BASICS OF SPORTS NUTRITION AND HYDRATION

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I have no financial interests or relationships to disclose in regards to this presentation.
CASE 1

- A 20 year-old college linebacker presents to your clinic asking about ways he can optimize his protein intake in order to build muscle mass, increase strength, and overall performance. He asks about protein and amino acid supplementation and is wondering whether any of these would lead to performance gains. What advice do you give him?
PROTEIN

• Important to repair and rebuild muscle mass

• RDA 0.8 g/kg per day

• Athletes: 1.4-2.0 g/kg per day
  • Recreational: 1
  • Endurance: 1.2-1.4
  • Ultra: 1.2-2
  • Strength: 1.5-2
• Does timing matter?
  • Studies have shown that protein consumption immediately pre and post workout can lead to greater lean mass and some strength gains

• High quality sources: eggs, dairy, lean meat

• Too much of a good thing?
  • Maybe, for specific groups – i.e. renal disease
  • However, no substantive evidence that protein intake in ranges discussed above will have adverse effects in healthy, exercising individuals
BRANCHED-CHAIN AMINO ACIDS (BCAA)

• Leucine, iso-leucine, valine
  • Naturally found in 2:1:1 ratio in animal protein

• Leucine has the most important role in protein synthesis
  • Suggested RDA for leucine is 45 mg/kg/day in sedentary individuals

• Animal studies show free leucine post-exercise leads to increased protein synthesis
BCAAs IN AEROBIC EXERCISE

- Decreased rate of protein degradation

- Delays glycogen depletion during exhaustive aerobic exercise

- May help combat fatigue during endurance sports
  - May attenuate free tryptophan/BCAA ratio
  - Prolonged aerobic exercise = increased tryptophan in brain = increased serotonin production = subjective fatigued feeling
Athletes protein requirements are higher than sedentary counterparts

- Variation among sports

- Intake 1.4-2.0 g/kg per day may improve performance

- With a balanced diet, intake at these levels is not detrimental to renal or bone health in healthy individuals
• Protein supplements are a practical way of ensuring adequate intake for athletes, but whole foods should be primary source

• The superiority of one protein type over another remains to be convincingly demonstrated

• Specific amino acid supplements, such as BCAAs, may improve exercise performance and recovery
CASE 2

- A 18 year-old female collegiate cross country runner says she has recently started a low carb diet in an effort to drop fat and “lean up” for the upcoming season. She is concerned because although her body fat % is slightly lower, she is having difficulty completing her training runs due to fatigue. What do you tell her?
CARBOHYDRATES

- Maintain blood sugar

- Provides fast energy
  - Muscle glycogen stores = muscle energy

- Increased carb need with:
  - Increased duration
  - Decreased rest period

- Range: 6-10 g/kg/d
• High protein, low carb diet

• HYPOENERGETIC
  • Lower muscle glycogen stores

• Lose fat, rather than muscle mass
ALSO IMPORTANT TO NOTE THE IMPORTANCE OF FATS…

• General recs: <30% of diet with <10% from saturated fats

• Important source of energy
  • 70% of body’s energy at rest

• Requirements vary for athletes
  • Endurance – up to 2 g/kg/d
CASE 3

- A 19 year-old female collegiate high jumper comes to your office to discuss recent weight gain. She reports a 10 pound weight gain since last season. Her coach is telling her to lose weight if she wants to perform at a competitive level.
BODY COMPOSITION

• DO NOT strive for “ideal” composition or weight

• AVOID frequent weighing

• Optimum body fat different among individuals and sports

• If intentional changes are made, do it in OFF SEASON, with a dietician/nutritionist
MEAL FREQUENCY

• Small number of studies specifically looking at effects of increased meal frequency in athletes show it may increase lean mass and fat loss

• When energy is limited... increased meal frequency may
  • Decrease hunger
  • Decrease nitrogen loss
  • Improve lipid oxidation
  • Improve LDL and insulin levels
BOTTOM LINE...ENERGY BALANCE

