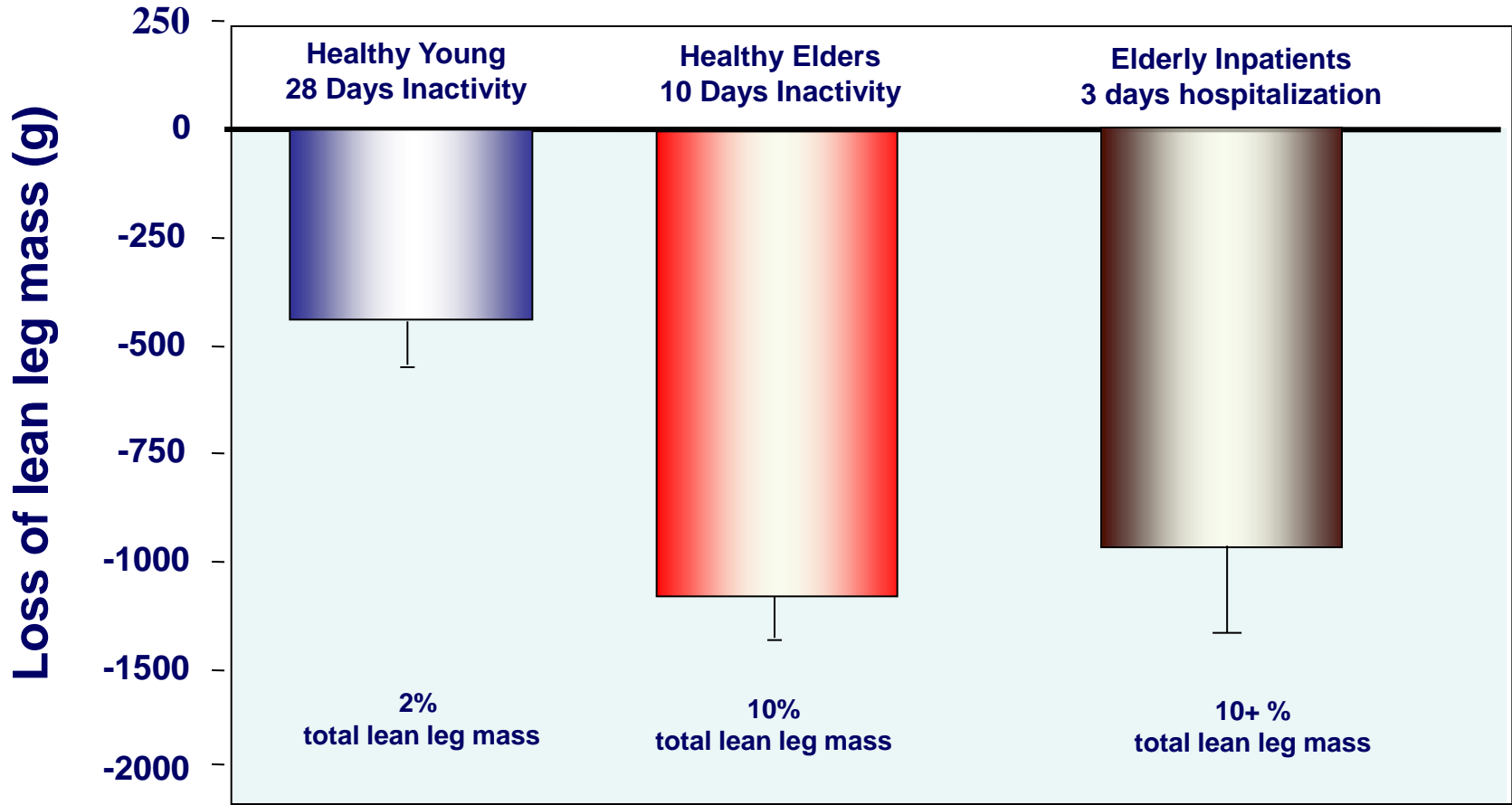


24 h muscle protein synthesis during 10 day of inactivity in elders  
(stable isotope methodology)

