SPORTS NUTRITION FOR HIGH-INTENSITY, INTERMITTENT ACTIVITY: FUELING THE TEAM SPORT ATHLETE

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The Team Sport Athlete

Energy

Hydration

Structure

Key takeaways
All Athletes:
- Use and need fuel for energy to train/compete
- Sweat and need hydration
- Use muscles, need to be strong and recover

Team Sport Athlete Specifics:
- Mixture of high and low intense activity over specific duration
- Changes in pace/direction ("stop & go", fast, slow, jumping, forward, backward, lateral)
- May have certain skill involvement (throwing, swinging, kicking, dribbling, catching)
- Can involve physical contests (guarding, pushing, pulling, tackling)
- May involve a ball/puck or other pieces of equipment
ENERGY
Carbohydrates = Muscle Fuel

During Endurance Exercise

• Maintain high rates of carbohydrate oxidation
• Reduce ratings of perceived exertion
• Increase endurance capacity
• Delay the onset of fatigue
• Prevent hypoglycemia

What about for Team Sports?
The duration of a sprint can last several seconds with recovery lasting a few seconds to several minutes during lower intensity periods or breaks.

Since sprinting is primarily reliant on the anaerobic system of ATP generation, phosphocreatine (PCr) and glycogen contribute in almost equal amounts to ATP turnover.
Muscle glycogen is used during team sport activities! (eg. soccer)
Studies showing benefits of carbohydrate in team sports:

Intermittent high-intensity exercise: 10 of 12
Sprinting: 5 of 17
Jumping: 1 of 5
Change of Direction/Agility: 4 of 9
Skill: 10 of 17
Compared to water, carb intake during a basketball protocol resulted in...

14%
Faster
20 m sprint (4th Q)

37%
Longer
Run time to fatigue

↑
Improved
second-half motor skills

↓
Decreased
second-half fatigue (POMS)

Welsh RS, Davis JM, Burke JR, et. al. MSSE. 2002;34(4):723-731
Field Sports

STRENGTH + POWER

Short distances covered, many short bursts

Field Sports

ENDURANCE

Large distances covered, high speeds

Batting Sports

Lower overall energy demands, long duration

Court Sports

Smaller area, shorter duration, tournaments, substitutions

CARBOHYDRATES ARE ESSENTIAL

Maintain short energy bursts

To maintain glycogen stores

To maintain blood glucose for attention & decision making

To maintain glycogen over time

**Recommendations based on body weight**

**Team Sport Athletes (3-5 or 5-7 g/kg)**

A wide range of carbohydrate is recommended since each sport is different. Within the sport, needs also vary by position and intensity.

Choose a starting point and then alter within the range based on tolerability and energy level.

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**Type of Activity** | **Daily Carbohydrate Targets**
---|---
Low intensity or skill-based activities | 3-5 g/kg
Moderate exercise (~1 h per day) | 5-7 g/kg
Endurance program (~1-3 h/d mod-high intensity exercise) | 6-10 g/kg
Extreme commitment (>4-5 h/d mod-high intensity exercise) | 8-12 g/kg

For a performance benefit

1-4 Hours Before
1-4 g/kg

1 Hour Before
~25-30g

During
30-60 g/h
≥ 60 min duration
Performance goal

After
1.0-1.2 g/kg
< ~8 h until next training or competition
1-4 Hour Prior to Exercise (“Pre-game Meal”)

- Higher glycemic carbohydrate-rich food foods
  - Cereals, breads, potatoes, rice, pasta, etc
- Minimal fiber, fat, and protein
- What works for the athlete! (Trial and error best while training vs games)

<1 Hour Prior to Exercise

- Same rules as above but may come in form of gels, gummies, and/or sports drinks (falls in line with “During” types)
Choose mostly Fast vs Slow Carbs

Fast = easily digested, rapidly absorbed and oxidized

Slow = slowly digested, not as rapidly absorbed and oxidized

A high rate of carbon oxidation = better performance

Fructose is appropriate in small amounts when combined with Fast Carbs

The form in which CHO is consumed (gel, drink, gummy) does not influence oxidation rates and athletes should choose the form that works best for them
• The stomach is an organ that can be trained

• Gradually increase the amount of fuel intake during exercise to meet the recommendations

• Consuming more carbohydrates than an athlete is used to can result in a “sloshy” stomach and other more intense gastrointestinal (GI) discomfort
Types may vary, depending on next exercise bout

Higher glycemic vs lower glycemic carb foods (within 24 hours/same day)

