

ACHIEVING GREATNESS

NSCA COACHES CONFERENCE

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Conflict of Interest Statement

- I have no actual or potential conflict of interest in relation to this presentation.

A Coaches Guide to Changes in Energy Needs Throughout the Competitive Season

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Objective

I. KEY BACKGROUND INFORMATION

- Highlight key components of energy expenditure
- Discuss concepts of energy balance and energy availability

II. IDENTIFY AND DISCUSS PROBLEMS IN ATHLETES

- Discuss available data in athletes

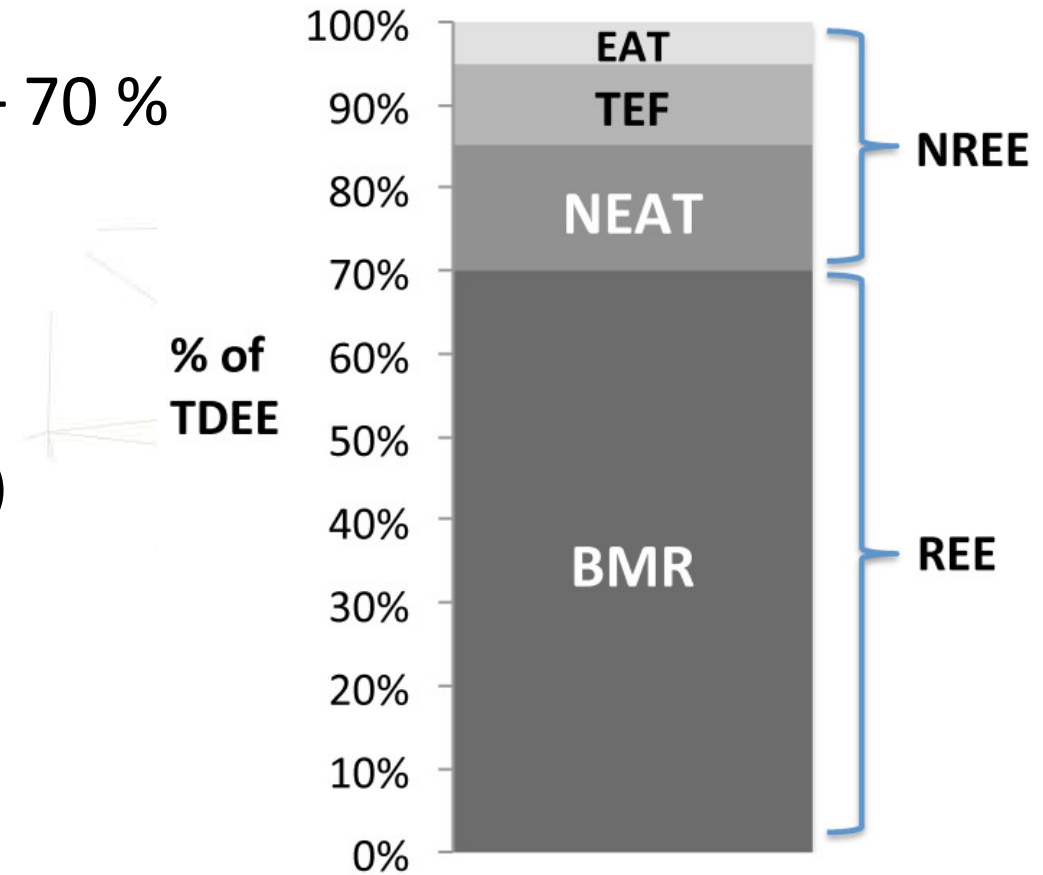
III. STRATEGIES TO SOLVE PROBLEM

- Outline approach to prescribing energy needs

IV. QUESTIONS / ANSWERS

Energy Expenditure Components

- Basal/Resting metabolic rate (RMR): 60 – 70 %
- Thermic Effect of Food: 10 – 15%
 - Dietary Induced Thermogenesis
- Activity Thermogenesis: 20 – 25%
 - Non-Exercise Activity Thermogenesis (NEAT)
 - Exercise Activity Thermogenesis



Key Points of Understanding

- **BMR/RMR:**

- *Calories burned to keep body alive and functioning, nothing beyond that*
- Makes up the largest component
- This is what is used as the basis for prescribing calorie needs
- Moves up and down a little, but largely set based upon fat-free mass

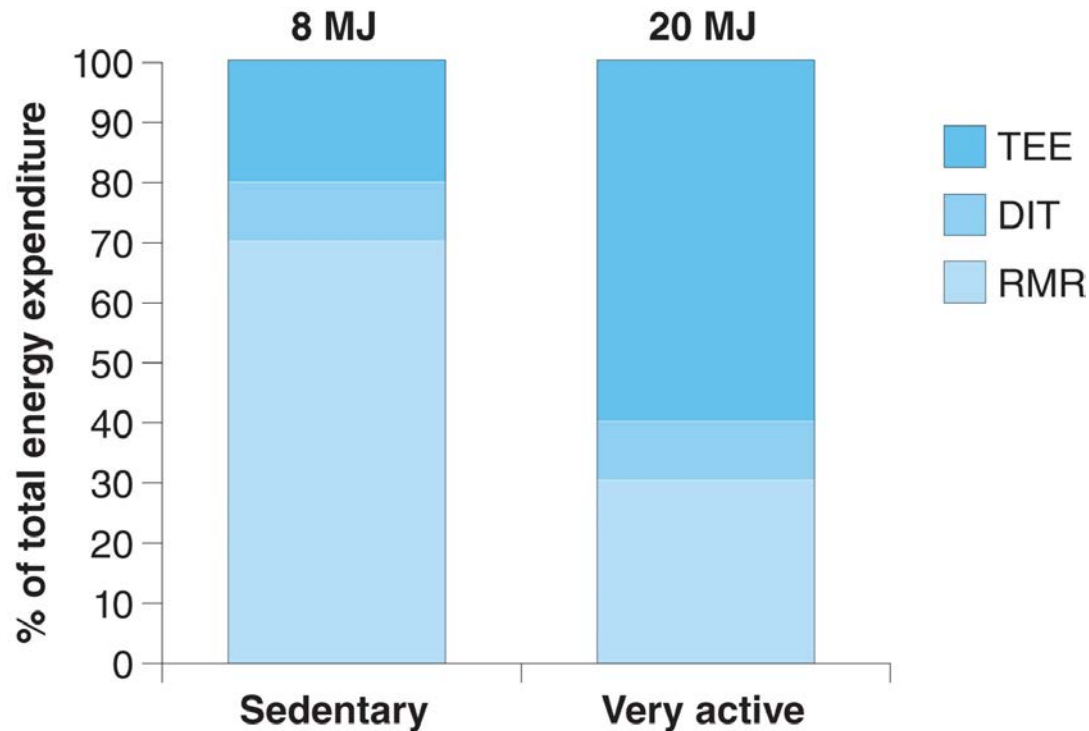
- **Activity Thermogenesis:**

- *Calories burned from formal exercise and physical activity*
- Easily most variable, large shifts from one day to the next
- Quantifying calories burned from training becomes central consideration

