FUELING ATHLETIC PERFORMANCE

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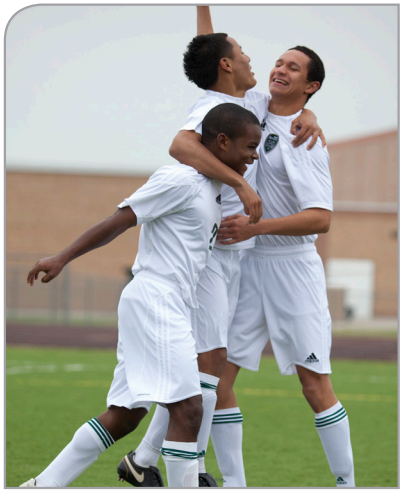

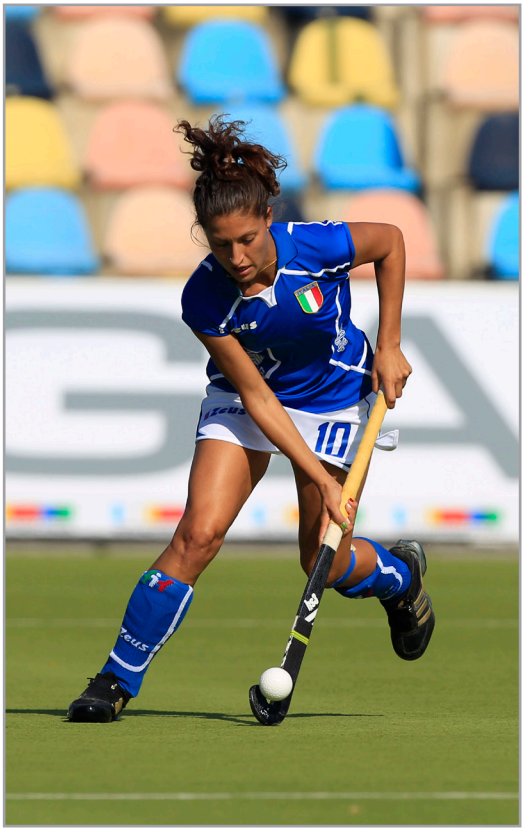

FOODS & FLUIDS FOR TEAM SPORTS

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Success in many sports relies on each individual doing his or her 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 of working hard. Good nutrition and hydration practices are two 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. While the characteristics of team sports vary (see table below), one common feature is the "stop and go" nature of team sport, with high-intensity bursts followed by lower intensity or rest periods.[5] Based on this pattern, all team sports use a combination of the anaerobic and aerobic energy systems, both of which rely on carbohydrate as the primary fuel source.[5]

Suggested Daily Macronutrient Intake

(per kilogram of body weight)

Carbohydrate:[5] 5-7 g/kg/day
Protein:[1] 1.2-1.7 g/kg/day

Team Sport Classifications

Classification	Examples	Sport Distinctions	Nutrition Considerations
Strength & Power Field Sports	American Football, Rugby	Less distance covered, frequent short bursts, high contact	Carbohydrate provision to maintain frequent high-intensity bursts
Endurance-Based Field Sports	Soccer, Field Hockey, Lacrosse	Larger distances covered, most at high speeds	Maintenance of glycogen stores, hydration strategies
Batting Field Sports	Baseball, Softball, Cricket	Lower overall energy demands, many hours on playing field during summer months	Hydration concerns in the heat, adequate blood glucose for attention, decision making
Court Sports	Basketball, Volleyball	Smaller playing area, shorter duration games, frequent substitution, often several games per day or over several days	Glycogen and fluid depletion over time

Adapted from Holway & Spriet 2011 [5]

This guide provides an overview of sports nutrition guidelines for team sports, which should be adapted to individual athletes and teams based on the distinct characteristics of each sport and athlete.[5] 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, energy requirements may be much higher in the pre-season during training camps or two-a-day workouts, during which time recovery is also of great importance. In another example, during the off-season an athlete may be looking to lose fat mass and gain lean mass, which would require a different nutrition strategy than during-season maintenance. The recommendations in this guide are focused on practices and games in the competitive season.