Adding protein while equating calories result in a similar rate of glycogen resynthesis
• Team sports, although very diverse, contain commonalities including:
  • a mixture of high and low intense activity over specific duration
  • changes in pace/direction
  • rely on skill
  • can involve physical contests
  • may involve a ball/puck or other pieces of equipment

• Glycogen is a major energy source during sprinting as well as overall team sport activity

• Carbohydrate is well known to improve aspects of team sports performance

• Daily feeding of carbohydrates depending on the activity and body size are crucial

• Acutely, feeding carbohydrate before and during can top off fuel supply and improve performance

• Types of carbs in addition to amount and timing are also important (fast and slow)

• It is imperative that the athlete personalize their carb intake based on recommendations and tolerance with trial and error in a practice/training setting
HYDRATION
• Water ~ 60% of body weight
• Roles in numerous physiological processes
• Evaporation of sweat cools the body
• Performance suffers with fluid/sweat losses >2% body weight
Dehydration impairs the ability to remove heat
Increased cardiovascular strain
Altered metabolic & CNS function
Increased glycogen use
Decreased fluid absorption
Risk of heat illness
• 2% dehydration = decreases in endurance performance

• Performance decrements also seen in:
  • Anaerobic/high intensity performance
  • Muscle strength
  • Muscle power
  • Cognition

Does this mean dehydration impacts team sport performance?
• Fluid either was or was not provided during a 90-min LIST test
• Resulted in dehydration of 1.4% and 2.5%, respectively
• For 2.5% dehydration:
  • RPE was higher (panel A)
  • Sprint time was slower at the end of LIST (panel B)
  • Also, football-specific skill performance (i.e., dribbling skill) decreased by 5% (was maintained with 1.4% dehydration)

2% Dehydration vs. Euhydration

- Repeated sprint times
- Defensive slide times
- Shooting %
FULLY HYDRATED

2% DEHYDRATED

4% DEHYDRATED

FEWER SHOTS MADE and SLOWER SPRINT SPEED as level of dehydration increases

It is not uncommon for team sport athletes to show up to practices or games already dehydrated (USG > 1.020). For example, in specific studies it was found:

- 89% youth soccer players showed up to a morning training camp dehydrated
- 15 out of 29 professional male basketball players started games dehydrated
- Prevalent in football players due to large daily sweat losses with inadequate replenishment
Athletes do not always replenish the fluids needed during exercise:

- Soccer- only 50% replenishment
- Thirst is not a reliable indicator
- Limited availability?
- Soccer - gastric emptying to replenish unable to keep up with sweat losses
SWEATING RATE: NORMATIVE DATA BY SPORT

Sports sharing same letter are not different (p>0.05)
SODIUM LOSS: NORMATIVE DATA BY SPORT

Sports sharing same letter are not different (p>0.05)

Example of a football player that underwent a fluid balance assessment during training:

- Pre weight: 100kg  
  Post weight: 97kg
- 1L fluid consumption (96kg corrected)
- Sweat test exercise duration: 120 minutes
- Sweating rate: 100-96=4 L / 2 hours = 2 L / hour
- 3-hour game = 6 L or 6 kg body mass loss
  (in similar conditions at similar intensity as sweat test)

- Drinking volume (sweat loss – 2% window):
  6L-2L = 4 L

- **Hydration strategy**: 4 L/3 h = 1333 ml/h OR 445 ml/20 min; 1 L per quarter
• Dehydration can decrease performance within the team sport setting
• Efforts to hydrate should be made to avoid fluid losses of ≥ 2% of body mass
• Risk for fluid imbalances vary among sports because of differences in fluid availability or opportunity for hydration breaks
• Sweat rates and sodium losses vary between and within sports, so you need to know your losses whenever possible throughout a season
• Take advantage of assessment techniques and use collectively (thirst, urine color, body weight changes, USG)
• Drink 16-20 fl oz for every pound lost after activity
• Include sodium with fluids to improve palatability, stimulate drinking, and retain fluid
• Protein ~ 45% of body
• Numerous roles in the body
• Important component of recovery nutrition and muscle repair
• Important component of injury rehabilitation
• Team sport athletes sustain eccentric loads + plyometrics + physical contact = increased muscle damage/CK levels
Recommended dietary allowance: 0.8 g/kg/d