- **Dietary Induced Thermogenesis**

- *Calories burned to digest, transport, absorb food*
- Most static/stable

Energy Expenditure Components



- 8 MJ = 1,912 kcals
 - RMR (70%): 1,338 kcals
 - DIT (10%): 191.2 kcals
 - **TEE: (20%): 382 kcals**
- 20 MJ = 4,780 kcals
 - RMR (30%): 1,434 kcals
 - DIT (10%): 478 kcals
 - **TEE (60%): 2,868 kcals**

Energy Balance vs. Energy Availability

Energy Balance

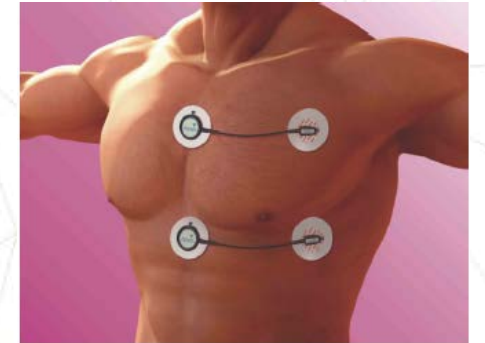
- Simple
- Calories in vs. Calories Out
- PROs: Relative to simple to estimate
- CONs: Doesn't really tell us the entire story

Energy Availability

- Amount of calories consumed that are left after accounting for calories burned during exercise energy expenditure
- $EA = (EI - EEE) / \text{kg FFM}$
- More complicated to measure

Available Data

- Monitored changes in energy intake, expenditure, and balance throughout entire collegiate women's basketball season
- Body composition via DEXA (1x)
- RMR via indirect calorimetry (2x)
- 5x for 4 days (20 days total)
 - Acti-Heart monitor (CamNTech): 24h HR monitor
 - Self-reported nutrition intake, sleep and recovery



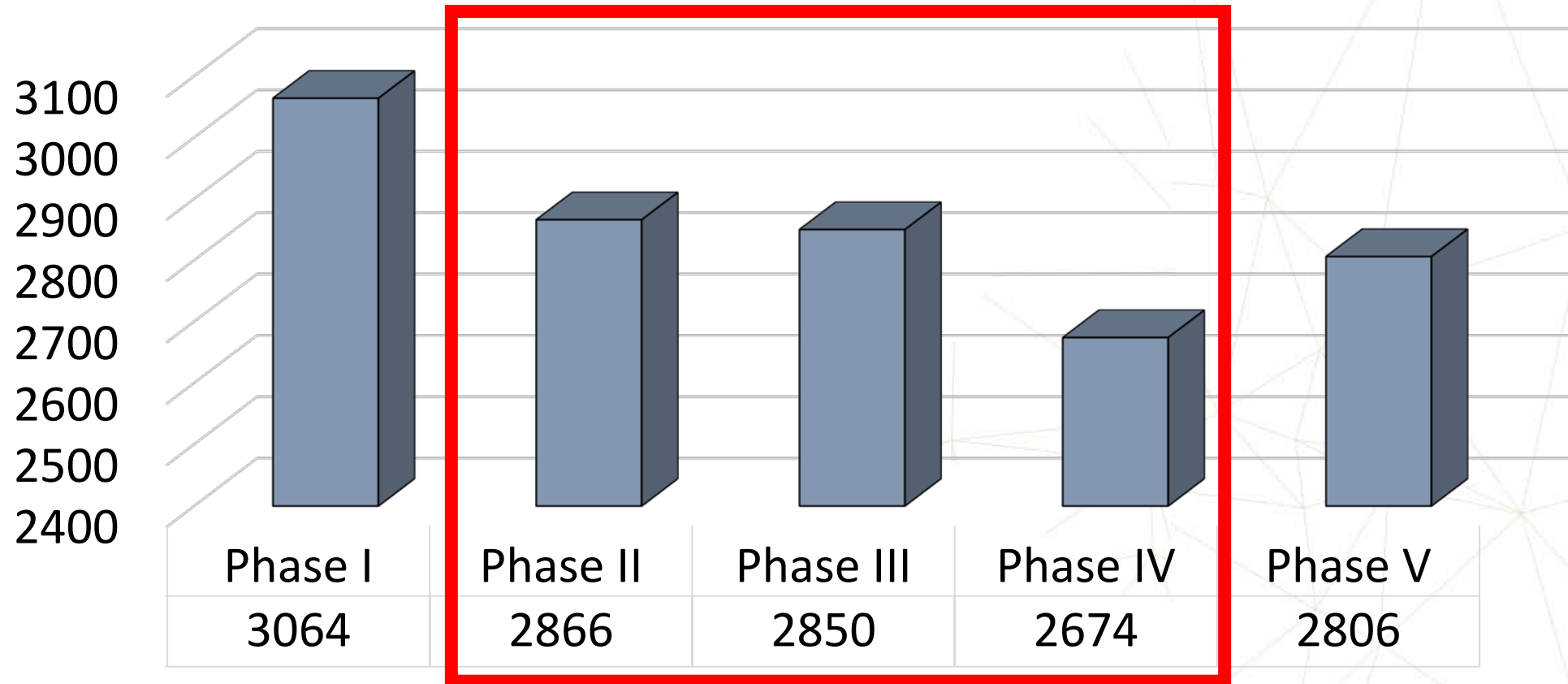
Participants

Descriptive	Average $\pm$ Standard Deviation
Age	19.8 $\pm$ 1.3 years
Height	68.5 $\pm$ 5.4 inches
Weight	164.1 $\pm$ 20.0 lbs
% Fat	27.1 $\pm$ 3.2 % fat
Fat Free Mass	116.2 $\pm$ 14.5 lb
VO ₂ max	53.9 $\pm$ 6.4 mL/kg/min
Resting Energy Expenditure	1,829 $\pm$ 185 kcal