PRE-PRACTICE OR GAME FOODS & FLUIDS

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

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.[3] 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 the urine is dark.[9, 10]

Ingesting carbohydrate within the hour prior to training or competition essentially begins to meet the athlete's during-exercise fueling needs[6] 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 or Game Meals

(Examples for a 180 lb [81.8 kg] athlete)

Menu #1

(~4 hours prior, target ~4 g/kg, 326 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, use butter sparingly
- 20 oz grape juice
- 2 cups fat-free frozen yogurt with 1 cup sliced strawberries

Approximate totals: 1,586 calories, 328 g carbohydrate, 5.4 g fat, 55 g protein, 11 g fiber

Menu #2

(~3 hours prior, target ~3 g/kg, 245 g carbohydrate)

- Burrito from popular fast-food burrito restaurant: flour tortilla, black beans, grilled chicken, rice and pico de gallo. No cheese, sour cream or guacamole
- 1 large banana
- 1 small bag (31.8 g) Baked Lay's® potato chips
- 8 vanilla wafers

Totals: 1,415 calories, 238 g carbohydrate, 30 g fat*, 52 g protein, 23 g fiber

Note the high fat content of this meal. This is not ideal, but when traveling or eating at fast food restaurants, athletes need to make the best choices. Choosing to avoid cheese, sour cream and guacamole helps to keep the fat content down.

Menu #3

(~2 hours prior, target ~2 g/kg, 164 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
- 20 oz Gatorade

Totals: 826 calories, 168 g carbohydrate, 5 g fat, 29 g protein, 7 g fiber

Pre-Practice or Game Key Messages

- Team sport athletes 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.
- Team sports and positions within sports vary greatly based on a number of factors; a nutrition plan should take into account rules of the sport, the position, environment, etc.

G Series 01 Prime: designed to provide carbohydrate energy shortly before exercise

	Serving Size	Carbohydrate	Sodium
Pre-Game Fuel Pouch	1 pouch (4 fl oz)	25 g	110 mg
Energy Chews	6 chews	24 g	90 mg

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 exercising in hot and humid conditions.[10] Specific to team sports, two research studies have indicated that dehydration at this level has been found to impair skill performance in basketball players.[2, 4]

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

- Am I thirsty?
- Is my urine a dark yellow color?
- Is my body weight noticeably lower than yesterday?

Importance of Hydration

Team sport athletes spend several hours each day training, sometimes twice a day and often in the sun or in a hot and humid gymnasium. 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

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 – fluid intake (L))/exercise time (hours).

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.[7] 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.[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.
- 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

In some studies, carbohydrate has been demonstrated to improve indices of performance in team sports. For example, in one study, athletes were asked to complete four 15-minute quarters of shuttle running at different intensities followed by jumping to reach a target while consuming fluid with carbohydrate or water before the task and during each break. The athletes who consumed fluid with carbohydrate had faster 20-meter sprint times and average jump height in the fourth quarter as compared to when they drank water alone. The carbohydrate-fed group also had improved mood, motor skills and reduced force sensation after the testing.[11]

Consuming carbohydrate during exercise provides fuel to the muscle, brain and nervous system.[3] The recommended amount of carbohydrate ingestion every hour of exercise for a team sport athlete is 30-60 g/h.[1, 3, 5] The form (solid, semisolid or liquid) should be determined by the preferences of the individual athlete.

Sodium and Carbohydrate Content of G Series 02 Perform Beverages

	Carbohydrate *(g/8 oz)*	**Sodium** *(mg/8 oz)*
G Series 02 Gatorade Thirst Quencher	14	107
G Series 02 G2	5	107
G Series Pro Endurance Formula	14	200
G Series Pro Gatorlytes	0	780 (mg/ packet)

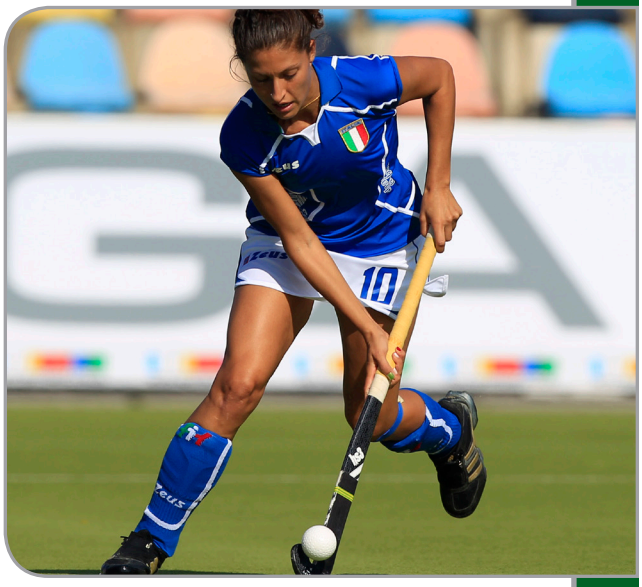
Examples of Strategies to Meet the 30–60 g/h Carbohydrate Recommendation

