



# SPORTS NUTRITION

for Endurance Training and Competitions





## Mini-Clinic Instructor's Guide:

### Sports Nutrition for Endurance Training and Competitions

#### Overview:

In this instructor's guide, as a coach, you will learn how to educate your athletes on what it takes to properly fuel and hydrate for endurance training and competitions.

#### Objective: Help your athletes:

- Understand the importance of sports nutrition
- Develop a personalized fueling and hydration plan for before, during, and after endurance exercise

#### Who is this for?

- This guide was written primarily for Team-in-Training coaches of high-intensity endurance athletes, such as runners, cyclists, and triathletes. We have tried to keep the information as simple as possible to make it easy for beginner athletes to understand the fundamentals of sports nutrition. We have also included specific teaching notes for walkers.

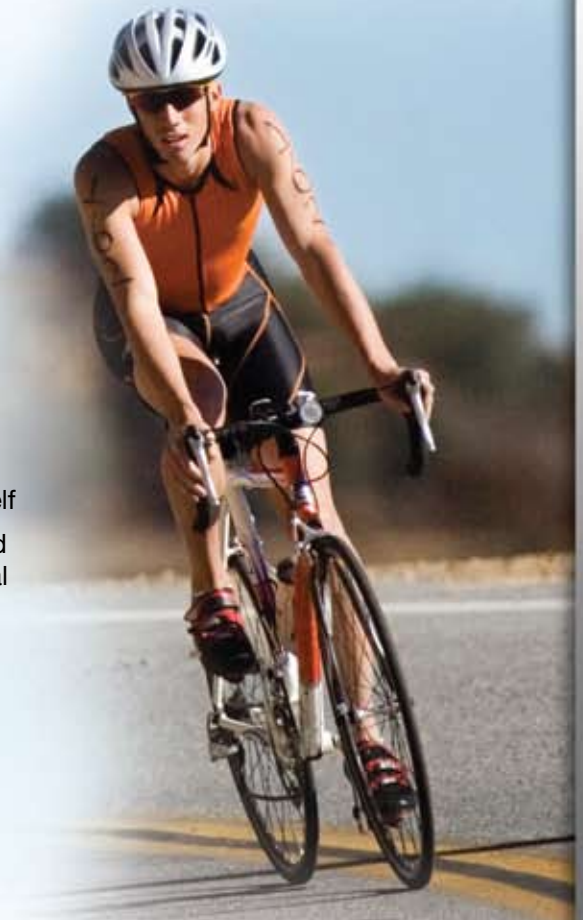
**Estimated Teaching Time:** 20–40 minutes

#### General Outline of Lesson:

- I. Introduction
- II. Importance of Sports Nutrition
- III. **BEFORE EXERCISE:** (fueling and hydration *before* exercise)
- IV. **DURING EXERCISE:** (fueling and hydration *during* exercise)
- V. **AFTER EXERCISE:** (refueling and rehydration *after* exercise)
- VI. Conclusion

#### Notes:

- Every coach has his/her own teaching style. We encourage you to customize this guide to your needs by writing notes to yourself
- Encourage participation! Your athletes will be more engaged and understand the relevance of sports nutrition if they hear personal stories from each other
- We cannot emphasize enough: Every athlete is unique. Remind your athletes that there is no one single right approach for all endurance athletes





## Introduction

### Background and Clinic Goals — Suggested Talking Points

- A. Sports nutrition is the practical science of hydrating and fueling before, during, and after exercise. Done properly, sports nutrition can help support optimal athletic performance. Done incorrectly or ignored, it can detract from an athlete's ability to perform.
- B. This mini-clinic will specifically cover what you need to know to fuel and hydrate during the 3 phases of endurance exercise:
  - 1. **BEFORE:** In preparation for exercise, so you can be your strongest.
  - 2. **DURING:** During exercise, to help delay the onset of fatigue.
  - 3. **AFTER:** After exercise, to help speed your recovery.

