FUELING FOR ENDURANCE EXERCISE

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OUTLINE

- Nutrient timing
- Overview of sports supplements
- Race day preparation
NUTRIENT TIMING CONSIDERATIONS

- What am I going to eat before exercise?
- What do I need during exercise to optimize performance?
- What do I eat for optimal recovery from exercise?
BEFORE EXERCISE

- Intensity dependent
- Keep it simple
  - Practice so you know what works for you
  - Know what you can handle within certain time frames
    - i.e. 4 hours before, 2 hours before, 30 minutes before, etc.
- If it’s race day, don’t try anything new!
- You can eat the same things you would during exercise
DURING EXERCISE

- CHO consumption during exercise of 60+ minutes
  - Sparing of muscle glycogen
  - Performance improvement

- Types of supplements:
  - Liquid (6-8% CHO)
  - Solid
    - Gels
    - Gummies
    - Bars

- How to choose?:
  - Climate
  - Preference
  - What did you practice with?

You can train your gut....so PRACTICE!
DURING EXERCISE

Why 6-8% CHO in fluid replacement drinks?

- Little to no benefit with less than 5%

- Greater than 8% concentration
  - Associated with abdominal cramps, nausea, and diarrhea
  - This is why it is usually recommended on the packaging of gels, etc that they be consumed with water
DIFFERENT CHO SOURCES

- Different products contain different sources of CHO, based on 2 concepts:
  - 1. speed of absorption
  - 2. saturation of absorption channels

- **Speed**: 
  - Monosaccharides >> disaccharides >> polysaccharides
  - Different rates of absorption/metabolism useful for prolonged energy provision

- **Saturation**: 
  - Different modes of absorption for different sugars
  - Maximize CHO/kcal absorption by providing variety of sugars
DIFFERENT CHO SOURCES CONT:

- Fast absorbing: **Fructose** and **Glucose**
  - fructose takes a different transporter protein

- Slower absorbing: **Sucrose**
  - Problem with sucrose?
    - Sometimes there is a lack of sucrase or the enzyme that breaks down sucrose into glucose and fructose

- Even Slower: **Maltodextrin**

**THESE ARE THE COMMON SUGARS IN ENDURANCE SPORTS DRINKS/SUPPLEMENTS**
SPORTS DRINKS

- 6-8% carbohydrate-electrolyte solution

- \( H_2O \) absorption across intestinal mucosa enhanced by concurrent absorption of glucose & Na

- Glucose stimulates sodium absorption, sodium is necessary for glucose absorption, and co-transport stimulates water’s passive uptake by osmotic action.
THINGS TO CONSIDER WHEN CHOOSING A SPORTS DRINK:

- What does the product contain?
  - Carbohydrates?
  - Electrolytes?
  - Both?

- What kinds of carbohydrates does it contain?

- Will I be consuming liquids only or do I plan to consume multiple products? (i.e. GU, Shot blocks, bars, etc)

- How long will I be exercising?
COMPARING PRODUCTS

- Gatorade
- Accelerade
- PowerAde
  - High Fructose Corn Syrup
- Cytomax
- GU Brew
  - Varying sodium concentrations
- There are a gazillion products...you honestly have to be a chemist to understand the minor differences.
GATORADE

- Multiple products:
  - Prime (pre-exercise)
  - Thirst Quencher (during exercise)
  - Recover (post-exercise) (2.5:1 CHO:Pro)
  - Gatorade Endurance (2x sodium, 1.5x potassium)

- Main ingredients: sucrose, dextrose

- Per 8 oz serving of regular Gatorade:
  - 6% CHO concentration, 14 g CHO
  - 100 mg of Sodium
  - 30 mg of Potassium
ACCELERADE

- Main ingredients: Primarily sucrose, some fructose & maltodextrin; Whey protein concentrate, sunflower oil
- Per 8 oz serving:
  - 6% CHO concentration, 14 g of CHO
  - 145 mg of Sodium
  - 60 mg of Potassium

*NOTE: Contains 5 g protein, 0.5 g fat

May work best for cycling or ultra-endurance, but worth a try if interested
POWERADE