# Protein combats muscle loss during inactivity



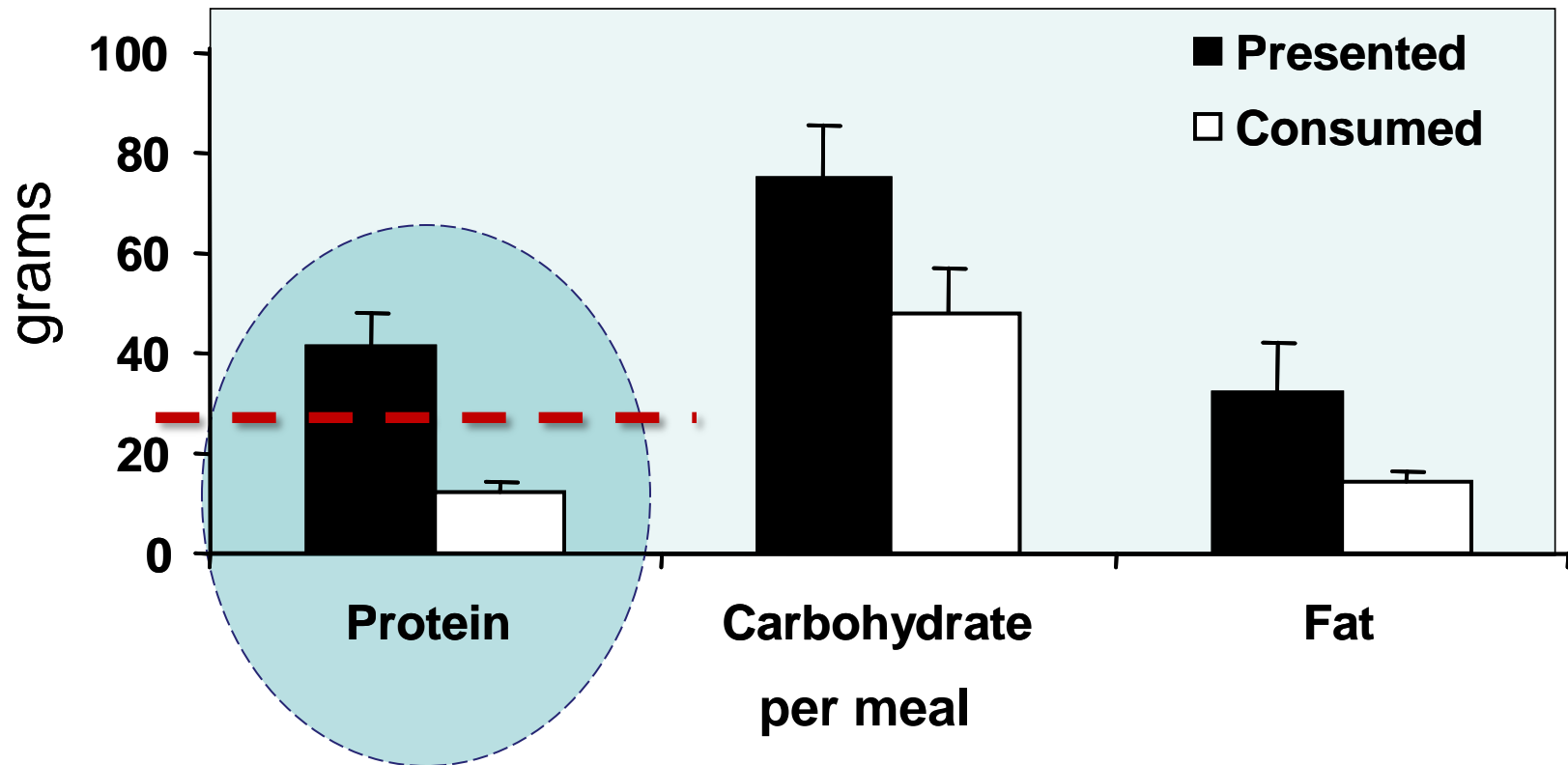
# Muscle Loss in Hospitalized Older Adults





# Are our older inpatients eating enough ?

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**High simple sugar desserts  
accounted for 50% of the protein  
consumed by inpatients**



