GATORADE SPORTS SCIENCE INSTITUTE®

FOODS & FLUIDS FOR AMERICAN FOOTBALL

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Success in many sports relies on each individual athlete doing their part on behalf of the team. Athletes set individual and team performance goals for the season, but rarely set nutrition goals. For example, one goal might be to arrive at practices hydrated and properly fueled in preparation to work hard. Good nutrition and hydration practices are one of several important behaviors that together can be key to successful individual performances.

Every team sport is different, and factors such as rules of play, frequency of games, length of season and position-specific requirements alter the nutritional plans. Football is classified as a strength and power team sport, in which most players do not cover large distances but rely on frequent short bursts of energy and must handle intense, repeated contact.[1] Therefore, one of the greatest nutrition considerations is the consumption of adequate carbohydrate to maintain these frequent high-intensity bursts over the course of a practice and game.[1]

Additionally, players should focus on hydration since the demands of the sport, the environment and the protective clothing may all lead to risk of dehydration and heat illness. Football players should make hydration a priority when they have two-a-day practices during training camp, especially for teams located in hot, humid environments and when the players are wearing helmets and pads. Teams that are located in cooler environments should plan ahead for competitions located in a warmer location. Additionally, late in the season when the weather is colder, athletes must realize they can still dehydrate if fluid intake is not adequate.

This guide provides an overview of sports nutrition guidelines for football, which should be adapted to individual athletes based on their position, and teams based on their environment. It should be noted that off-season workouts and training programs likely require different considerations, based on the nature and goals of the off-season program. For example, a football player may have a goal to lose fat mass and gain lean mass in the off-season, which would require a different nutrition strategy than during-season maintenance of lean mass. The recommendations below are focused on practices and games in the competitive season.

SUGGESTED DAILY MACRONUTIRENT INTAKE

(per kilogram of body weight)

Carbohydrate:[2] 5-7 g/kg/day

Protein:[2,3] 1.2-2.0 g/kg/day

PRE-PRACTICE OR GAME FOODS & FLUIDS

Eating before a practice or game tops off the body's carbohydrate stores (called glycogen), especially if the workout or competition is in the morning. Carbohydrate is the primary fuel source for muscle contraction during both high- and low-intensity points of the game, so it is important athletes start practices and games with enough carbohydrate stored in their bodies.

The pre-event meal should be eaten ~1-4 hours before exercise, contain ~1-4 g/kg carbohydrate and be low in protein, fiber and fat to minimize the risk of gastrointestinal upset. The exact timing and amount of carbohydrate consumed during this time should meet the individual preferences of the athlete.[2,4] Additionally, it is recommended that athletes drink ~5-7 mL/kg of fluids

with sodium approximately 4 hours prior to a workout or competition, and another 3-5 mL/kg about 2 hours prior if they cannot urinate or if the urine is dark.[5,6]

Ingesting carbohydrate within the hour prior to training or competition essentially begins to meet the athlete's during-exercise fueling needs,[2,4] and may also help the athlete decrease feelings of hunger. The amount and form of carbohydrate, such as a beverage, chew or solid food, is the individual choice of the athlete.

SAMPLE PRE-PRACTICE/GAME MEALS

(Examples for a 250 lb [114 kg] athlete)

Menu #1

(~4 hours prior, target ~4 g/kg, 456 g carbohydrate)

- Large baked potato with 1 Tbsp fat-free sour cream
- 4 oz grilled chicken breast sandwich on a Kaiser roll with 1 Tbsp barbeque sauce
- 2 cups cooked white rice with 1/2 cup black beans, use butter sparingly
- 32 fl oz grape juice
- 1 1/2 cup strawberry sherbet with 1 cup sliced strawberries, 1 medium banana

Approximate totals: 2,210 calories, 458 g carbohydrate, 21 g fat, 65 g protein, 25 g fiber

Menu #2

(~3 hours prior, target ~3 g/kg, 342 g carbohydrate)