### Instructor Introduction — Teaching Notes

- A. Talk briefly about your sports nutrition background — when you started taking it seriously, and how important it is to you personally as an athlete
- B. Share a story of your own personal success or failure as a result of proper or improper sports nutrition

### POWERBAR® Introduction — Teaching Notes

- A. Explain that this clinic is based on sports nutrition information available on the POWERBAR website ([www.powerbar.com](http://www.powerbar.com)) and that it is derived from published science and position stances of reputable organizations such as the American College of Sports Medicine
- B. You can learn much more about sports nutrition at [www.powerbar.com](http://www.powerbar.com)
- C. Explain that POWERBAR has been a proud sponsor of the Team-in-Training (TNT) organization for several years. POWERBAR not only supplies TNT with funding and free product samples for coaches and participants; it also lends its nutrition expertise so all participants know the basics of sports nutrition and everyone can train to their potential



This guide is intended as an additional training tool for TNT coaches. Please use it in conjunction with training materials provided during Coach Certification and in TNT newsletters to educate your participants about sports nutrition. Coaches should remind their participants that this information is not intended as a substitute for medical advice from a personal physician or dietitian. Participants should regularly consult a physician in matters relating to their health.

# Importance of Sports Nutrition

## 1. Think of your body like a car! It's an analogy that makes this science easier to understand:

### A. The right gas: carbs (glycogen)

- i. As an athlete, your body is somewhat like a car. Just like a car needs the proper grade of gas and a full tank for a long trip, you need the right kinds and amounts of carbohydrate (glycogen) to fuel muscles during endurance training and competitions.
- ii. A car without gas sputters and then comes to a stop. Glycogen-depleted muscles can cause you to drastically slow your pace or even stop. Runners call it "hitting the wall."

### B. The right oil and coolant: hydration

- i. Just like a car needs oil and coolant to avoid overheating, your body needs fluids and the electrolyte sodium to avoid overheating.
- ii. A car running low on oil or coolant overheats, and this can ruin an engine. An athlete running low on fluid or with a fluid-sodium imbalance will also overheat, leading to impaired physical performance and potential life-threatening health effects.

You can avoid problems and give yourself the chance to be as strong as possible by starting exercise fully fueled and hydrated!

## 2. Explain that there are three stages of fueling and hydration:

- A. The fuel and hydration strategy you use to **prepare** for endurance exercise differs from what you will do **during** exercise, which in turn differs from what you will need to do **after** exercise to promote recovery.
- B. In this lesson, we will break down each of the 3 steps or phases of endurance exercise, and explain what you need to do to fuel and hydrate properly.

## 3. Remember that everyone is different:

- A. Just like cars have different sizes of fuel tanks and some cars need more frequent oil or coolant changes, athletes are different. Thus, your needs are different. Therefore, plan to do some experimenting during training:
  - i. Adjust and fine-tune strategies to meet your individual needs.
  - ii. Keep a training log to track what's working and not working.
  - iii. Use your training-tested strategy for the competition.





# Fueling and Hydration *Before* Exercise

## Key points of emphasis:

- A. Maximize glycogen stores:  
Remember that glycogen = gas for long trips; carbohydrates = muscle fuel
  - 1) Keeping your tank full = eating a carb-rich diet.
  - 2) Topping off = eating a carb-rich pre-exercise meal and/or snack.
  
- B. Hydrate before exercise:  
Prevent your car from overheating by having sufficient oil and coolant





## Suggested Talking Points:

### A: Start with a full tank of gas:

#### Why do I need to eat a carbohydrate-rich diet?

Only a limited amount of glycogen is stored in your body. Your “glycogen tank” can be depleted in an hour or two of intense exercise. So make sure your tank is full; starting exercise with full glycogen stores can delay the onset of fatigue and help you train more effectively. Another analogy that you can use is that eating ample carbs prior to training allows you to have more money in your wallet, so that you don’t have to use money from the bank.

#### Practical Suggestions:

- As a high-intensity endurance athlete in training, you need to consume a high-carb diet regularly. In general, fill three-fourths of your plate at meals with carb-rich foods like cereals, grains, pasta, bread, potatoes, fruits, vegetables, and beans, and fill the other one-fourth from protein foods.
- If walking is your training of choice, you will be relying more on your stores of body fat and your glycogen reserves will last longer. But as the duration of your training picks up, so too should your intake of carbs.

### B: Topping off the tank:

#### Eat a carb-rich pre-exercise meal and/or snack.

Eat a high-carb meal 2–4 hours before and/or a high-carb snack 1 hour before exercise, to prevent hunger during exercise and to top off glycogen stores. Meals and snacks should feature carb-rich foods and beverages; moderate protein intake is okay, but avoid slow-to-digest, fatty foods and too much fiber.