- Consists of: High-fructose corn syrup
- Per 8 oz serving:
  - 6% CHO concentration, 14 g of CHO
  - 100 mg of Sodium
  - 25 mg of Potassium
CYTOMAX

- Consists of: Maltodextrin, fructose, dextrose, alpha-L-lactate
- Per 8 oz serving:
  - 6% CHO concentration, 14 g of CHO
  - 80 mg of sodium
  - 40 mg of potassium
GU ELECTROLYTE BREW

- Contains: maltodextrin and fructose
- Per 8 oz serving:
  - 3% CHO concentration, 7 g of CHO
  - 95 mg sodium
  - 12 mg of potassium
- Also comes 2X sodium (190 mg per 8 oz serving)
- Some have caffeine
ELECTROLYTE TABLETS

- GU Brew Electrolyte Tablets
  - 320 mg sodium, 55 mg potassium
- Hammer Nutrition Endurolytes and Endurolytes Fizz
  - Capsule: 40 mg sodium, 60 mg potassium
  - Fizz tab: 200 mg sodium, 100 mg potassium
- NUUN Active Hydration
  - 360 mg sodium, 100 mg potassium
SOLID SUPPLEMENTS

- Should always be taken with water or calorie-free electrolyte drink!

- Types:
  - Gels
  - Gummies
  - Bars
GELS

- **Hammer Gels**
  - 90 calories, 22 g CHO
  - Maltodextrin and fructose
  - 25 mg sodium, 35 mg potassium

- **GU Energy Gels**
  - 100 calories, 25 g CHO
  - Maltodextrin and fructose
  - 60 mg sodium, 40 mg potassium

- **E Gels**
  - 150 calories, 37 g CHO
  - Maltodextrin and fructose
  - 230 mg sodium, 85 mg potassium

- **PowerBar Energy Gels**
  - 110 calories, 27 g CHO
  - Maltodextrin, fructose
  - 200 mg sodium, 20 mg potassium
GUMMIES

- **GU Chomps**
  - 90 calories, 23 g CHO
  - Tapioca syrup, cane sugar, maltodextrin
- **Honey Stingers**
  - 160 calories
  - Glucose, fructose, maltose, sucrose
- **Sport Beans**
  - 100 calories, 24 g CHO
  - Evaporated cane juice, tapioca syrup
- **Power Bar Energy Blasts**
  - 190 calories, 45 g CHO, 3 g protein
  - Glucose, fructose
BARS

- Probably most appropriate for cycling
  - Clif Bars
    - 3.5 g fat, 44 g CHO, 9 g protein, 5 g fiber
  - Power Bar Performance
    - Good source of electrolytes
    - 3.5 g fat, 45 g CHO, 8 g protein
  - Bonk Breakers
    - Nutrient content varies
    - 5-9 g fat, ~8 g protein, ~35 g CHO
FLUIDS VS SOLIDS

- 15 oz. of Gatorade or Powerade is equal to the kcal in 1 GU gel pack
  - It is possible to only drink Gatorade or Powerade, if you’re conscious of drinking approximately 15 oz. every 40-45 minutes
  - If you don’t do this early and often, you risk glycogen depletion late in the race
SUPPLEMENTATION DURING EXERCISE

- PRACTICE, PRACTICE, PRACTICE

- Make a supplementation plan
  - Per time interval or per mile
  - Be flexible

- Consider whether your plan works for all weather situations
  - May shift to relying more on fluid calories in warmer weather
  - Gut may be more sensitive in warmer weather

- Start early, especially with hydration!
Oklahoma Memorial Marathon is providing Powerade and GU gels on course:

- Practice with Powerade if you think you might drink it on race day
- If it doesn’t sit well with you, then make sure you have an alternative plan
  - Fuel belt
  - Family/friends along the course to hand you bottles
- GU only offered at mile 16, so have alternative plan!
AFTER EXERCISE

- Delaying carbohydrate/protein intake post-exercise may:
  - hinder muscle glycogen restoration
  - impair the ability of the muscles to recover

- There are several research studies that show that consuming carbohydrates and protein immediately after exercise is beneficial.