- Pasta (2.5 cups cooked) with 1.5 cups marinara sauce
- Medium piece French bread (~4 oz)
- 16 oz apple juice
- 1 cup vanilla fat-free pudding (not sugar free!) with 1/2 cup sliced banana

Totals: 1,610 calories, 336 g carbohydrate, 7 g fat, 43 g protein, 11 g fiber

Menu #3

(~2 hours prior, target ~2 g/kg, 228 g carbohydrate)

- Turkey sandwich
  - 4 oz low-fat deli turkey
  - Mustard/low-fat mayo (use mayo sparingly)
  - Plain bagel
- ~40 tiny twist pretzels
- 1 large apple
- 6 fig cookies
- 20 oz Gatorade

Totals: 1,096 calories, 234 g carbohydrate, 5 g fat, 32 g protein, 10 g fiber

OPTIONS TO PROVIDE CARBOHYDRATE ENERGY SHORTLY BEFORE TRAINING AND COMPETITION

	Serving Size	Carbohydrate	Sodium
Energy Chews	6 chews	21 g	70 mg
Gatorade Endurance Energy Gel	1 gel	20 g	90 mg
Banana	1 medium	27 g	1 mg

PRE-PRACTICE OR GAME KEY MESSAGES

- Football players should consume carbohydrate before a practice or game to ensure adequate carbohydrate is stored in the muscle. Carbohydrate is the primary fuel for both the high-intensity bursts of muscle contraction and prolonged muscle contractions that occur during "stop and go" activity.
- Adequate fluids should be consumed about 4 hours before a practice or game.
- A nutrition plan for football players should take into account the position of the athlete, environment and equipment.

DURING-PRACTICE OR GAME FOODS & FLUIDS

DEHYDRATION

It is generally accepted that dehydration of a ~2% or more decrease in body weight (approximately a 3 lb loss in a 150 lb athlete) may negatively affect an athlete's performance, especially when playing in hot and humid conditions.[6] American Football players have higher whole-body sweat rate and rate of sweat sodium losses than other team sports.[7] Remember that adding pads and a helmet, especially in a hot, humid environment, blocks the dissipation of heat from the body and can increase the risk of dehydration and heat illness.

Answering "yes" to any of these questions may indicate inadequate hydration:

- Am I thirsty?
- Is my urine a dark yellow color (like apple juice)?
- Is my body weight noticeably lower than yesterday?

IMPORTANCE OF HYDRATION

Football players spend several hours each day training, sometimes twice a day, often in the sun, while wearing equipment. Therefore, for both safety and performance, paying attention to hydration is important. Athletes should be sure to drink enough fluid to prevent dehydration without over-drinking. Dehydration may strain the cardiovascular system and increase body temperature, which increases the risk of heat illness.

HYDRATE THE RIGHT WAY

Since practices are often longer than games, especially early in the season, it is important to develop a hydration strategy for both practices and games. To determine an athlete's sweat rate, measure body weight before and after a training session in the same environment as a competition. Also, keep track of all the fluid consumed. A rough estimate of sweat rate can be obtained by using the following equation: sweat rate (L/h) = (weight loss (lbs) + fluid intake (L))/exercise time (hours). This measurement will likely need to be made several different times for practices and competitions, especially as the weather changes. Reference the Sweat Rate Calculator on page 10.

SODIUM

Athletes sweat, and sweat contains sodium. Consuming fluid with sodium, such as in a sports drink, is important because sodium helps maintain the physiological desire to drink and helps retain the fluid consumed.[8] Athletes, especially when training or competing for more than 2 hours or those who have high sweat losses, should replace both fluid and sodium during exercise.[6] Football players who are prone to cramping may possibly have higher sweat sodium losses.[9,10] To estimate if an athlete is a "salty sweater," look for white residue on dark-colored clothing after a training session.

TIPS FOR HYDRATION

- Know your sweat rate in the environments where you will train and compete to customize a plan to meet your unique needs.
- Begin practices and games hydrated. Monitor your urine color; it should be a light yellow color (like lemonade) to indicate adequate hydration.
- Rehearse your game-day strategy during team practices and make sure you can tolerate the fluids without problems.
- Use sports drinks to provide fluid and electrolytes for hydration as well as carbohydrate for energy.