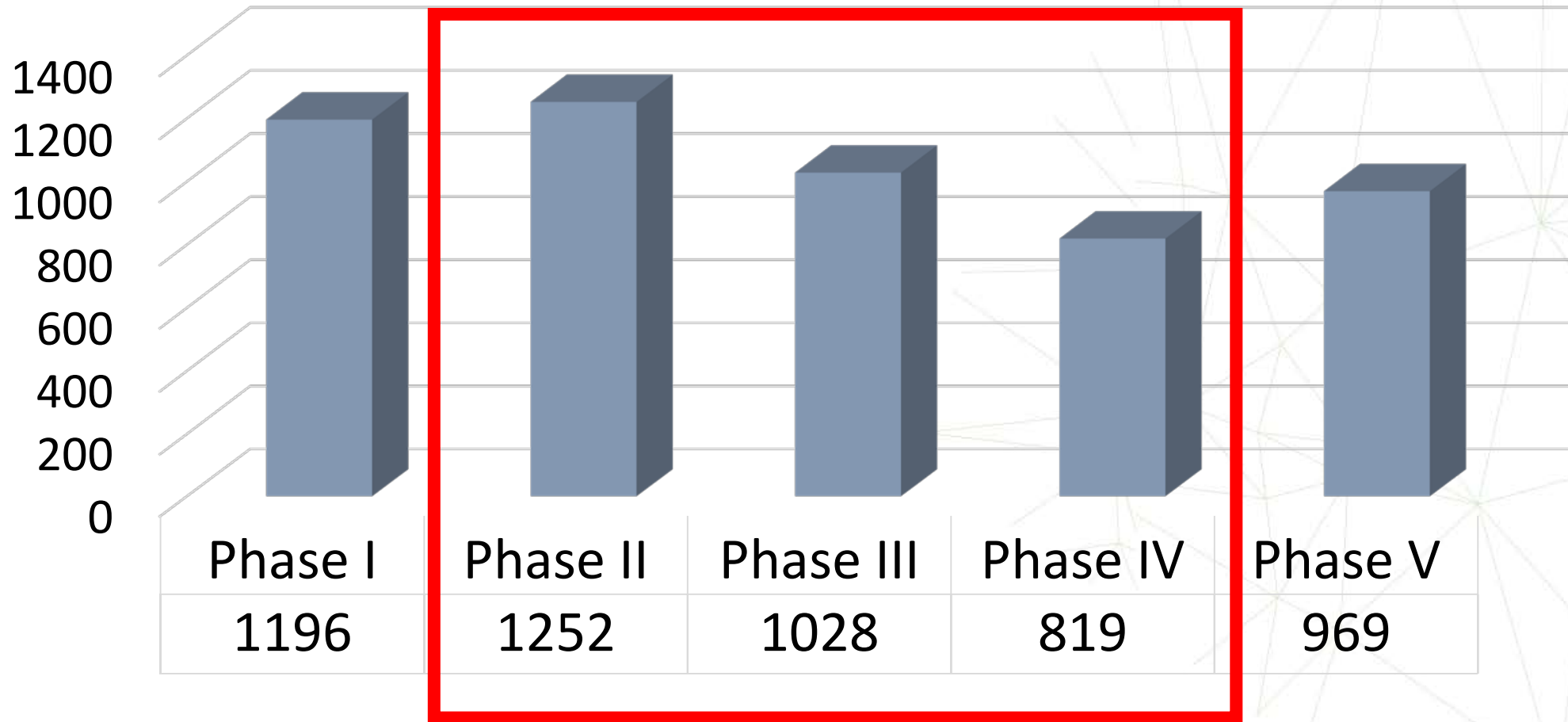
Energy Data

Avg Calories Burned Per Day Across Season



- Reasonable trend across the season
- As season ensues, players get beat up, travel, etc. can lead to decreases in volume

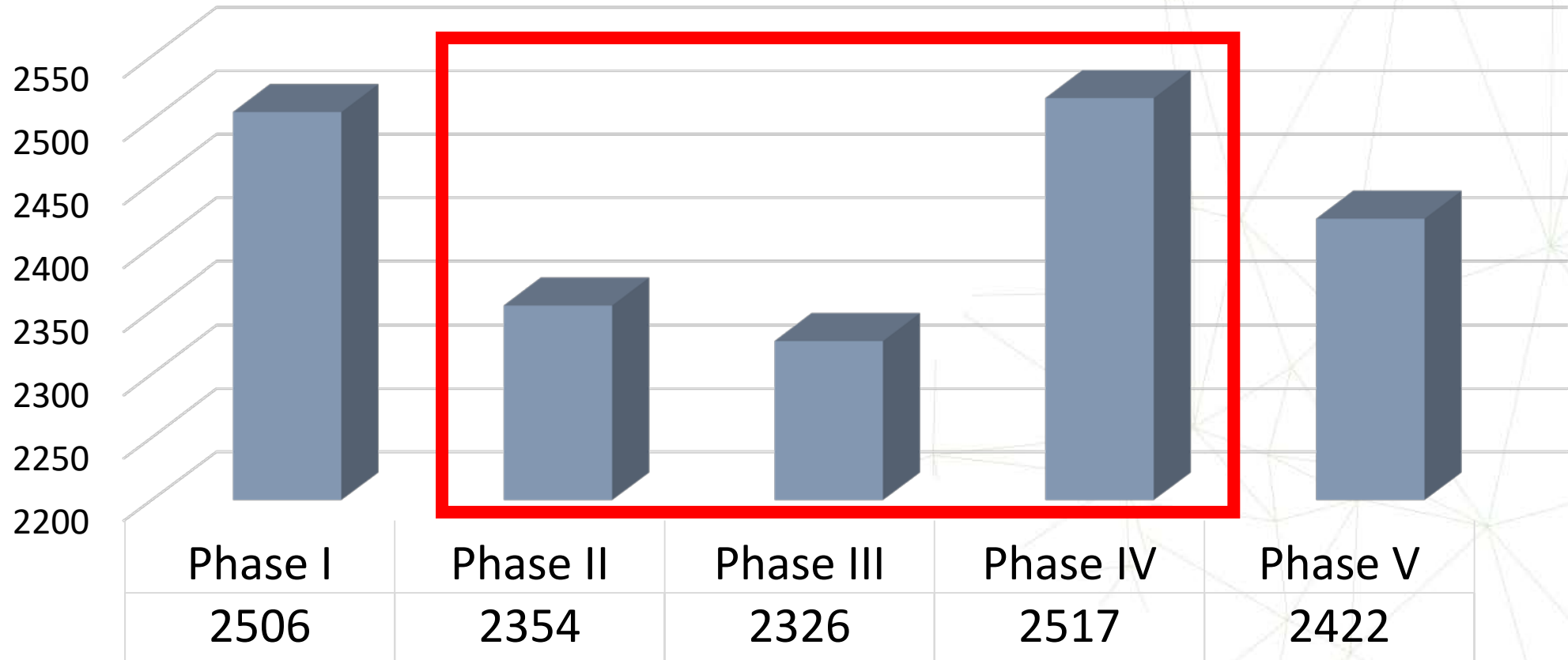
Avg Calories Burned From Activity Per Day Across the Season



- Followed same trend as daily calories burned (previous slide)