- 16 oz Gatorade Thirst Quencher or Endurance Formula = 28 g carbohydrate
- 32 oz Gatorade Thirst Quencher or Endurance Formula = 56 g carbohydrate
- 32 oz G2 plus G Series Prime Pre-Game Fuel Pouch or 6 G Series Prime Energy Chews = 45 g carbohydrate

Plan ahead to take advantage of timeouts and halftime to refuel

During-Practice or Game Key Messages

- Team sport athletes should determine their individual sweat rate, taking into account any equipment and environment, and consume fluids with sodium to minimize body weight changes during training and competition.
- Carbohydrate intake during exercise can help maintain performance levels in "stop and go" activities; athletes should aim to consume 30-60 g (120-240 calories) per hour of practice or competition.[3]
- 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

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 team sport athletes. 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 daily carbohydrate needs for team sport athletes (5-7 g/kg/day) and choose carbohydrate-rich meals and snacks with some protein regularly throughout the day.[3, 5]

Athletes should consume about 20 g 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 high-quality, complete protein such as milk protein, whey, egg or meat.[8]

Following exercise, athletes should drink 16-24 oz per pound of body weight lost of fluid with sodium to replace the amounts lost during training and competition.[1, 5, 10]

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Recovery Food and Fluid Examples:

		Calories	Carbohydrate *(g)*	Fiber *(g)*	Protein *(g)*	Fat *(g)*	Sodium *(mg)*
Option 1	G Series Protein Recovery Shake	270	45	1	20	1.5	320
	Water (amount based on body weight changes)						
Option 2	Gatorade Recover Whey Protein Bar	340-370	42-43	1-2	20	9-12	150-210
	Water (amount based on body weight changes)						
Option 3	G Series Recover Beverage	230	41	0	16	0	220
	Additional water if needed based on body weight changes						
Option 4	Beef jerky (1 oz) & 10 saltine crackers	200	25	0	18	4	982
	Additional water if needed based on body weight changes						

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 ~20 g of high-quality protein as soon as possible following training or competition to help repair muscle tissue.
- Rehydrate with 16-24 oz of fluid with sodium for every pound of body weight lost during exercise.

AN EXAMPLE: PUTTING THE SCIENCE-BASED RECOMMENDATIONS INTO PRACTICE

Athlete Profile

Name: Mike

Age: 17

Weight: 170 lbs (77 kg)

Type of athlete: Boys high school basketball player

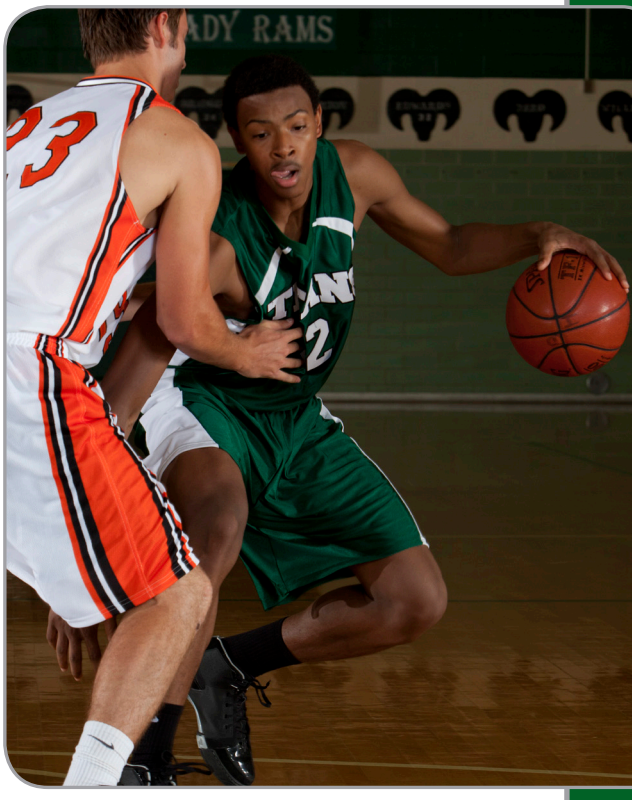
Goal: To determine a fueling strategy for games

Background: Mike is the starting point guard for his high school basketball team and averages 30 minutes per game. He is looking for some help to maintain his energy levels in the fourth quarter.