### NOTES:

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**The bottom line — when to eat and snack before exercise:**

2–4 hrs before: carb-rich foods/beverages

1 hr before: carb-rich snack

Don't let your engine overheat!

**Why hydration is important:**

High-intensity endurance training leads to fluid losses through sweating. Avoid carrying fluid deficits from one workout to the next. Begin your workouts well-hydrated by consuming water or a sport drink about 4 hours before exercise (~1 fl oz for every 10 lbs body weight). When well-hydrated, this should lead to urine production. Clear urine means you are drinking too much, lemonade color is perfect, and a darker yellow color means that you need more fluids. If urine is dark in color, drink roughly half again as much fluid about 2 hours before exercise.

**The bottom line — when and how to hydrate before:**

4 hours before exercise (1 fl oz for every 10 lbs body weight)

<i>Body weight (lbs)</i>	<i>Fluid volume needed (fl oz)</i>
100	8–11
150	12–16
200	15–22

2 hours before exercise, drink half again as much fluid, if needed. This will allow you sufficient time to eliminate excess fluid before starting exercise.

**NOTES:**

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## Teaching Notes:

### Fueling and hydration before exercise

#### Expect Questions on...

##### **I train in the morning. I can't eat a big meal a few hours before!**

For early morning exercise, it's the rare athlete who wants to get up extra early in order to eat a hearty pre-exercise meal. Instead, a light meal or snack will do. But with this scenario, it would be wise to also consume carbs throughout the training run if it is longer than an hour, in order to balance out the fact that pre-exercise fueling opportunities were missed.

Some athletes are predisposed to gastrointestinal discomfort or pre-event nerves. Here again, a light meal or snack may be all that is realistic. Liquid meal supplements or carb-containing beverages, bars, and gels may be helpful options.

##### **Should I eat carbs within an hour of exercise?**

The benefit of consuming carbs within an hour of exercise varies from one athlete to the next. Some studies show no benefit, while others show up to 20% improvements in endurance performance. Typical sports nutrition guidelines are 40–60 grams of carbs 30–60 minutes before exercise to top off energy stores, so try it out during training and find out what works best for you.

##### **What types of fluids should I avoid immediately before exercise?**

Fluids to avoid immediately before training or competing include large volumes of fruit juices and sugared soft drinks. These beverages may be too concentrated. This can slow fluid absorption and cause stomach cramping and gastrointestinal discomfort during exercise. Carbonated beverages can fill you up too much, which could impair adequate hydration.

##### **What about caffeine?**

For reasons that aren't yet fully understood, caffeine may help you work out or compete at a higher intensity without actually feeling like you're working harder. Then again, it might not, because effects seem to vary from one person to the next. If you want to see what impact caffeine has on your endurance performance, use it during training first, and stick to a moderate intake in the range of 70–150 mg taken prior to and during exercise. That's about 1–2 cups of coffee. If it doesn't help or makes you feel too jittery, cut back or skip it altogether.

##### **Ideas for high-carb pre-exercise meals and snacks:**

- Cold or hot cereal with fruit or fruit juice and low-fat or nonfat milk
- French toast or pancakes with maple or fruit syrup
- Toast with jam or honey
- Breakfast burrito (scrambled eggs, salsa, and cheese in a flour tortilla) and fruit nectar
- Pasta with low-fat, tomato-based sauce
- Low-fat energy bar with a serving of fruit
- Roll or sandwich made with a banana and honey
- Fresh fruit or fruit salad with low-fat or nonfat yogurt
- Fruit smoothie made with your fruit of choice and low-fat or nonfat milk or yogurt





## Fueling and Hydration *During* Exercise

### Key points of emphasis:

- A. Don't run low on fuel! Maintain blood glucose levels and spare glycogen stores by consuming carbs during exercise.
- B. Know your hydration zone! Don't let the "check oil" light come on!
- C. Avoid overhydration.



## Suggested Talking Points:

### A. Don't run low on fuel! Refuel with carbs:

High-intensity endurance athletes (runners, cyclists, and swimmers) can delay the onset of fatigue by consuming carbs during exercise. Most are generally comfortable with sports drinks and energy gels as carb sources during endurance exercise. But the need for carbs depends on the duration of exercise:

#### Short-duration training (<1 hr)

You don't need to consume carbs while exercising; glycogen stores will meet your needs.