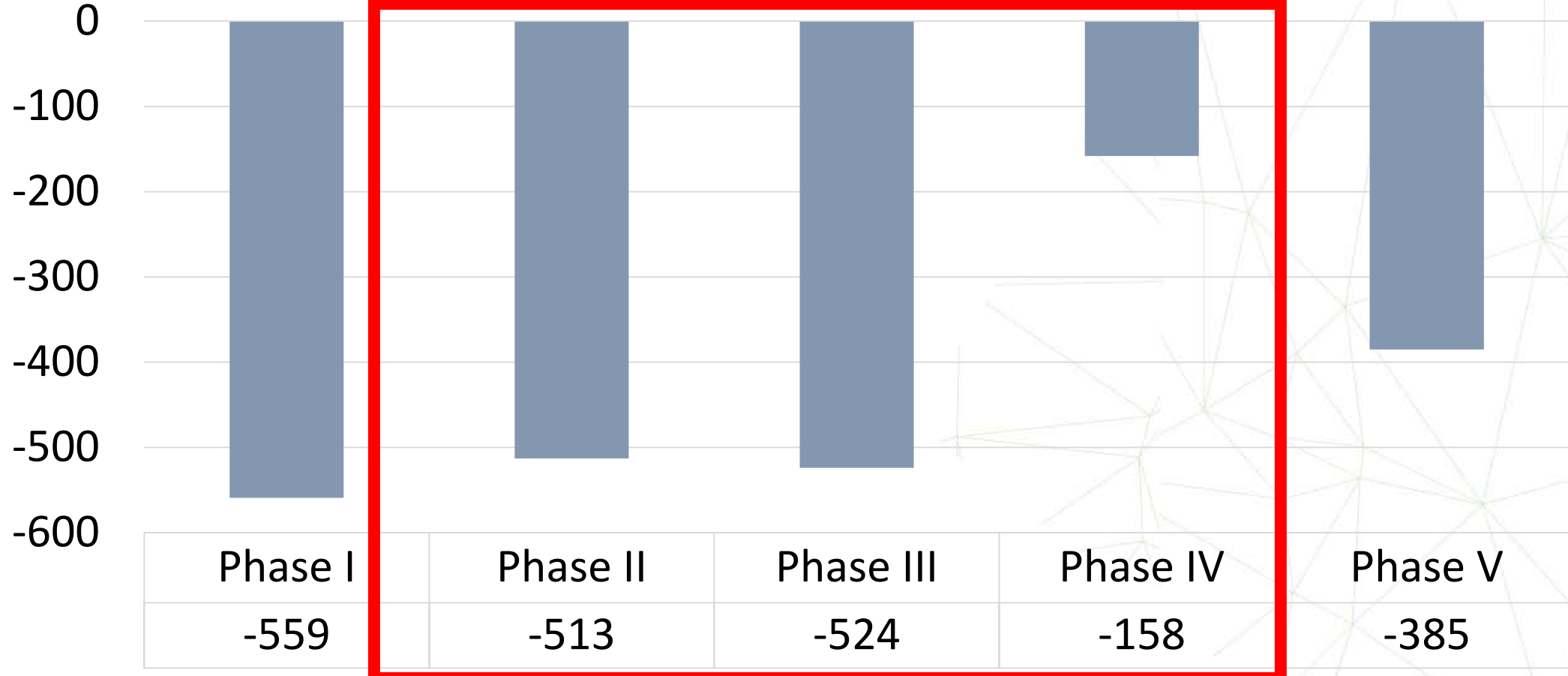
Energy Intake (Nutrition) Data

Avg Calories Consumed Per Day Across Season



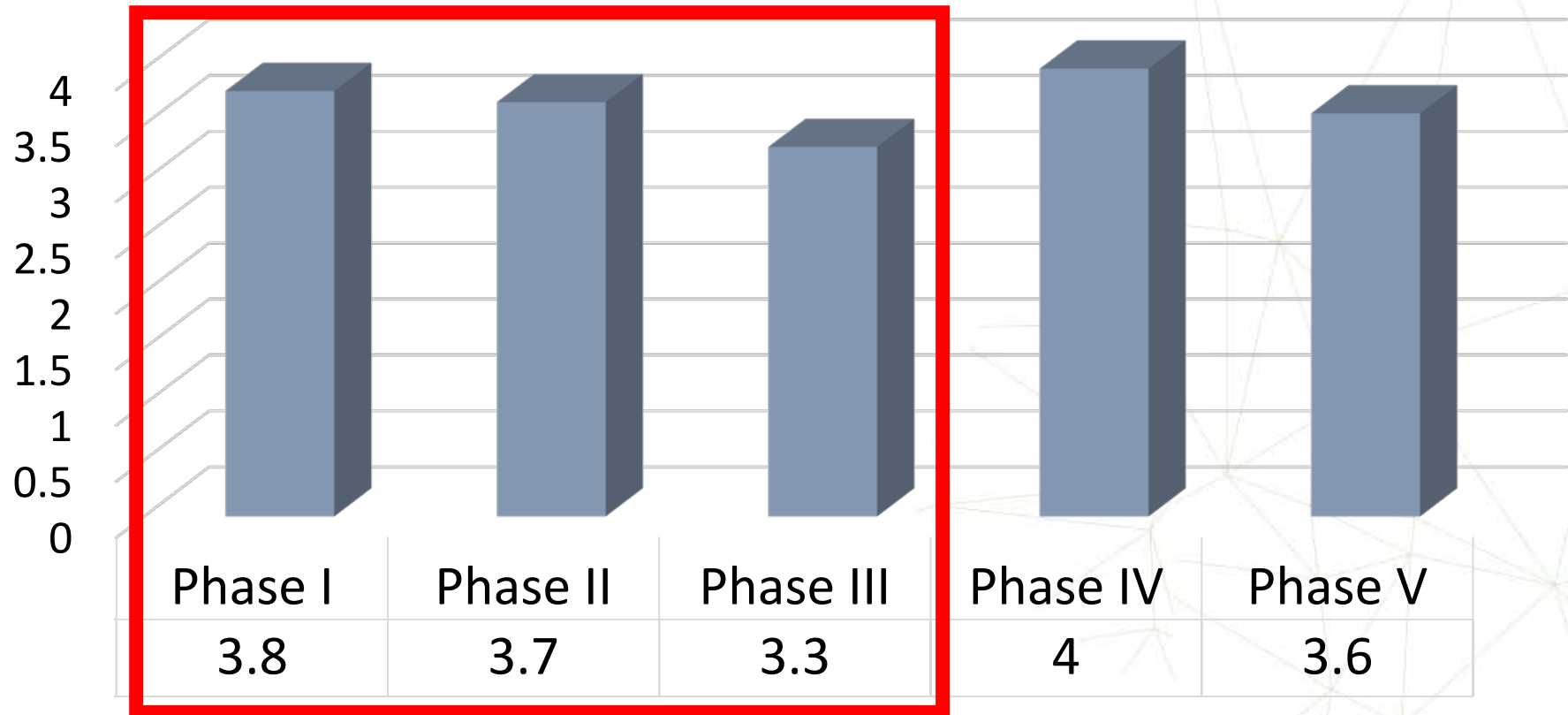
- Calorie intake decreased as season progressed, then increased toward season end
- More travel? Problems with food access?

Avg Energy Balance Across Season



- Negative across entire season...not ideal...not uncommon
- **EXCELLENT area** for nutritional education and counseling

Avg Carbohydrate Intake Per Day Across Season



- Problem #1: Low! Much lower than what would be recommended (5-6 g/kg/day)
- Problem #2: Decreased across season and increased to highest level at end of season
- Offer excellent insight for education and counseling