- Energy IN v Energy OUT

- If negative…
  - Fatigue
  - Injury risk
  - Decreased immunity
  - Loss of muscle mass
  - Female athlete triad
  - PERFORMANCE suffers
CASE 4

- A 30 year-old female triathlete asks you for recommendations for what to eat prior to, during, and after her training sessions. What do you suggest?
BEFORE

- Hydrate
- Low fat
- Low fiber
- Moderate protein
- Familiar
- High CHO
  - 1-4 g/kg
  - 1-4 hr prior to activity
DURING

• Hydrate

• Carbs
  • 30-60 g/hr

• +/- protein

*especially for acitivity >1hr or not enough intake prior
AFTER

• Protein
  • 0.1-0.2 g/kg

• Carbs
  • 1.2 g/kg

• Within 30 min; then q2h x2-3
<table>
<thead>
<tr>
<th>Food</th>
<th>CHO</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate Milk*</td>
<td>52</td>
<td>16</td>
</tr>
<tr>
<td>Clifbar</td>
<td>45</td>
<td>10</td>
</tr>
<tr>
<td>PB&amp;J</td>
<td>45</td>
<td>12</td>
</tr>
<tr>
<td>Banana</td>
<td>23</td>
<td>0</td>
</tr>
<tr>
<td>OJ*</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Bagel</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Muscle Milk (light)</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Rockin Fuel</td>
<td>14</td>
<td>30</td>
</tr>
</tbody>
</table>
CASE 5

• At an annual exam, a 35 year-old recreational weight lifter informs you that he has begun using a creatine supplement. What advise can you offer about this supplement and it’s potential benefits or harms?
CREATINE

• More rapid ATP regeneration during high intensity exercise, which increases muscular performance

• Evidence for benefits with anaerobic exercise
  • Increased muscle strength and hypertrophy
BENEFIT WITH AEROBIC EXERCISE?

• Creatine has been shown to:
  • Increase plasma volume
  • Improve muscle recovery
  • Increase glycogen storage
  • Increase ventilatory threshold and possibly reduce oxygen consumption

• However, increase in body mass may have negative effects for endurance sport
CASE 6

- A 32 year-old female cyclist asks how caffeine intake may effect her performance. She has heard that it may cause diuresis and cause her to make more stops. What do you tell her?
CAFFEINE

- Easily absorbed in GI tract
- Easily crosses BBB
- Increases endorphins
- Decreases reliance on glycogen, increases free fatty acid mobilization

- Legal urine level: 12-15 µg/mL
  - Equates to 7mg/kg
  - ~ 3 cups Starbucks for 150lb athlete (16oz = 320 mg)
• Alertness and vigilance

• Aids in sustained max endurance activity

• Benefits on performance at 3-6 mg/kg

• Benefits even if consumed 15-20 min prior to exercise
• No conclusive evidence regarding caffeine’s effect on strength

• Effect on glycogen re-synthesis
  • Enhances re-synthesis during recovery phase

• Caffeine-induced diuresis?
  • Zhang et al 2015: metaanalysis of caffeine and UOP at rest and followed by exercise…
    • The diuretic effect was negated by exercise
CASE 7

- A 18 year-old college freshman tells you some of his friends have started using anabolic steroids. He is frustrated because they are gaining muscle much easier than him. He has contemplated trying it for himself. What can you tell him regarding steroid use?
ANABOLIC STEROIDS

• PRO:
  • Increase protein synthesis and muscle mass

• CONS:
  • Psych: aggression, euphoria, nervousness
  • Sexual: +/- libido, decreased sperm production, testicular atrophy (not always reversible)
  • Skin: edema, acne, hirsutism
  • Other: transaminitis, nausea, increased urination
AND IT GETS WORSE…

- HTN (mineralocorticoid effects)
- Tendon rupture*
- Liver tumors
- Psychosis – “Roid Rage”
- Gynecomastia (IRREVERSIBLE)
- Premature closure of growth plates
HOW THEY THINK...