Pre-Game

We want to make sure Mike 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 basketball game. Weeknight games start at 7:30 and school ends at 4:00. Since Mike doesn't like to eat too close to the start of a game, he will need to eat his pre-game meal about 3 hours before game time. We recommend he then follow the same timing for weekend games. Aiming for ~3 g of carbohydrate per kilogram of body weight and taking into account his favorite foods, we designed a meal to deliver 231 g of carbohydrate. Mike likes to eat the same thing before every game so he knows how his stomach will react and has a superstition about eating red gelatin before a game, so we incorporated that into his pre-game meal.

In the past, Mike usually ate his favorite food, pepperoni pizza, with the red gelatin before a game. In order to help stay closer to his traditional food but provide more carbohydrate and less fat, we suggested a homemade pizza bread, with French bread (1/3 loaf), pizza sauce (1/2 cup) and a small amount of shredded mozzarella cheese (~2/3 cup). With that he had a 20-oz Gatorade



to meet his fluid needs (385-539 mL, or 13-18 oz) and provide additional carbohydrate. We also made sure his red gelatin (~1/2 cup) was NOT sugar-free, to ensure he was getting enough carbohydrate. The nutritional totals for this meal are approximately 1,306 calories, 240 g carbohydrate, 49 g protein, 18 g fat and 6 g fiber.

Mike gets fairly nervous before a game so he doesn't think about eating again but does feel like he could use a little energy at the start of the game. During practices we had him try a G Series Prime Pre-Game Fuel Pouch shortly before starting to give him some extra carbohydrate energy. The pouch was a bit too much liquid for him, so we had him try three G Series Prime Energy Chews (a serving of six is equivalent to the carbohydrate in one Prime pouch). This strategy didn't upset his stomach, so now Mike's pre-game ritual includes three chews and some water while listening to coach in the locker room.

During the Game

To determine Mike's sweat rate, we attended a practice when the team was scrimmaging to simulate the game situation as closely as possible. We weighed him before and after practice, and measured his fluid intake. Based on that information, we've estimated Mike's sweat rate to be 1.5 L/h (51 oz/h), which is fairly high. Mike doesn't report any issues with cramping and we didn't observe salt on his dark green clothing during the practice, so he likely doesn't have higher than average sodium needs.

Carbohydrate intake throughout the game is going to be important for Mike to help maintain energy level in the fourth quarter. Not to mention, research shows carbohydrate intake during a simulated basketball game, as well as maintaining hydration, helps skills such as free throw shooting.[4] Therefore, it will be important for us to help Mike consume close to the upper end of the 30-60 g/hour recommendation.

Mike averages 30 minutes of playing time and a high school basketball game usually lasts a little over an hour. Since Mike has high fluid needs, we suggested he try to consume one 32-oz and one 20-oz bottle of G2 over the course of a game, which will provide 52 oz of fluid to match his sweat rate and 32 g of carbohydrate. Since we want him to be a little closer to 60 g of carbohydrate, we will also have him eat G Series Prime Energy Chews at halftime to provide an additional 25 g of carbohydrate, for a total over the course of the game of 57 g. It is important that Mike practices this amount of fluid and carbohydrate intake and plans ahead to take advantage of every timeout, break between quarters and halftime to refuel and rehydrate.

After the Game

Good recovery practices can help an athlete persist through a long season like basketball. Since Mike plays a lot of minutes, we want to make sure he recovers well after each practice and game. Mike reports feeling very hungry after games, so we recommend he drink the G Series Protein Recovery Shake or eat the Gatorade Recovery Protein Bar to get 20 g of protein to rebuild muscle, carbohydrate to replace the stores in his muscles and electrolytes to help replace sodium lost in sweat. The total amount of carbohydrate he eats at this point isn't of great importance since Mike's next practice isn't until after school the next day and this shake will serve as a bridge to his next meal (which should contain ample carbohydrate). It will be easy for him to drink the shake or eat the bar while he is icing down after the game. Also, since every game is different, we recommend he weigh himself before and after each game and drink his shake, as well as drink ~20 oz of water for every pound of body weight lost.