#### For longer workouts

Consume carbs during exercise based on your body weight (see chart below). For longer-lasting endurance events, make sure to use products with a carb blend of glucose and fructose in the ratio of 2:1 (C2 MAX).

#### Estimated carbs per hour (recommended)

Weight	Exercise	Duration (hrs)	Duration (hrs)
	<1 hr	1–2 hrs	2–3 hours or more*
100 lbs	None	33 g	45 g
150 lbs	None	50 g	68 g
200 lbs	None	67 g	91 g

\*POWERBAR C2 MAX is a dual source energy blend that can deliver more energy to muscles, fast. In fact, breakthrough studies showed that the same 2:1 glucose/fructose blend as that used in C2Max delivered energy 20-55% faster than glucose alone and another study showed an 8% improvement in 8 athletes' cycling times.

#### Walkers: Refuel to prevent hunger.

If you are a walker, you will be relying more on your fat stores during exercise, so your carb reserves will last longer. Consume foods and beverages during exercise to prevent hunger. Choose easy-to-digest foods. These will generally be carb sources. Avoid harder-to-digest choices that are high in fat and fiber during exercise.

### B: Know your hydration zone and drink to your thirst.

Whether you are a runner, a cyclist, a swimmer, or a walker, you will perform at your best if you don't lose any more than 2% of your body weight due fluid loss during exercise. This 2% rule is called your hydration zone. When you fall out of your hydration zone, especially in high-temperature or high-humidity conditions, the perceived difficulty of exercise is much harder. You also put yourself at risk for the adverse health effects of dehydration. It is equally important to avoid overhydrating during exercise, as this, too, can lead to adverse health effects.

#### NOTES:

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## C. Overhydration

It is possible to consume too much fluid. In fact, this tends to be more of a problem in slower runners and walkers.

While losing too much fluid leads to dehydration, consuming too much fluid during exercise can lead to overhydration or a condition called hyponatremia. Similar to dehydration, overhydration can impair performance and lead to serious adverse health effects. Overhydration is a real danger, because often the symptoms (lightheadedness, nausea, etc.) also can be symptoms of dehydration! So remember, never consume so much fluid during training or competition that you actually increase your body weight.

## D. Help replace some of the sodium you lose in sweat.

Consuming sodium during exercise helps replace some of the sodium you lose in sweat. This can help maintain the fluid-sodium balance in your body and stimulate thirst, which helps you hydrate more effectively. Sodium is included in well-designed sports drinks and energy gels. For walkers, salty snacks can serve as an extra source of sodium.

### The bottom line — how much to fuel and hydrate during exercise

#### Exercise lasting <1 hr:

Hydrate with plain water or a sports drink. In high-temperature or high-humidity conditions, a sports drink may be a better option than water because of the sodium content.

#### For exercise lasting 1–3 hrs:

Hydrate with a sports drink, as you will benefit from the carbs and sodium. Begin ingesting fluids early in your exercise at a rate that is comfortable. Drink enough fluids to prevent losing more than 2% of your body weight, and don't overhydrate.

For moderate- to high-intensity endurance events lasting 1–2 hours, consume approximately 30-60 grams of carbs per hour. For high-intensity endurance events lasting more than 2–3 hours, have 45–90 grams of carbs per hour utilizing optimized carb blends (C2 MAX). Carbs can come from sports drinks and gels. Also, energy gels taken with water can be used as an alternative to a sports drink at any point during exercise.

## NOTES:

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## Teaching Notes:

### Fueling and hydration during exercise

#### Expect Questions on...

##### What is involved in calculating sweat rate?

Calculating your sweat rate is simple. With the POWERBAR **Sweat Rate Calculator**, you'll be guided through a one-hour test workout that will calculate your sweat rate for you.

Conduct the test workout at the intensity and in climate conditions similar to the conditions you encounter during training and competing. Also, test yourself at different exercise intensities and in different climate conditions, and as your fitness level progresses. By repeating sweat rate-testing under varying conditions, you will better understand how your body responds to different conditions. This will help you fine-tune your hydration plans for whatever you encounter during training and competing.