For Perspective

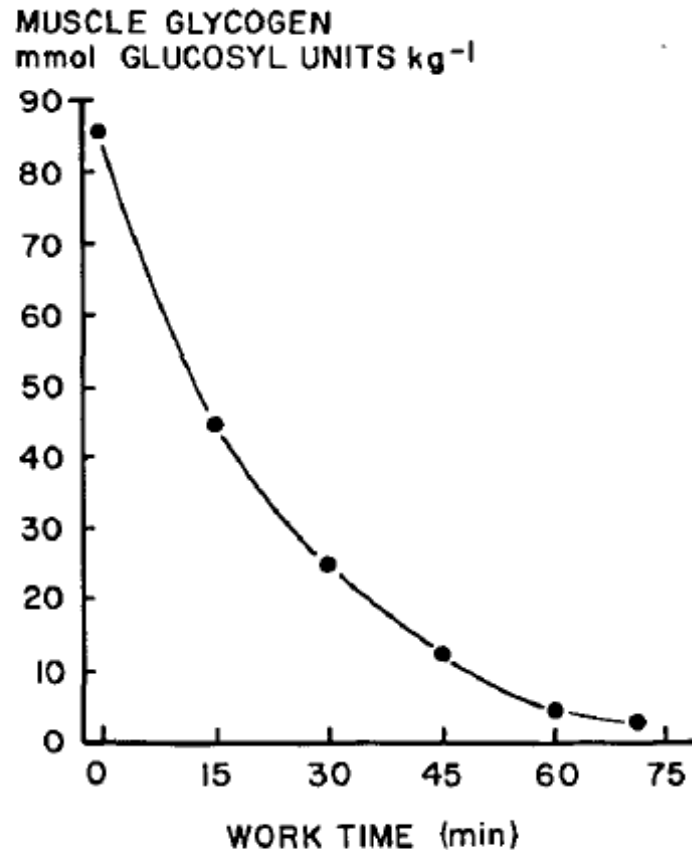


Fig. 1. Muscle glycogen content during 75 min of cycling at 85 % of maximal oxygen uptake (24)

- Energy metabolism patterns are more similar than different across sports
- Your sport may not be basketball, but see the similarities
- Changes in stored fuel from one 75 minutes bout of intense cycling
- In one hour, stored fuel dropped 94%!!!
- Certainly continuous vs. variable intensity makes a big difference, but many teams practice for 90 – 120 minutes

More Perspective

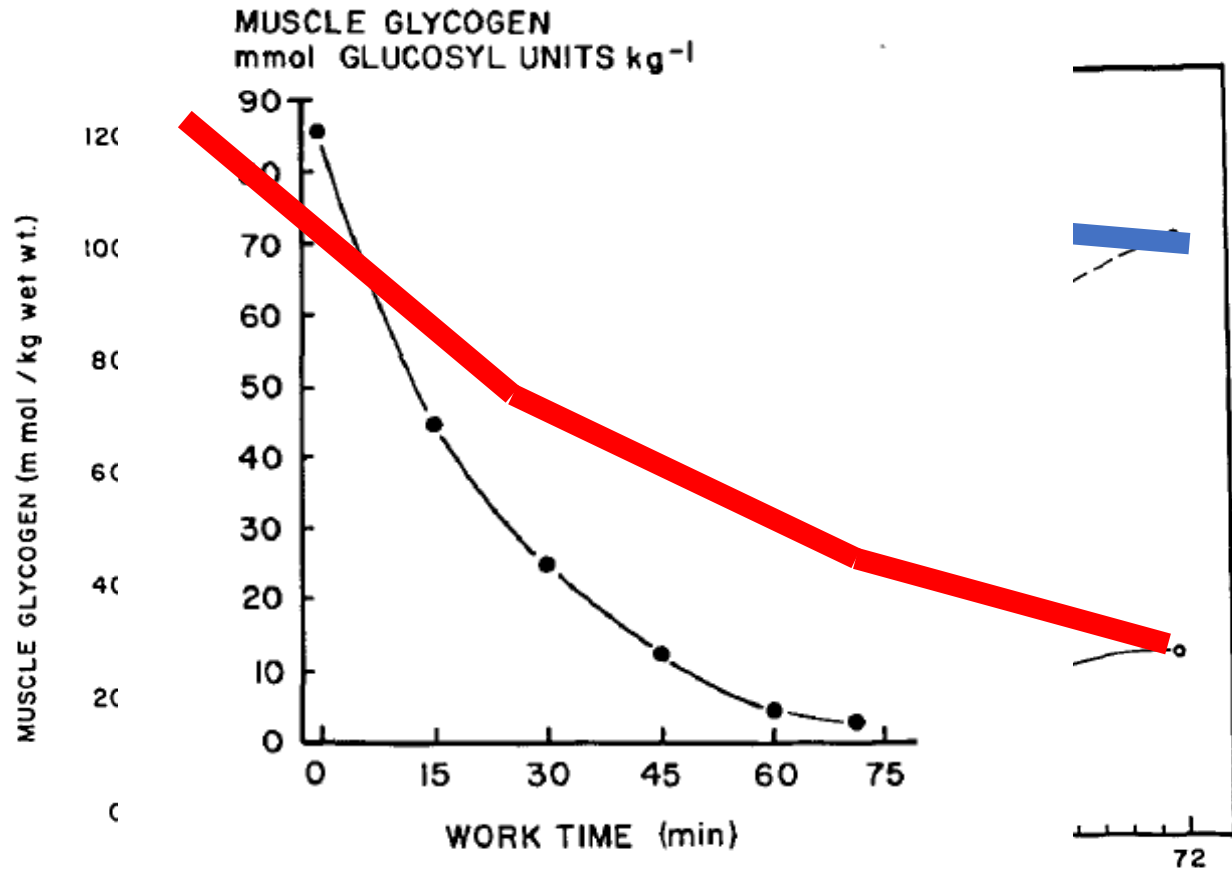


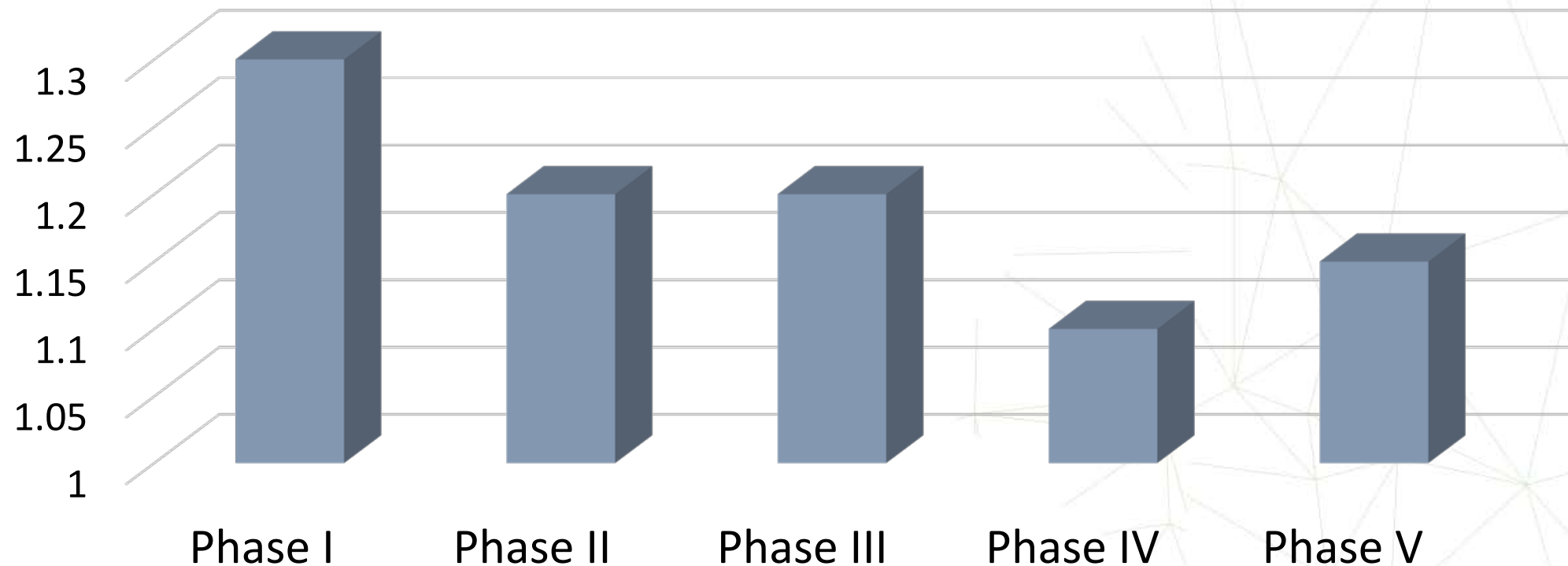
Fig. 1. Muscle glycogen content during 75 min of cycling at 85% of maximal oxygen uptake (24)