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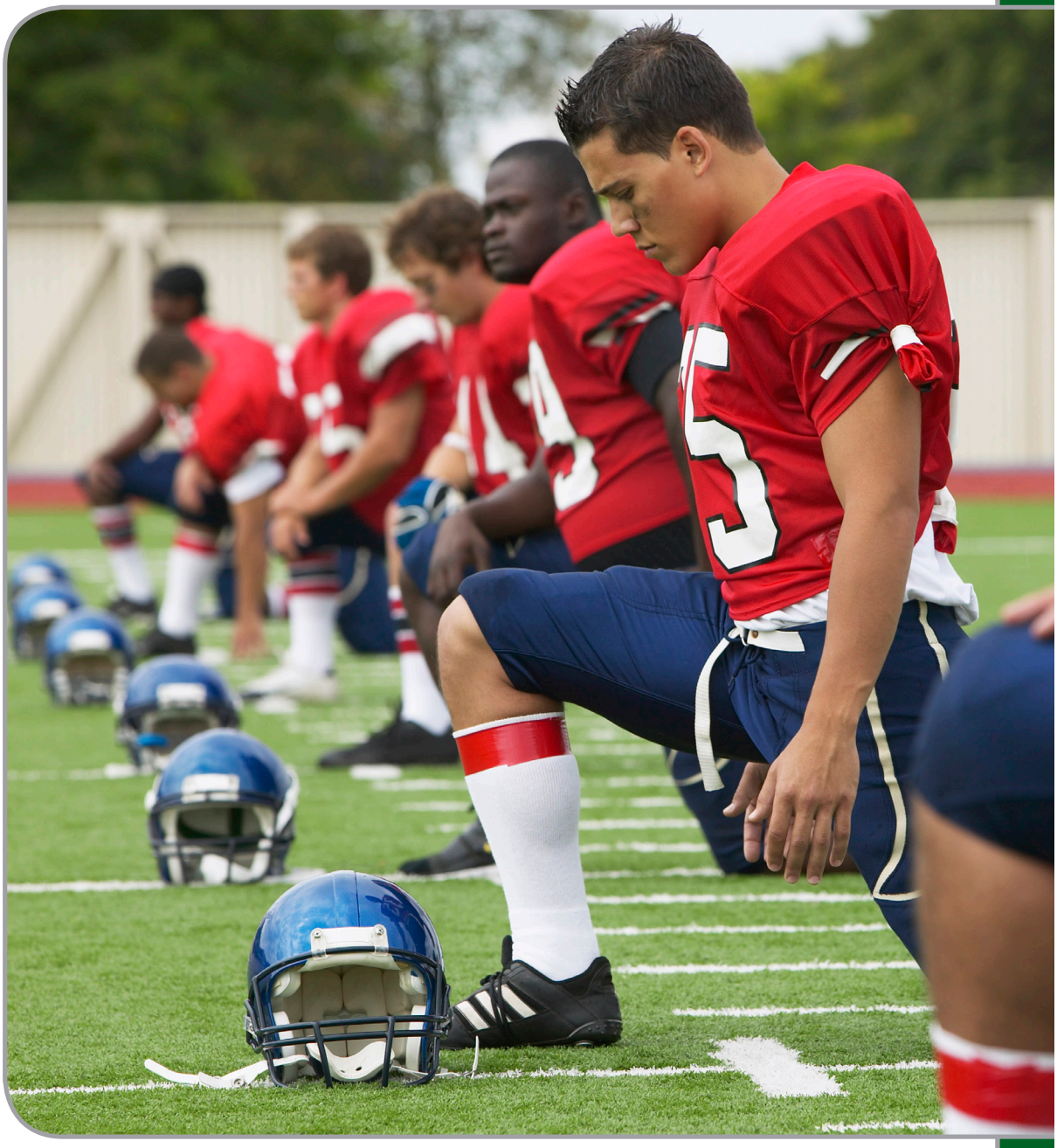

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CALCULATIONS/YOUR WORKSHEET

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) * 1.7 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 * 16 oz = [ ] oz

TO

_____ body weight lost * 24 oz = [ ] oz

9. POST-EXERCISE PROTEIN NEEDS

No calculations are needed, ~20 g is appropriate for everybody.