CARBOHYDRATE

Carbohydrate has been demonstrated to improve indices of performance in team sports, particularly intermittent high-intensity exercise capacity.[11] Consuming carbohydrate during practices and games provides fuel to the muscle, brain and nervous system.[12] The recommended amount of carbohydrate ingestion every hour of exercise for a team sport athlete, including football players, is 30-60 g/h.[1,2,12] The amount within this range may be tailored by the demands of each position and the form (solid, semisolid or liquid) should be determined by the preferences of the individual athlete.

SODIUM AND CARBOHYDRATE CONTENT OF GATORADE BEVERAGES

	Carbohydrate (g/12 oz)	Sodium (mg/12 oz)
Gatorade Thirst Quencher	21	160
G2	8	160
Gatorade Endurance Formula	22	310
G Zero	0	160
Gatorlytes powder*	0	780 (mg/ packet)
Gatorlyte RTD	8	300

** Gatorlytes are not a beverage. They are a packet of electrolytes to be added to a 20 oz bottle of Gatorade Thirst Quencher.*

EXAMPLES OF STRATEGIES TO MEET THE 30-60 G/H CARBOHYDRATE RECOMMENDATION

- 16 oz Gatorade Thirst Quencher = 28 g carbohydrate
- 32 oz Gatorade Thirst Quencher = 56 g carbohydrate
- 32 oz G2 plus 6 Gatorade Prime Energy Chews = 42 g carbohydrate

Plan ahead to take advantage of timeouts and halftime to refuel.

DURING-PRACTICE OR GAME KEY MESSAGES

- Football players should determine their individual sweat rate, taking into account equipment and environment, and consume fluids with sodium to minimize body weight changes during practices and games.
- Carbohydrate intake during exercise can help maintain performance in “stop and go” activities such as football; athletes should aim to consume 30-60 g (120-240 calories) per hour of practice or games.
- It is possible to train the gut! If athletes are currently consuming less than the recommendations, gradually increase intake to minimize gastrointestinal issues.

POST-PRACTICE OR GAME FOODS & FLUIDS

In-season recovery nutrition should support the daily energy and hydration needs of the athlete while helping the muscles withstand the rigors of a long season. Nutrients and fluids consumed throughout the time between practices and games support recovery; highlighted here are the specific recommendations for the immediate recovery period.

Restoring the carbohydrate used from the muscle and liver during both aerobic- and anaerobic-type muscle contractions is a key focus of the post-exercise fueling needs of football players. When athletes have less than 8 hours between practices or competitions, 1.0-1.2 g/kg carbohydrate should be consumed every hour for 4 hours. When athletes have more than 8 hours between sessions, they should follow the daily carbohydrate needs for team sport athletes (5-7 g/kg/day) for moderate training, 6-10 g/kg/d during periods of heavy training and choose carbohydrate-rich meals and snacks with some protein regularly throughout the day.[1,2]

While consuming carbohydrate for recovery will help replenish energy stores in the muscle to help the athlete be ready for the next practice or game, eating protein is important to rebuild muscle and adapt to the demands of football, helping the athlete recover over the course of a long season. Athletes should consume about 20-40 g [13] or 0.25-0.3 g/ kg[14] of protein to start the recovery process as soon as possible after each training session, practice and game to help rebuild muscle tissue as well as adapt to the demands of training. Choose a rapidly digested, complete protein rich in the amino acid leucine, such as milk, whey, meat[9] or eggs.[14,15] Research is emerging on the use of plant-based proteins for recovery and muscle gain. Athletes consuming plant-based proteins should ensure they are eating a variety of foods in order to meet their essential amino acid needs to support recovery and training adaptations.[16]

Following practices and games, athletes should drink 20-24 oz per pound of body weight lost of fluid with sodium, to replace the amounts lost during training and competition.[2,5]

