

Sports Nutrition and Supplements



Presented by
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Bigger....Faster....Stronger....



Safe....Effective....Legal....



Nutrition and Supplements just Another Training Tool



Performance Enhancement Nutrition Education

- General Guidelines
 - Caloric and Macronutrient needs
 - Meal Timing
 - Hydration
 - Food Selection
- Nutritional Supplements
 - Weight Gain
 - Weight Loss
 - Ergogenic Nutrients
 - Education About Banned and/or Dangerous Supplements



General Nutritional Guidelines

- Isoenergetic diet of macronutrients to maintain BW
- CHO (50-65%)
 - 5-8 g/kg/d normal training
 - 8-10 g/kg/d heavy training
- Protein (15-20%)
 - 1.0-1.5 g/kg/d light training
 - 1.5-2.0 g/kg/d heavy training



- Fat (25-30%)
 - 0.5-1.5 g/kg/d
- Fluids
 - 50% BW in oz. daily maintenance
 - Loss in practice < 2% BW (4-6 lbs.)
 - >3% needs medical attention
 - Regain weight lost before next practice
- Snacks: 4-6 times per day



Macronutrient Manipulation

- High Protein vs. High CHO (Layman et al. 2003: J Nutr 133: 411)
- Isocaloric diets
 - 30% Protein, 41% CHO, 29% Fat
 - 16% Protein, 58% CHO, 26 % Fat
- Decrease BF and BW, maintain LBM with high protein



Macronutrients and Body Weight

	<u>Weight Gain</u>	<u>Weight Loss</u>
• CHO	45-55%	40-50%
• Protein	15-20 %	20-30%
• Fat	20-25%	20-30%



Strategic Eating and Meal Timing

- Eating in relation to exercise and training vs. 24 hour cycle
- Pre-exercise meal: 4-6 hours
- Pre-exercise snack: 30-60 minutes
- Sports drink during event > 60 minutes
- Immediate and post-exercise high CHO/PRO meal
- Ergogenic aids between meals





Protein What Do Athletes Need?

- Repair, recovery, increase muscle mass, decrease body fat, increase strength, decrease fatigue & protein breakdown
- Support amino acid requiring processes functioning at higher rate vs. non-athlete
- Maximize protein synthesis by **quality**, **timing**, and quantity of protein intake



Protein: What Do Athletes Need?

- Myth: Increase protein causes loss of calcium and osteoporosis
- Fact: Increase protein intake increases calcium uptake and appropriate increase of calciurea
- Myth: Increase protein causes renal dysfunction
- Fact: Increase protein not related to decreased kidney function with age

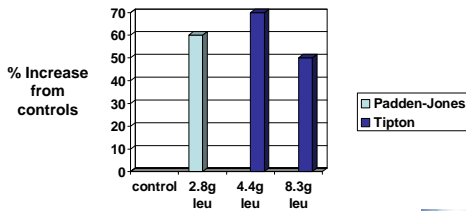


Optimal Protein Intake and Frequency of Meals

- Specific recommendations per meal vs. daily recommendations
- Leucine shown to stimulate protein synthesis & initiation to same extent as complete meal
- Leucine is major amino acid responsible for anabolic effects



Padden-Jones et al. and Tipton et al. showed increase MPS with administration of solutions containing 2.8g, 4.4g, 8.3g leucine in adults (1,2)



Leucine

- MPS maximized by oral administration of 3-4g (0.045-0.06g/kg) leucine in adults and elderly
- Dairy protein has highest quality protein available.



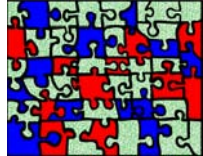
Leucine Sources

Source	% Leu	Amt Pro to reach 3-4g leu	Food amount required
Whey pro isol	12.0%	25-33g	27-36g
Milk pro isolate	9.8%	31-41g	34-46g
Casein	9.3%	32-43g	Varies with powder type
Egg	8.6%	35-47g	4.5-6.5 large eggs (280-376g)
Fish	8.1%	38-50g	158-208g
Beef	8.0%	38-51g	126-170g
Pork	8.0%	38-51g	133-179g
Chicken	7.5%	41-54g	132-174g
Wheat	6.8%	44-59g	15-20 slices (440-590g)



Next Question

- How long does MPS response last?
- When can this response be stimulated again?