### Fluid and food choices for endurance events

Choice	Comment
<b>Water</b>	Does not assist with fuel or sodium needs, but can be used for short-duration exercise or consumed in addition to a sports drink or with an energy gel to meet fluid needs.
<b>Sports Drink</b>	Best option for meeting fluid, carb, and sodium needs for endurance exercise; flavoring stimulates consumption.
<b>Energy Gel</b>	Serves as a concentrated source of quickly absorbed carbs. POWERBAR® GELS also provide sodium. Consume with water. The combination of a gel and water can be substituted for a sports drink. Some gels contain caffeine, which may give a performance boost in long-duration exercise.
<b>Energy Bar</b>	Can be useful for athletes who want solid food. Choose low-fat versions. Fluid needs require separate attention.
<b>Fruit</b>	May help relieve hunger during long events. Several portions will be needed to provide substantial amounts of carbs. Fluid needs require separate attention.
<b>Soft Drinks &amp; Fruit Juices</b>	May be more slowly absorbed due to the carbohydrate concentration.



\*Some of the choices above can cause gastrointestinal distress in some individuals, so test your choices during training.



## Refueling and Rehydration *After* Exercise

### Key points of emphasis:

- A. Consume carbohydrates after exercise to replenish glycogen stores.
- B. Consume protein after exercise to help stimulate muscle tissue building and repair.
- C. Replace lost fluids and sodium.
- D. Consume some fat post-exercise to reload muscle lipids.





## Suggested Talking Points:

### A. Refill your tank right away (glycogen reloading)

Rebuilding muscle glycogen stores after a long, strenuous workout is a key factor in determining how long it will take you to recover. Glycogen rebuilding rates are fastest in the first 3 hours after exercise, with the highest rate of glycogen repletion taking place within 30 minutes after exercise. Failing to consume carbs after exercise leads to very low rates of glycogen restoration until feeding does occur.

#### For rapid recovery:

If you are doing twice-a-day workouts or you are exercising again in less than 12 hours, take advantage of the rapid phase of glycogen resynthesis by consuming carbs as soon as possible after completing exercise.

- Divide your body weight in half to estimate the grams of carbs needed within 30 minutes after exercise
- Repeat the same intake of carbs every hour for up to 3 hours or until your meal schedule is resumed
- Smaller carb portions every 15–30 minutes are fine and may be more easily tolerated than large amounts of carbs taken at once
- Stick with quick-to-digest carb sources, e.g., recovery bars and drinks, energy bars and gels, sports drinks, fruit smoothies and fresh fruit, salted pretzels, low-fat yogurt, and low-fat chocolate milk
- Solid and liquid carbohydrates are equally effective for glycogen reloading

#### For 24-hr recovery:

If you have 24 hours or more to recover between training sessions, total carbohydrate intake rather than timing of intake is the more important issue for glycogen restoration.

- For light training days, a total daily carb intake of about 3 grams per lb body weight is needed
- For moderate-to-heavy endurance training, about 4 grams carbs per lb body weight is recommended
- For extreme training ( $\geq 4$  hrs per day), consume about 5 grams of carbs per lb of body weight

### B. Protein for muscle tissue repair and synthesis

There are two reasons to consume protein along with carbs right after exercise:

1. Firstly, unless carb intake post-exercise is very high, a combination of carbs and protein together is better at boosting glycogen storage rates than carbs alone.
2. Secondly, the amino acids in the protein you eat are used to make new proteins for muscle tissue repair and to adapt to the physiological demands of exercise.

#### NOTES:

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As soon as possible after exercise, consume about 10–20 grams of protein to provide amino acids for muscle tissue repair and synthesis. The overall total daily protein requirement for endurance athletes is about 0.5–0.7 grams protein per lb body weight.

### **C. Fluid and sodium for rehydration**

After exercise, fluids and sodium lost through sweat need to be replaced. How fast to rehydrate depends on when your next training session takes place.

#### **For rapid rehydration:**

If you've lost excessive fluid (more than 2% of your pre-exercise body weight) and need to be fully rehydrated in less than 12 hours to be ready for another workout, you will need to drink about 23 fl oz per lb weight lost during exercise. Drink the necessary volume of fluid gradually between the end of your first workout and 1–2 hours before the start of your next workout.