Fig. 2. Muscle glycogen content after 72 h of recovery following 72 h of heavy training on 40% carbohydrate (low CHO) and 70% carbohydrate (high CHO).

compositions were

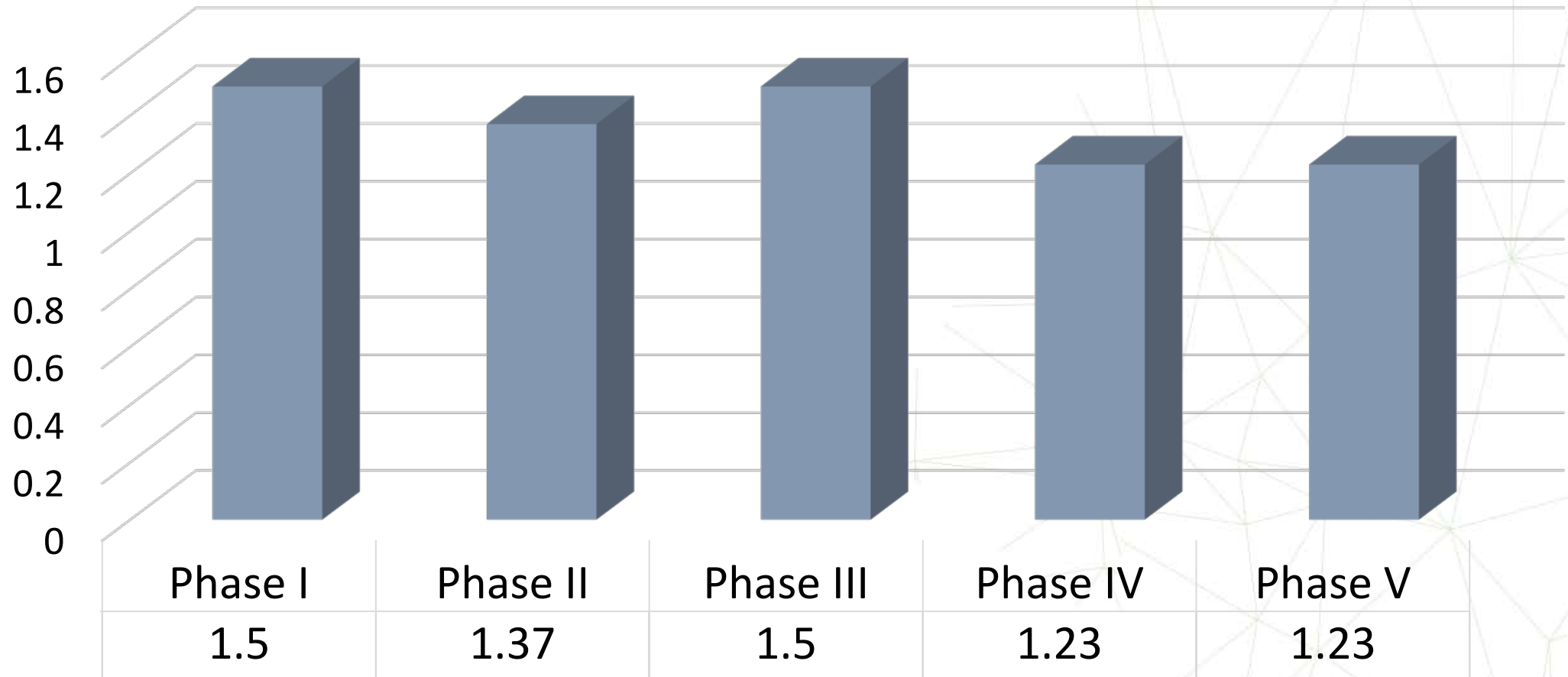
- How many of you have athletes who train hard for two hours per day on consecutive days?
- How many of you have kids whose diets are garbage?
- Likely don't consume enough calories or carbohydrates?
- 3 successive days of heavy training (2 hour bouts of running)
- Two Diets
 - 40% CHO
 - 70% CHO

Avg Protein Intake Across Season



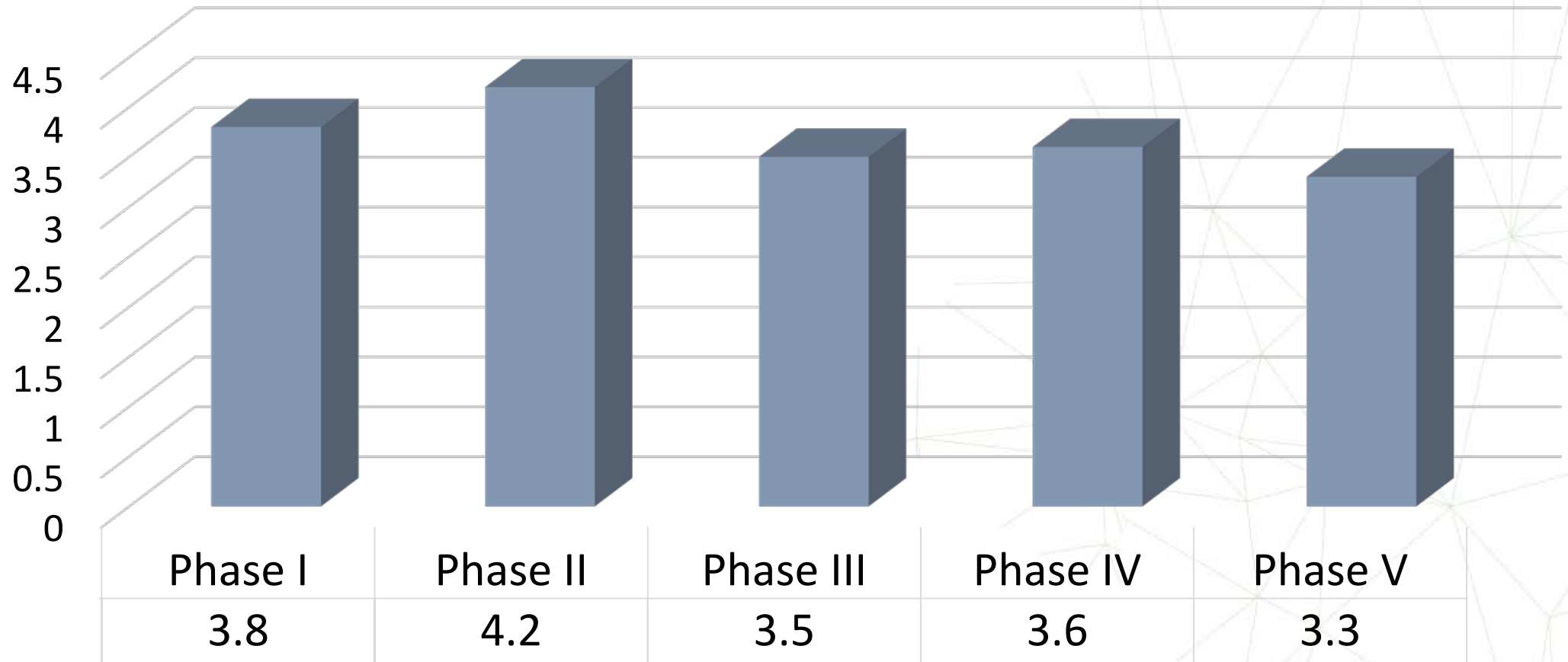
- Problem #1: Lower than recommended (1.5 – 1.6 kg/kg/day) at all time points
- Problem #2: Decreased across season, lowest levels corresponded with lowest energy balance levels