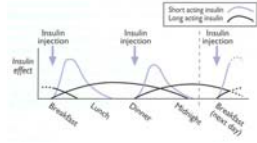


Optimal Frequency

- Duration of MPS response to purified leucine or EAA is 2 hours
- Bohe et al. (3) infused EAA for 6 hours but MPS response only lasted 2 hours even though plasma amino acids remained elevated for duration of experiment
- MPS becomes 'refractory' to constant elevations in leucine



Possible Explanation



- Insulin?
- Similar time course as MPS.
- Cause or coincidence?
- Insulin exerts stimulatory effects on MPS through mTOR pathway(4) .



Conclusions

- Paddon-Jones et al. demonstrated MPS could be improved by taking an EAA supplement containing 2.8g leu in between meals consumed every 5 hours compared to an unsupplemented group consuming the same meals (5).
- Possible that a free amino acid supplement is able to increase plasma leu concentrations greater than a meal alone and improve MPS.



Optimal Meal Frequency?

- Unlikely that another meal will stimulate MPS while it is refractory.
- Unlikely that consuming small amounts of protein over many meals will produce sustained elevations in MPS.
- It is likely better to consume larger doses of protein to maximize the MPS response and spread these doses apart by at least 4-6 hours.
- Consuming an EAA/leu supplement in between meals may help optimize MPS.



General Considerations?

Example: 200 lb male athlete/bodybuilder



5 meals per day (one meal every 4-6 hours)

Goal: 4g/leu per meal (0.045g leu/kg BW/meal)

Meal protein sources:

2 meals: whey (33g protein at each meal)

2 meals: chicken (54g protein at each meal)

1 meal: beef (51g protein)

Total protein intake: 225g/day

3-4g leu supplement consumed between meals may optimize MPS response.



Performance Nutrition Supplement Categories

- **Convenience Nutrition**

MRP's, RTD's, Bars, Sports Drink

- **Weight Gain**

Protein Powders/Formulations

Anabolic/Anti-catabolic nutrients and supplements

- **Performance Enhancement**

Ergogenic Aids



Supplements

- Convenience nutrition

– MRP's, RTD's, bars, sport drinks

– Dietary needs for caloric intake and nutrients

– Comply with regulations

- Weight gain

– Protein

– EAA

– Creatine

– β -HMB



Supplements

- Weight gain and weight loss products represent the largest segment of nutrition industry
- Many developed based on theoretical rationale with little scientific evidence
- Several nutrients & nutritional strategies have been shown to augment strength and muscle gains during training



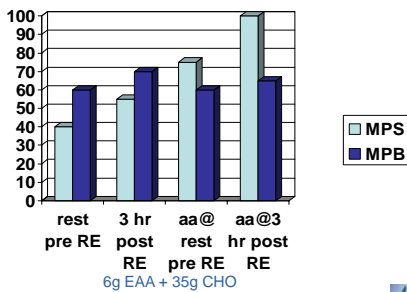
Essential Amino Acids (EAA)

- Ingestion of 3-6 EAA or 18g whey protein after exercise stimulates protein synthesis
- Post-exercise ingestion of CHO and protein promotes more anabolic hormonal effect
- Ingestion of EAA, protein, and CHO following exercise should promote greater recovery and training adaptations



Effect of EAA on Protein Turnover

Rasmussen & Phillips. Ex Sport Sci Rev.31(3):127-31,2003



Essential Amino Acids (EAA)

- Minimal of 3g EAA to stimulate and 4-6g to optimize protein synthesis
- 20g of whey protein contains about 9g of EAA's
- Borsheim et al.2003 (6) demonstrated 100g of CHO can increase protein synthesis by 35%and 6g of EAA can increase it by 250%