**Delicious ? ...maybe.... Healthy ?.... not so much**

## 5. Sarcopenia and a new approach to interventions



# SARCOPENIA

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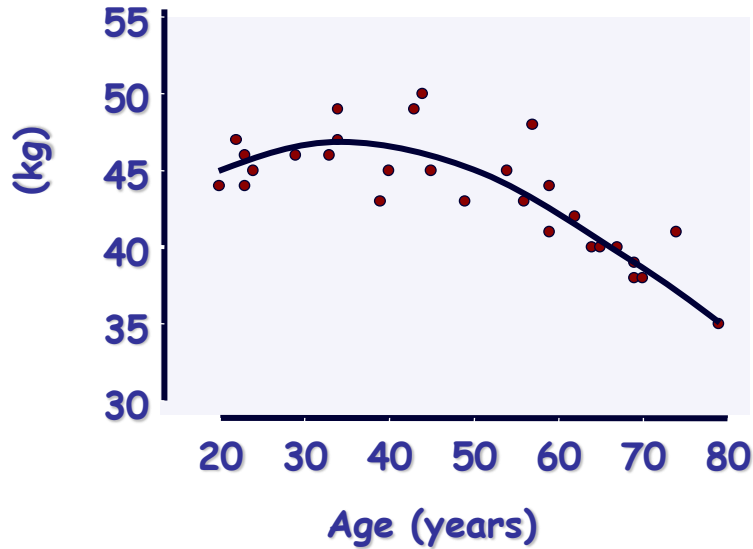
- Decline in basal energy expenditure
- Reduced insulin sensitivity
- Reduced muscle strength
- Reduced physical performance
- Increased risk for falls
- Increased health-related expenses
- Increased morbidity
- Increased mortality