Avg Fat Intake Across Season



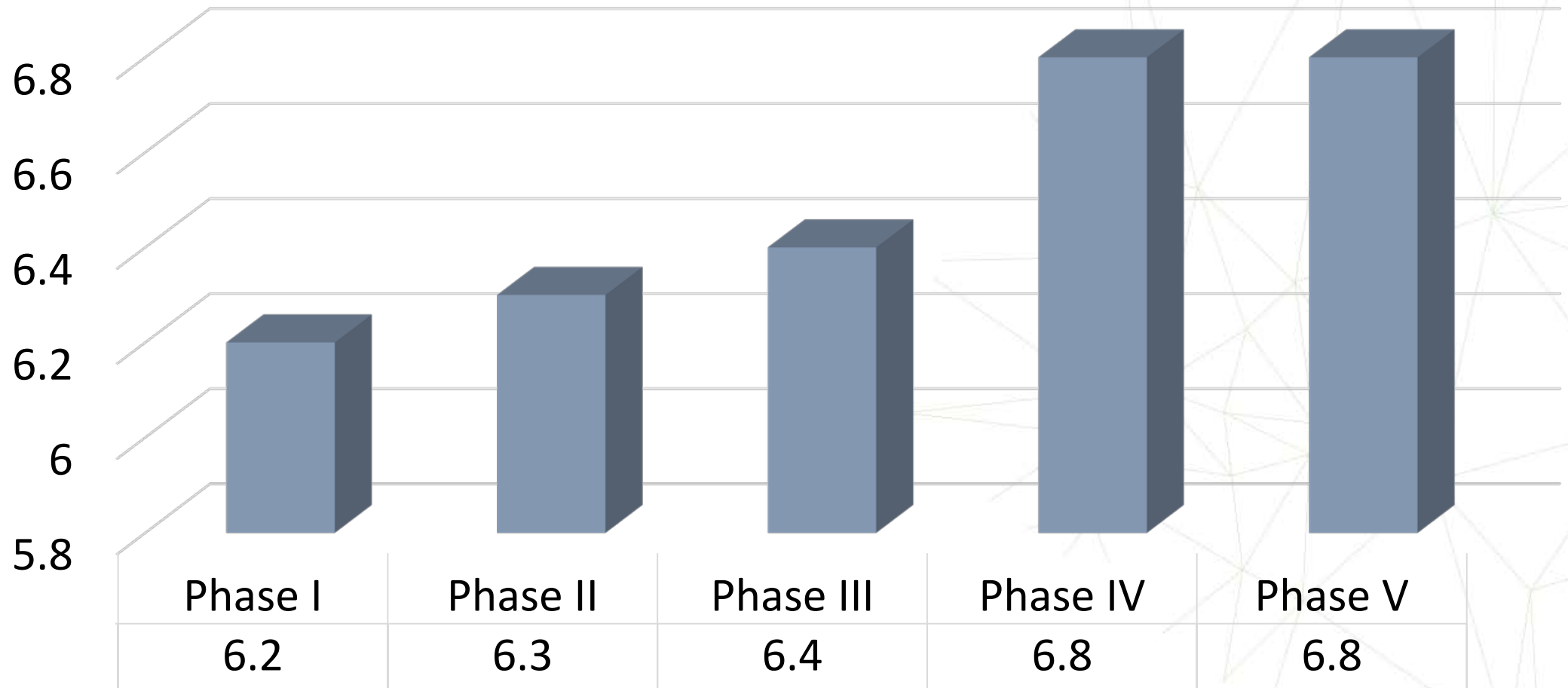
- Fat intake was higher than typically advised; Stayed relatively stable across season
- **Opportunity for athletes to replace some fat intake with carbohydrate and protein intake**

Avg Number of Meals Per Day Across Season



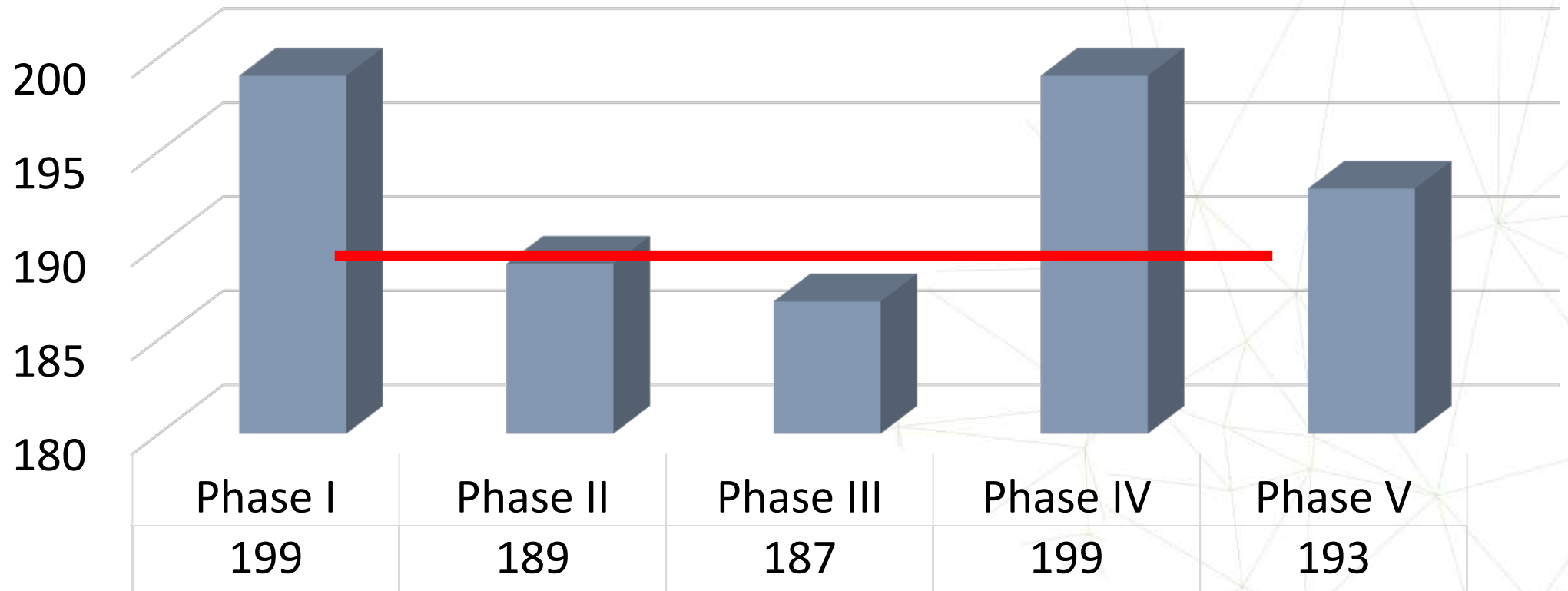
- Phase III/IV: Slight decrease might be due to traveling, being busy, etc.
- Phase V (Post-Season): Likely due to laziness