RECOVERY FOOD OPTIONS

	Calories	Carbohydrate (g)	Fiber (g)	Protein (g)	Fat (g)	Sodium (mg)
Option 1 **Gatorade Protein Recovery Shake** Water (amount based on body weight changes)	270	45	1	20	1.5	320
Option 2 **Gatorade Recover Whey Protein Bar** Water (amount based on body weight changes)	340-370	42-43	1-2	20	9-12	160-210
Option 3 **Beef jerky (2 oz) & 10 saltine crackers** Water (amount based on body weight changes)	360	28	1	21	14	1,490
Option 4 **Muscle Milk 100% Whey protein mixed with water plus a banana**	235	30	3	25	2	160
Option 5 **Evolve plant-based protein powder mixed with water**	160	21	10	20	2.5	380

POST-PRACTICE OR GAME KEY MESSAGES

- Restore carbohydrate after practices and games to replace used glycogen (carbohydrate stored in the muscle and liver) and to store more glycogen as an adaptation to training.
- Athletes should consume ~20g, or 0.25-0.3 g/kg of high-quality protein as soon as possible following training or competition to help rebuild muscle tissue.
- Rehydrate with 20-24 oz of fluid with sodium for every pound of body weight lost during exercise.


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AN EXAMPLE: PUTTING THE SCIENCE-BASED RECOMMENDATIONS INTO PRACTICE

ATHLETE PROFILE

Name: Marcus

Age: 20

Weight: 220 lbs (100 kg)

Type of athlete: Starting NCAA Division 1 running back

Goal: Start second half with more energy and decrease risk of muscle cramping

PRE-GAME

We want to make sure Marcus eats adequate carbohydrate before the game to top off the stores in his muscle (called glycogen), since glycogen is an important fuel source during a football game, especially for a running back. Because the timing of the pre-game meal is set by the football staff, he is going to have to eat this meal about 4 hours prior to the game. He will also be limited to the food provided at the training table, but we can help him make the best choices. He should try to get about 400 g of carbohydrate (1,200 calories from carbohydrate) in this meal (4 g/kg body weight). Good choices are pasta dishes, rice, potatoes, fruit, fruit juice, pancakes, waffles, cereal, bread, pudding, low-fat frozen yogurt or ice cream. We've advised him to make choices that are fairly low in protein and fat, so minimizing meat, eggs and cheese. He can add a 20 oz Gatorade to his meal to add carbohydrate and fluids. Overall, since his choices will vary, we've advised him to listen to his stomach and eat from the above choices until comfortably full.

Marcus would prefer to eat his meal closer to the game, since he is always hungry again about 2 hours before the game, but doesn't have the flexibility based on the time pre-game is served. His superstition is to eat goldfish crackers at some point before a game, and these crackers are actually not a bad choice since they are baked. We suggested to Marcus a plan to eat ~1 cup of goldfish crackers and 20 oz of Gatorade for ~37 g of carbohydrate when he is hungry in the 2 hours prior to the game, and advised him to have Gatorade Energy Chews just before the game starts to ward off hunger and provide additional carbohydrate energy.

DURING THE GAME

By weighing him before and after a scrimmage, we determined Marcus' sweat rate to be 1 L/h (34 oz/h). Also, we observed traces of white residue on his black T-shirt and pants, indicating he is a fairly salty sweater, which could be a possible reason why he is prone to cramping in the fourth quarter of games.

Carbohydrate intake throughout the game is going to be important for Marcus to help maintain energy levels, and since feeling sluggish coming out of halftime is an issue for him, it will be important for us to help Marcus consume

close to the upper end of the 30-60 g/hour recommendation. Marcus reports feeling hungry during halftime but never eats anything. We've suggested he try eating one package of Gatorade Prime Energy Chews, providing 21 g of carbohydrate. He tried eating the chews during a practice to make sure they didn't upset his stomach, and he didn't have any issues.