- There are also studies that show no effect unless you exercised in a fasted state.
AFTER EXERCISE

- **Carbohydrate intake:**
  - Promotes the restoration of muscle glycogen
  - Important for minimizing fatigue associated with repeated days of heavy training

- **Protein + carbohydrates**
  - May increase the insulin response, therefore encouraging more uptake of glucose by cells
  - Provides essential amino acids to aid in repair of damaged muscle tissue
AFTER EXERCISE

- 3:1 or 4:1 CHO:Pro

- In addition to meat sources of protein, dairy products, nuts, nut butters and seeds are all rich sources of protein and can easily be added to any meal or snack.
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- Chocolate Milk
  - 4:1 CHO:Pro (32 g carbohydrate, 8 g protein)
  - The added sugar is beneficial for recovery
  - Whey and casein proteins
    - Different digestion and absorption rates
    - Whey rich in leucine

- Soy milk
  - 5:1 CHO:pro (25 g CHO, 5 g protein)
  - Add a small carb/protein snack
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- Ideas for vegetarians/vegans
  - Crackers and nut butter
  - Lara bars
    - Uber variety is not vegan, as it uses honey
    - ALT variety is probably best for post-workout
  - Odwala bars
    - http://www.odwalla.com/good-products/bars
  - Element bars
  - Mixed nuts and CHO drink
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- **Slim-Fast**
  - Meal-replacement bars
    - 3:1 – 4:1 CHO:Pro
      - Chocolate Cookie Dough
      - Chocolate Fudge Brownie
      - Chewy Chocolate Crisp
  - **Shake Mixes**
    - Not the pre-mixed shakes, which are a bit low in carbohydrate
    - Not the “High Protein” variety, which is also a bit low in carbohydrate
    - 3:1 CHO:Pro
    - Also good source of electrolytes
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- Advocare Post-Workout Recovery
  - 3:1 CHO:Pro
  - Contains Creatine (2 g)
  - Contains soy protein, casein, and branched chain amino acids
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- **Endurox**
  - 4:1 CHO:Pro ratio
  - Particularly high in carbohydrate and protein
    - Not a problem, as long as your gut can handle it
    - Not high in monosaccharides
  - Contains whey and soy protein
  - Good source of electrolytes
  - Contains Glutamine
POST-EXERCISE PRODUCTS AND SUGGESTIONS

- **Glutamine**
  - Has been shown to reduce risk of developing URTI after marathon
  - Synthesized and released by skeletal muscle
    - BCAAs major nitrogen source for synthesis
  - Promotes intestinal health and stimulates immune system
  - Can purchase at drugstores, GNC, etc.
STRATEGIES TO MAXIMIZE ENDOGENOUS FUEL CAPACITY

Evidence that exercise training in fasted state can:

- Increase fat oxidation
- Increase intensity of exercise that corresponds to maximal rate of fat oxidation
- Decrease exercise-induced drop in blood glucose

HOWEVER:

- I wouldn’t try this on your long runs
Doesn’t just begin on race day

Things to consider:
  - Training taper
  - Diet leading up to event
  - Activities and diet day before event
  - Morning of event
  - Executing race plan
  - Recovery
Race Day Prep

Carb Loading:

- Often effective in maximizing muscle glycogen stores prior to endurance events
- Found to be beneficial for endurance activity lasting longer than 90 minutes
- Various different proposed methods:
  For example:
  - 8-10 g of carb/kg or about 500-600g/day
  - Greater than 600g/day does not show additional benefits
3-DAY CLASSICAL CHO LOADING REGIMEN

- Perform glycogen-depleting exercise
- Then follow 3-day high CHO diet

- Fine....except you’re performing exhaustive exercise three days prior to a long endurance event
6-DAY CLASSICAL CHO LOADING REGIMEN

- Perform glycogen-depleting exercise
  - Then 3 days high fat/low CHO diet

- Then another glycogen-depleting exercise
  - Followed by 3 days high CHO diet
  - Minimal exercise during this time

- Now we have 2 exhaustive exercises in the week leading up to your event
Revised 6-day CHO Loading Regimen