Adapted from: Dr. OMAR JALUUL

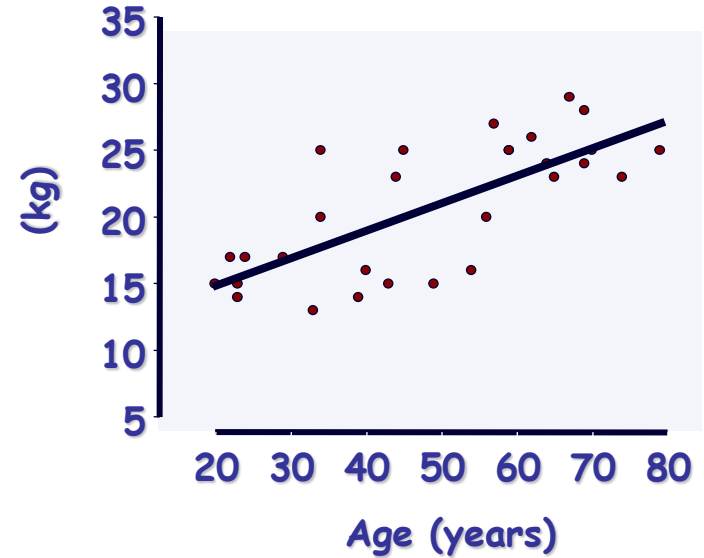


# Sarcopenia: - definitions -

## Lean Body Mass

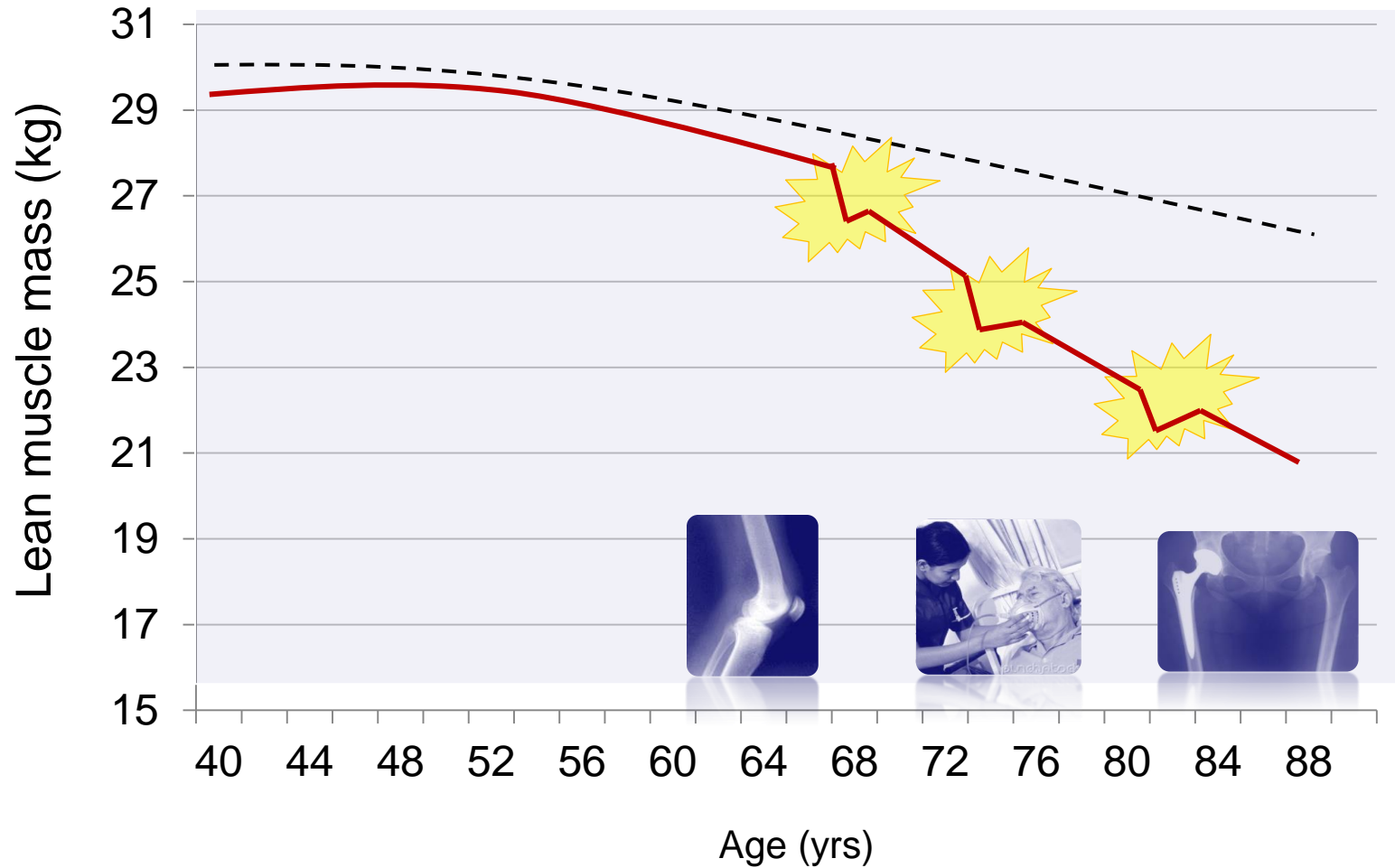


## Fat Mass



# Alternate model of muscle loss

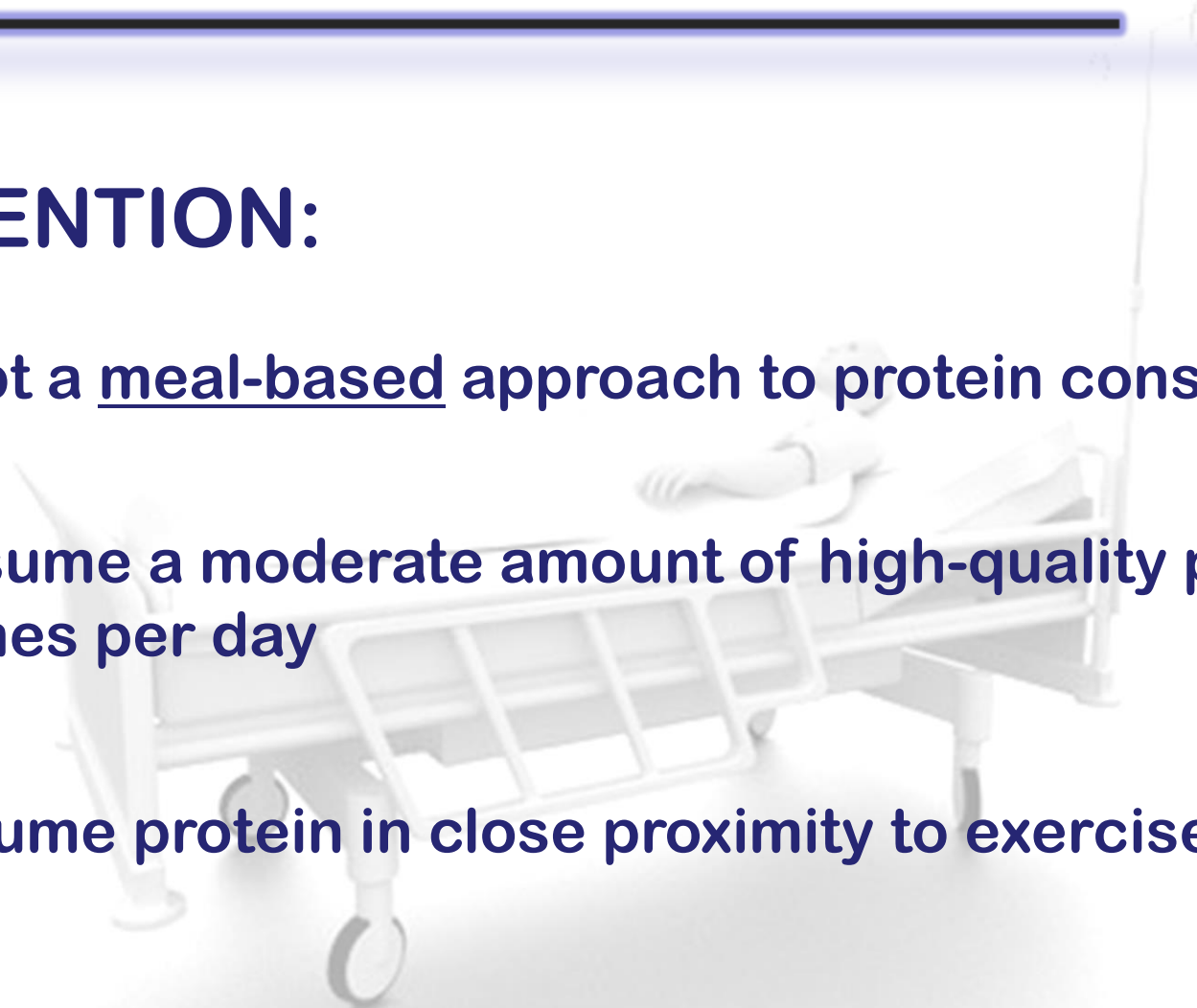
- developing tactical nutrition interventions -



# Prevention and treatment strategies

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## PREVENTION:

- ❑ Adopt a meal-based approach to protein consumption
  - ❑ Consume a moderate amount of high-quality protein, 3-times per day
  - ❑ Consume protein in close proximity to exercise
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# Prevention and treatment strategies

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## **TREATMENT:**

**React aggressively with nutritional support to reduce the rapid loss of muscle and strength associated with physical inactivity, illness or injury**







**Madonna Mamerow, Ph.D.  
Fellow**



**Kirk English  
Doctoral Student**



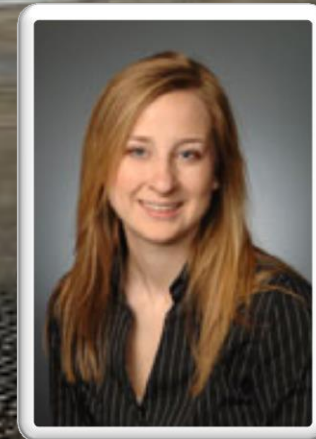
**Barbara Doucet, OT., Ph.D  
Assistant Professor**



**Joni Mettler, Ph.D.  
Assistant Professor, TSU**



**Christopher Danesi  
Coordinator**



**Emily Arentson-Lantz, Ph.D.  
Fellow**