An NCAA football game lasts approximately 3 hours, with a 15-minute halftime. To meet his hydration and carbohydrate energy needs, we suggest Marcus consumes about 85 oz of Gatorade, and work with his athletic trainer to space this out over the course of the game if possible. This will meet his hydration needs as well as provide 39 g of carbohydrate. Combined with the additional 21 g of carbohydrate from the chews during halftime, Marcus will meet the recommended amount of carbohydrate and should feel that he has more energy at the start of and throughout the second half. Additionally, as part of his fluid intake, we recommend Marcus add one packet of Gatorlytes to a 20 oz bottle of Gatorade at halftime to increase his sodium. If this does not help decrease the risk of muscle cramping in the fourth quarter, he could replace Gatorade Thirst Quencher with Endurance Formula, which provides the same carbohydrate energy with additional sodium.

AFTER THE GAME

Good recovery practices can help an athlete persist through a long, grueling season like football. While Marcus reports feeling very hungry before a game and at halftime, he is rarely hungry immediately after a game. In this case, we recommend he drink rather than eat. A good choice is a Gatorade Recover shake which will provide the protein, carbohydrate and electrolytes he needs. This beverage will serve as a bridge to his meal when he is hungry and is easy to drink while he is icing down in the training room.

His meal should then contain high-quality protein and carbohydrate, while being lower in fiber and fat. Also, since every game is different, we recommend he weigh himself before and after each game and drink an additional 20-24 oz of water for every pound of body weight lost.

Any opinions or scientific interpretations expressed in this document are those of the author and do not necessarily reflect the position or policy of PepsiCo, Inc.

REFERENCES

1. Holway F & Spriet L. (2011) Sport-specific nutrition: Practical strategies for team sports. *J Sports Sci*. 29(Suppl 1):S115-125.
2. Thomas DT, Erdman KA, Burke LM (2016) American College of Sports Medicine Joint Position Statement. Nutrition and Athletic Performance. *Med Sci Sport Exerc*. 48:543-568.
3. Packer et al. Variable-intensity simulated team-sport exercise increases daily protein requirements in active males (2017) *Front Nutr.* 4:1-8
4. Jeukendrup A & Killer S. (2010) The myths surrounding pre-exercise carbohydrate feeding. *Ann Nutr Metab*. 57(Suppl 2):18-25.
5. Sawka, MN, Burke LM, Eichner ER, Maughan RJ, Montain SJ, Stachenfeld NS. (2007) American College of Sports Medicine position stand: Exercise and fluid replacement. *Med Sci Sport Exerc*. 39:377-390.
6. Shirreffs S. & Sawka M. (2011) Fluid and electrolyte needs for training, competition, and recovery. *J Sport Sci*. 29 (Suppl 1): S39-46.
7. Barnes KA, Anderson ML, Stofan JR, Dalrymple KJ, Reimel AJ, Roberts TJ, Randell RK, Ungaro CT, Baker LB. (2019) Normative data for seating rate, sweat sodium concentration, and sweat sodium loss in athletes: an update and analysis by sport. *J Sports Sci.* 37:2356-2366.
8. Maughan RJ & Murray R. (2001) Sports Drinks: Basic Science and Practical Aspects, Boca Raton, FL: *CRC Press.* 7-8:183-224.
9. Horswill C, Stofan J, Lacambra M, Toriscelli T, Eichner E, Murray R. (2009) Sodium balance during U.S. football training in the heat: cramp-prone vs. reference players. *International J Sports Med*. 30:789-794.
10. Stofan J, Zachwieja J, Horswill C, Murray R, Anderson S, Eichner E. (2005) Sweat sodium losses in NCAA football players: a precursor to heat cramps? *Int J Sport Nutr Exerc Metab*. 15:641-652.
11. Baker LB, Rollo I, Stein KW, Jeukendrup AE. (2015) Acute effects of carbohydrate supplementation on intermittent sports performance. *Nutrients*. 7:5733-5763.
12. Burke L, Hawley J, Wong S, Jeukendrup A. (2011) Carbohydrates for training and competition. *J Sports Sci*. 29(Suppl 1):S17-27.
13. Macnaughton LS, Wardle SL, Witard OC, McGlory C, Hamilton DL, Jeromson S, Lawrence CE, Wallis GA, Tipton KD. (2016). The response of muscle protein synthesis following whole-body resistance exercise is greater following 40 g than 20 g of ingested whey protein. *Physiol Rep*. 4:e12893.
14. Witard O, Jackman S, Breen L, Smith K, Selby A, Tipton K. (2014) Myofibrillar muscle protein synthesis rates subsequent to a meal in response to increasing doses of whey protein at rest and after resistance exercise. *Am J Clin Nutr*. 99:86-95.
15. Phillips S. & Van Loon L. (2011) Dietary protein for athletes: from requirements to optimum adaptation. *J Sports Sci.* 29(Suppl 1):S29-38.
16. Pinckaers P, Trommelen J, Snijders T, van Loon LJC. (2021) The anabolic response to plant-based protein ingestion. Sports Med. 51 (suppl 1):59-74.