• 1995 survey of olympic and elite athletes

• 195 of 198 would use performance-enhancing substance that was undetectable and guaranteed winning

• What if it would cause DEATH in 5 yrs…

> 50% would still try it
CASE 8

- A 28 year-old recreational marathon runner asks you for recommendations on hydration for his upcoming race. What advise can you offer?
FLUIDS & ELECTROLYTES

• Loss is dependent on the individual, activity, and environment

• Goal is to maintain euvolemia

• Electrolytes lost in sweat
  • Na, Cl, K, Ca, Mg

• Hydration status effects performance
PRE

• Start euhydrated

• Replete slowly if <12h of rest between activities

• Low UOP/dark urine – hydrate 2hr prior

• Salty beverages and foods
DURING

• Prevent dehydration

• **Periodic** intake
  • Depends on body composition and pace
  • Avoid excess fluid*

• Replace electrolytes
POST

• Mild: replaced @12h

• Mod: replace 1.5 L for every kg lost
  • Na

• IVF
  • >7% BW and NPO*
HYDRATION AND PERFORMANCE

• Dehydration increases strain and perception of work

• >2% decrease in BW = decreased aerobic and cognitive performance*

• Does not appear to decrease anaerobic performance
SPORTS DRINKS

• Recommended for prolonged activity in warm conditions

• Supplement carbs + electrolytes for activity >1hr

• Ideal content:
  • 8oz = 115-173mg Na, 20-48mg K
<table>
<thead>
<tr>
<th>8oz serving</th>
<th>Na</th>
<th>K</th>
<th>carbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gatorade (Endurance)</td>
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<td>30</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>90</td>
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</tr>
<tr>
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<td>32</td>
<td>17</td>
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<tr>
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<td>70</td>
<td>13</td>
</tr>
<tr>
<td>Life water</td>
<td>120</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Cytomax</td>
<td>55</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>Accelerade</td>
<td>120</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>
You are working a 50 mile ultramarathon. You are stationed at a medical tent near mile 35. You notice a runner stops near your tent. She is a 41 year-old female, BMI 19. She has been running for 6 h 30 min. You notice she is vomiting. Upon further questioning, she is able to tell you her name, but cannot provide the date. Her longest race thus far has been a half marathon.
VITALS

• RR 18

• BP 122/83

• HR 100

• Temp 100.1 F
EXERCISE ASSOCIATED HYponatremia

• Endurance sports

• Risk factors
  • hypotonic intake
  • women
  • low body weight
  • older age
  • over-hydrating
  • excessive salt loss or sweating less
  • slow pace
  • NSAIDs
• Worse symptoms if rapid drop in Na

• The longer it is low, and the lower it goes

• <125: ha, vomiting, swelling, fatigue, confusion/disorientation (cerebral edema), pulm edema (wheezing)

• <120: sz, coma, resp arrest, herniation, death

• Tx: hypertonic IVF
  • generally, 100mL of 3% saline q10min until resolution sx
SUMMARY

• Nutritional requirements should be individualized

• Athletes do have greater requirements than general population, but there is still a limit on what body can actually utilize

• Timing and content of meals can effect performance

• Focus on performance >> weight, BF%
• Strive to maintain euvolemia during exercise

• Supplement electrolytes and carbs if activity >1hr

• Important to replace protein and carbs within 30min-1hr

• Need to rehydrate more aggressively if <12hr rest

• In season or during competition is not the time for change
REFERENCES

• Basic Nutrition for Athletes, ACSM Team Physician Course 2013; speaker Heather Gillespie, MD, assistant professor UCLA.


• Fluids, Electrolytes and Hydration, ACSM Team Physician Course 2013; speaker Diana Heiman, MD, residency director East Tennessee State Univ.