Creatine

- Increase muscle strength
- Increase single and repetitive sprint performance
- Enhanced glycogen synthesis
- Possible enhancement aerobic capacity via greater shuttling of ATP from mitochondria and buffering acidity
- Increase work capacity
- Enhanced work capacity
- Greater training tolerance



Supplementation Protocols

- Load/Maintenance
0.3g/kg/d (15-25g/d) for 5-7d
3-5g/d to maintain
- High dose protocol
15-25g/d (0.3g/kg/d) during training
- Low dose protocol
3-5g/d during training
- Cycling protocol
Load/maintenance during training & reduce or abstain between training periods

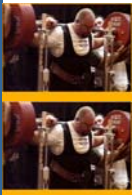


Creatine + β -Alanine (BA)

- Significantly greater losses in fat and increases LBM with combination vs. placebo or creatine alone
- Total weekly training volume increased
- 4.5g/d BA
- It's safe. It works.



HMB (hydroxy-beta-methylbutyrate)



- 1.5-3 g/d HMB increases LBM and strength in **untrained** individuals and elderly, **no** studies in athletes
- Gains in muscle mass 0.5-1kg greater than controls in 3-6 weeks of training



Performance Enhancement

- Bicarbonate loading
 - Buffers acidity and improves high intensity exercise performance (1-3 minutes)
 - 0.3g/kg baking soda 1-2h before competition
 - Possible GI upset; start with small amounts and build tolerance
 - Recommend for elite athletes
- Sodium Phosphate
 - 4g/d 3-6 days to increase VO₂max



Performance Enhancement

- Glutamine
 - Comprises 60% of amino acid pool in cells
 - Used for protein synthesis, cell hydration, fuel source during exercise, fuel for lymphocytes
 - Pre-marathon ingestion showed decrease incidence of infections reported by runners
 - No harmful side effects reported with 4-12g pre- and post-exercise



Caffeine

- Increases aerobic endurance capacity and performance in athletes
- Caffeine and CHO combined have additive effect on aerobic endurance
- Can be used effectively with CHO as pre-exercise energy drink



Caffeine

- Dose: 3mg/kg BW 60 min. pre-exercise
- >6mg/kg possible illegal doping levels
- Side effects: dizziness, headache, insomnia, GI distress
- Black/green tea (5-10mg/oz), coffee (13-26mg/oz), energy drinks (9-12mg/oz), chocolate milk or syrup (6-17mg/oz)



Strength/Power Athletes/ Sprint Athletes

- Moderate-High protein diet
- Water/ES
- Post exercise protein
- Creatine, β -Alanine
- Bicarbonate, Sodium phosphate
- Emphasize post-exercise refueling and snacking



Endurance Athletes

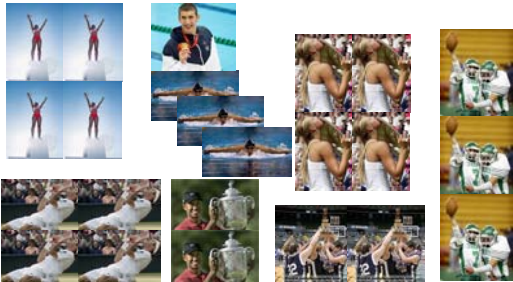
- High CHO diet/CHO loading
- Water/ES
- Caffeine
- Sodium phosphate
- Creatine



- Possible anti-catabolic nutrients
 - Creatine
 - HMB
- Possible immunoenhancing nutrients
 - Vitamin C, zinc, glutamine, post-exercise protein, Echinacea



How do you know when a strategy works???



Thank you
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References

- 1. Padden-Jones et al. Am J Physiol Endocrin Metab. 2004 Mar; 286
- 2. Tipton et al. Am J Physiol. 1999 Apr; 276
- 3. Bohe et al. J Physiol. 2001 Apr 15; 532
- 4. Anthony et al. Am J Physiol Endocrin Metab. 2002 May; 282
- 5. Paddon-Jones et al. Am J Physiol Endocrin Metab. 2005 Apr; 288
- 6. Borsheim et al. Am J Physiol. 2002. 282



36th Annual Symposium On Sports Medicine

“Nutrition can make a good athlete
great, or a great athlete good”



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