CALCULATIONS/YOUR WORKSHEET

1. BODY WEIGHT

For many calculations, you need to know your body weight in kilograms. To do this calculation:

Body weight in pounds _____ / 2.2 = [ ] kg

2. DAILY MACRONUTRIENT NEEDS

Carbohydrate:

_____ body weight (kg) * 5 g/kg = [ ] grams per day

TO

_____ body weight (kg) * 7 g/kg = [ ] grams per day

Protein:

_____ body weight (kg) * 1.2 g/kg = [ ] grams per day

TO

_____ body weight (kg) * 2.0 g/kg = [ ] grams per day

Amounts within these ranges should be determined based on the requirements of the individual sport and athlete.

3. BEFORE-EXERCISE CARBOHYDRATE NEEDS

A. Enter the time before exercise you like to eat (1-4 hours): _____ (h)

B. Enter your desired amount of carbohydrate (1-4 g/kg body weight): _____ (g)

C. Pre-exercise carbohydrate intake = _____ body weight (kg) * _____ carbohydrate amount from line 2 (g/kg) = [ ] g carbohydrate

4. BEFORE-EXERCISE FLUID NEEDS

A. 4 hours prior to exercise:

_____ body weight (kg) * 5 mL/kg = [ ] mL

TO

_____ body weight (kg) * 7 mL/kg = [ ] mL

B. 2 hours prior to exercise (if needed):

_____ body weight (kg) * 3 mL/kg = [ ] mL

TO

_____ body weight (kg) * 5 mL/kg = [ ] mL

To convert mL to oz: _____ mL * 0.03 = _____ fluid oz

5. DURING-EXERCISE CARBOHYDRATE NEEDS

The recommendation is 30-60 g/hour, no calculation needed. Amount should be determined based on the requirements of the individual sport and athlete.

6. DURING-EXERCISE FLUID NEEDS

A. Pre-exercise weight = _____ lbs

B. Fluid consumed during exercise = _____ L

(_____ fluid oz / 33.8 = _____ L)

C. Post-exercise weight = _____ lbs

D. Weight change = Pre-exercise weight _____ lbs - Post-exercise weight _____ lbs = [ ]

E. Exercise time = _____ hours

F. Sweat rate = (Weight change _____ + Fluid intake _____ L) / _____ hours = [ ] L/h

7. POST-EXERCISE CARBOHYDRATE NEEDS (WHEN <8 HOURS RECOVERY)

Body weight _____ (kg) * 1 g/kg = [ ] g carbohydrate

TO

Body weight _____ (kg) * 1.2 g/kg = [ ] g carbohydrate

8. POST-EXERCISE FLUID NEEDS

Weight lost = Pre-exercise weight _____ lbs - Post-exercise weight _____ lbs = [ ]

Fluid needs:

_____ body weight lost * 20 oz = [ ] oz

TO

_____ body weight lost * 24 oz = [ ] oz

9. POST-EXERCISE PROTEIN NEEDS

About 20 g is appropriate for most athletes; however, to calculate your individual needs use this equation:

Body weight _____ (kg) * 0.25 g = [ ] g protein

TO

Body weight _____ (kg) * 0.3 g = [ ] g protein


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