<table>
<thead>
<tr>
<th>Day</th>
<th>Training 70% VO2 Max</th>
<th>Carb g/kg</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>90 min</td>
<td>5 (Mixed diet)</td>
</tr>
<tr>
<td>2</td>
<td>40 min</td>
<td>5 (Mixed diet)</td>
</tr>
<tr>
<td>3</td>
<td>40 min</td>
<td>5 (Mixed diet)</td>
</tr>
<tr>
<td>4</td>
<td>20 min</td>
<td>10 (High CHO diet)</td>
</tr>
<tr>
<td>5</td>
<td>20 min</td>
<td>10 (High CHO diet)</td>
</tr>
<tr>
<td>6</td>
<td>Rest</td>
<td>10 (High CHO diet)</td>
</tr>
<tr>
<td>7</td>
<td>Competition</td>
<td></td>
</tr>
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*Taper your training while increasing your CHO intake—Recommended!*
CHO LOADING

- In general, be mindful of CHO consumption in the weeks leading up to event
- CHO consumption always important when training for an endurance event
- Not recommended to perform exhaustive exercise (glycogen-depleting exercise) if you don’t believe you can recover from it in time
  - However, you can store more glycogen immediately after intense exercise
  - Therefore, post-run supplementing so important in weeks leading up to race
ADDITIONAL THOUGHTS

- Be mindful of electrolyte consumption leading up to race if it will be hot
  - For one week, it probably doesn’t hurt to use the salt shaker a bit more

- Be sure to be adequately hydrated every day
  - Consider sipping on electrolyte replacement beverages once per day
    - ie Nuun, Gu Brew Tabs, etc.
DAY BEFORE YOUR RACE

- Focus on an abundance of sleep 2 nights before, in case nerves keep you up the night before
  - Therefore:
    - What time will you wake up?
    - Will you exercise?
    - Are you going to the expo? For how long?
    - What will you eat?
      - Food content
      - Timing of meals/snacks
    - In race packet/map, take note of where water stops will be for planning purposes
NIGHT BEFORE

- What time will you eat dinner? Will it be a big meal? Do you need a bedtime snack?

- Get everything you need for race day set out or packed
  - Every piece of clothing
  - Race number/pins
  - Fuel belt or whatever else you need to carry your supplements
  - Pre-race, mid-race, and post-race fueling/hydration
  - Do this earlier in the day or evening, so you’re not running around like crazy right before you try to go to sleep
RACE MORNING

- What time is the race?
- How many hours in advance will you wake up?
- What will you eat? How far in advance?
  - Timing will affect what you can eat

- Non-nutritional things to consider:
  - Will traffic be heavy around the race start?
  - Where will you park?
  - Are you checking a bag?
  - If it’s chilly, will you wear layers you can throw away?
DURING THE RACE

- What’s your nutrition plan?
  - How often?
  - Water or sports drink? When?
    - You could have a timed plan or a “mile” plan
      - I will eat a GU packet every 40 minutes or I will eat a GU packet every 4 miles or every 5 miles
      - I will drink water at fluid stations at miles x, x, and x (because you’re taking a solid form of supplement) and sports drink at stations x, x, and x
DURING THE RACE

- If it is hot:
  - Dilute fluids if they have CHO so you can drink more without going over the limit your GI can absorb.
  - Consider other sources of electrolytes in this case, especially if you’re a “salty” sweater.
  - SLOW down! You’ll be able to handle more fluids and keep body temp down for longer.

- Consider pouring a cup of water over your head at each water stop to try to cool down.
DURING THE RACE

- And finally...
  SMILE!
POST-RACE

- If possible, within 30 minutes get your 3:1 or 4:1 CHO:Pro snack
  - Chocolate milk and/or yogurt is usually in the post race snacks provided by big races these days

- Or have your snack in your checked bag so you can enjoy it as soon as you get your things

- After a long event, try to focus on liquid calories if at all possible—you will likely have a lot of fluids to replace!
POST-RACE

- After your initial snack, try to eat a meal within 2 hours.
  - Depending on how you feel when you finish or your hydration level, you may not be ready for this.
  - In that case, try another liquid CHO:Pro snack and just sip.
    - Electrolytes may help settle the stomach.
Training/Race Resources

1. oksportsandfitness.com; has multisport, cycling, and running events
2. trifind.com; has multisport activities categorized by state
3. MarathonGuide.com; has most marathons and half-marathons in the US and Canada listed by date and links to their websites