Avg Hours of Sleep Per Night Across Season



Putting It Together

Avg Energy Availability Per Day Across Season



- Decent News!
- Theoretical concept to indicate how much additional energy (calories) is available to the athlete's body for repair, recovery, growth, etc.
- ≤ 124 = **Danger Zone**; $125 - 188$ = Acceptable but for short periods; ≥ 188 = Adequate

Other Data – Mara 2015



- Eight elite female soccer
- 7 consecutive days during preseason
- **Game Days:** $2,925 \pm 144$ kcals/day
- **Training Days:** $2,794 \pm 66$ kcals/day
- **Rest Days:** $2,275 \pm 88$ kcals/day
- No difference between EE during game or training session:
 - Game: 644 ± 72 kcals/day
 - Training Session: 607 ± 76 kcals/day
- Different training sessions yielded significantly different energy expenditure amounts

Other Examples

- Professional Male Soccer Players
 - Energy Expenditure: $3,545 \pm 410$ kcals/day
 - Energy Intake: $3,125 \pm 583$ kcals/day
 - Game: $\sim 1,500$ kcals/game
- Elite Rugby Union (n=44)
 - Energy Expenditure: 3,346 - 3,800 kcals/day
 - Energy Intake: 3,393 - 3,967 kcals/day
 - Carbs: 3.4 – 3.5 g/kg/day
 - Protein: 2.7 g/kg/day

Coaching Points

- Ability of athletes to get adequate calories across season seems to be a significant challenge
- Carbohydrate intake was much too low
 - Opportunity for targeted counseling to balance performance needs with societal suggestions surrounding carbohydrates
- Protein intake has room for improvement
- Pull from fat intake (higher than needed)
- Discuss and plan strategies to get snacks and fueling across the day...YOU can help with this!
- Sleep...get to bed!



Prescribing and Putting Numbers to Work

How Many Calories – Impact of Sport Type

Men (20 – 27 kcals/pound)

- 20 – 23 kcals/lb: weight class/appearance sports
- 20 – 23 kcals/lb: precision sports such as baseball or golf
- 23 – 25 kcals/lb: football
- 24 – 27 kcals/lb: XC, tennis, swimming, basketball, field hockey, soccer, lacrosse, rugby

Women (15 – 20 kcals/pound)

- **Practical Point #1 – Sport Type**
 - 15 kcals/lb: Weight class/appearance
 - 16 – 17 kcals/lb: VB, tennis, throwing sports
 - 18-19 kcals/lb: VB
 - 20 kcals/lb: XC, soccer, field hockey

Do Not Overcomplicate

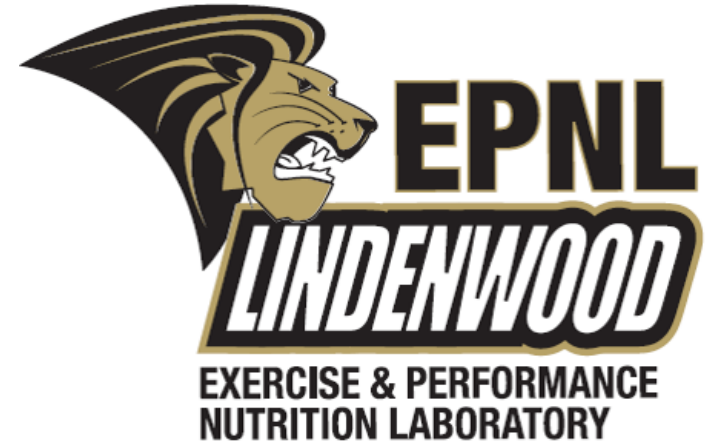
- YES...It's frustrating that ranges are so large!
 - As shown throughout, many factors that impact energy needs
- Goal: weight loss, avoid weight gain, improve leanness → lower end of kcals range, smaller portions, emphasize protein
- Increase performance: Middle end of range but pay attention to volume and intensity of effort during games or training
- Get lean mass/maximize hypertrophy: Higher end of range, added protein, heavy RT w/high volume

Practical Eating Strategies

- Do not overcomplicate! What is good enough for nearly everyone is vanilla and watered down...not sexy
- Eating 4,500 kcals each day can be daunting to an athlete who doesn't know anything
 - Sample breakfast meals
 - Sample lunch meals
 - Snacks
- Spend 2-3 minutes talking about nutrition tips or goals

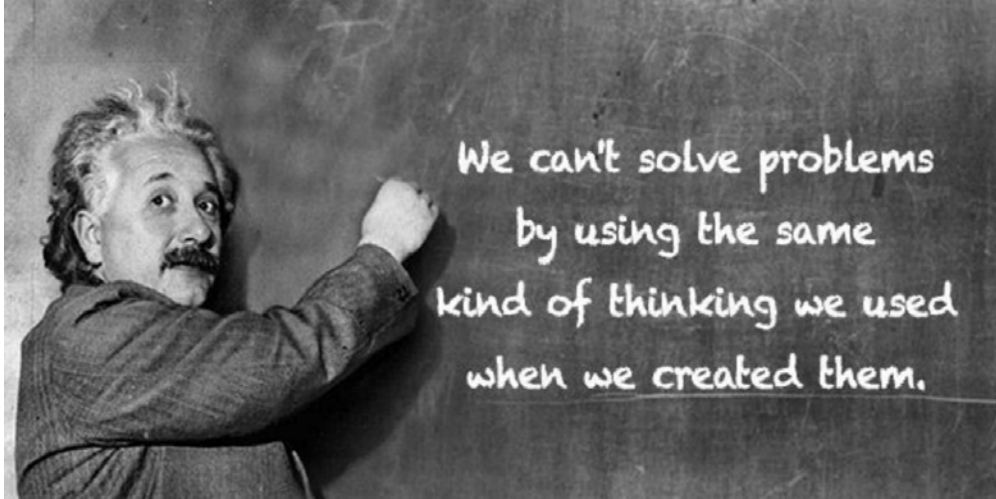
Acknowledgements

- Excited for what is in store
- Excellent group of faculty colleagues, administrators and students
- Immense support from everyone
- Look for continued work from our groups trying to better understand nutritional demands of sport



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QUESTIONS?



DATA



KNOWLEDGE



ACTION