DAILY PROTEIN RECOMMENDATIONS

TEAM SPORTS
1.2-1.7 G/KG/D

STRENGTH
1.6-1.7 G/KG/D

POWER
1.5-1.7 G/KG/D

ENDURANCE
1.2-2.1 G/KG/D

**Amount:** How much protein to be effective?

**Timing:** What is the best time after exercise to eat protein?

**Type:** Which source of protein is most beneficial for recovery?
PROTEIN AMOUNT FOR RECOVERY

~0.25-0.30 g/kg

260 LBS X 0.25 (g/kg) = 30G PROTEIN

185 LBS X 0.25 (g/kg) = 21G PROTEIN


The best protein for recovery will have these three critical components to drive muscle protein synthesis:

1. A complete protein
2. Rapidly digested & absorbed
3. Rich in leucine

While egg and whey have the highest leucine values, from a practical standpoint all foods on this list are appropriate. For vegetarian and vegan athletes, blend foods for complete amino acids. Vary the sources!
Team sport athletes should:

- consume \(~0.25\) g/kg body mass protein
- immediately after training
- every 3-4 h through the day

In one study, eating patterns found in high school basketball players:

• small, protein-deficient breakfast
• moderate-protein lunch
• large-protein dinner
• spread out 5-6 hours
• negative protein balance

Athletes need guidance not only eating protein after practice, but establishing a pattern throughout the day, taking into account practice times and travel.

SSE#166

Protein intake right before bed can improve muscle recovery

Casein (slow-digesting protein)
  Higher amount (30-40 g)

Could be beneficial during the season when:
  Frequent games (baseball, basketball)
  High muscle damage (football, rugby, hockey)
Protein is a critical nutrient for muscle repair and recovery especially for team sport athletes who sustain high amounts of muscle damage.

Daily amounts vary between athletes but are higher than the RDA.

Protein should be consumed post-practice, every 3-4 hours throughout the day and before sleep.

Types of protein should include complete protein sources that are quickly digested and absorbed and rich in leucine (whey and animal products meet all these criteria).

Eating the right amount and types of protein at the right times contributes to optimal recovery for a team sport athlete throughout a season with high physiological demands.
• Daily carbohydrate intake = 5-7g/kg
• Daily protein intake = 1.2-1.7g/kg
• Carbohydrates from fruits, vegetables, and whole grains for fuel.
• Protein from high quality source animal products for recovery.
• Meals/snacks spread throughout the day and evening for optimal energy and recovery
The player arrives to the locker room, weighs himself in the bathroom wearing compression shorts (219lbs) and then gets taped and dressed. He goes to the bathroom and notices even though his urine is not as dark, his USG was 1.021 so he continues to drink fluids steadily.

At 12pm the whole team heads out for warmups and he decides to eat a banana before going out. When he arrives back to the locker room from warm-ups he takes a 20 oz sports drink that the team sports dietitian is handing out to the team.

Overall, the player ingested ~60 g carbohydrates from the banana and sports drink within 1 hr leading up to kickoff. He’s ready to go!
The ball is kicked off a little after 1pm. Because there are many breaks in play, the player has ample opportunity to consume fluids and carbohydrates in amounts and products that he tolerates. He has undergone a sweat test during practice so he and the sports dietitian know how much fluid, sodium, and carbohydrate he needs during the game.

- He takes advantage of the times he is on the bench between each series to drink a combination of sports drinks and water.
- When he arrives back in the locker room during halftime, he adds a salt packet to a sports drink and also eats some gummies to refuel.
- For the second half of the game, he continues to drink a combination of sports drinks and water during his breaks on the bench.

**EXAMPLE: DURING GAME**
After winning the game, the player arrives back in the locker room at about 4pm where a ready-to-drink carbohydrate and protein shake (25g) is provided by the team sports dietitian. He decides to drink this right away while he weighs out at 217 lbs (~1% wt loss).

After the coach’s speech, seeing the athletic trainer, taking a shower, and getting dressed, he leaves the locker room at around 5pm.

On the way out, he finds a post-game buffet from a local restaurant in the hallway set up by the team sports dietitian. He grabs a pre-packaged meal in a to-go container consisting of a deli sandwich, baked chips, and a fruit salad (120 g carbs, 30 g protein or 0.3g/kg) to eat a little later when his stomach can better tolerate food.
Team sport activities involve high and low intensity activity over specific duration combined with skill performance.

Carbohydrate energy, hydration, and protein needs will be quite different compared to those seen with endurance type sports.

Carbohydrates are the primary fuel during high intensity training and competition and should therefore be emphasized at many points during the day and around activity for glycogen replenishment and to meet energy demands.

Hydration should be tailored to individual needs based on sweat losses and be encouraged outside of activity with team sport athletes since many may show up to training or competition already dehydrated.

Protein also plays a key role in many functions of the body and should be strategically incorporated with respect to time, amount, and type to help enhance recovery from highly damaging team sports.