#### **For 24-hr rehydration:**

For once-a-day training sessions, normal consumption of beverages, meals, and snacks will generally rehydrate you within about 24 hours.

#### **Sodium needs:**

Consuming sodium while rehydrating can help you retain ingested fluids and help stimulate your thirst. You can obtain sodium from recovery beverages and bars, sports drinks, energy bars and gels, salty snacks, and meals.

### **D. Muscle lipid restoration (for advanced athletes training for 3+ hours per session)**

Muscle fibers contain lipid droplets (deposits of fat) called intramyocellular lipids, or IMCL. Scientists theorize that muscle lipids may be an important muscle fuel early in exercise, and may help spare muscle glycogen stores. However, most endurance athlete eat high-carb, low-fat diets, and typically fall short of meeting their daily needs for lipid reloading during recovery by about 10–30 grams of dietary fat.

A newly proposed strategy is to boost fat intake just enough to replenish muscle lipid stores. A snack, such as a recovery bar, in the early recovery phase is a practical method to help restore muscle lipid levels, while also providing carbs and protein for glycogen restoration and muscle tissue repair and synthesis.

### **NOTES:**

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## Teaching Notes:

### Refueling and rehydration after exercise

#### Expect Questions on...

##### **What about protein intake for workouts that involve weight training?**

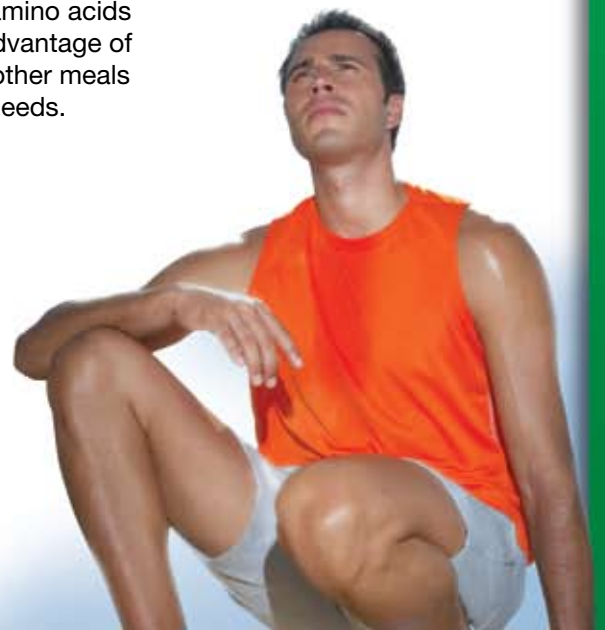
For resistance training workouts, consume a beverage or snack containing a combination of protein and carbs both before and after working out. This can help maximize training adaptations by making amino acids available for muscle-tissue building, and by increasing the production of the body's natural anabolic hormone, insulin. To optimize muscle protein synthesis after resistance training, have 0.05–0.18 grams of protein per hour within 4 hours after exercise. For example, for a 160-lb individual, this is 30 grams once or 8 grams each hour for 4 hours after training.

##### **More on muscle lipids (for advanced athletes training for 3+ hours per session)**

All athletes have plenty of energy stored as fat. Much of that fat is stored directly beneath the skin, as well as in and around the region of the hips, thighs, and abdomen. But new scientific findings are emerging that have the experts taking a second look at fat and wondering if it too might be an important nutrient to replenish during recovery — only this particular fat source is located deep within muscle tissue. Muscle tissue fibers contain distinct lipid droplets or deposits of fat called intramyocellular lipids. These muscle lipids are typically found right next to a structure in the cell which functions to produce energy for the muscle cell. Researchers have known for decades that glycogen is an important muscle fuel for endurance, but these new findings have scientists theorizing that muscle lipids may also be an important energy source, especially early in exercise, and that burning muscle lipid as fuel may help spare muscle glycogen stores for later in exercise. This is new, cutting-edge research.

As a general rule, athletes eating high-carb diets typically fall short of meeting their daily needs for lipid reloading during recovery by about 10–30 grams dietary fat. A recovery bar that contains carbs, protein, and some fat, eaten in the early recovery phase, represents a practical and efficient method for boosting dietary fat intake to help restore muscle lipid levels, while also providing carbohydrates and protein for glycogen restoration and muscle tissue repair and synthesis.

As long as carbohydrate intake is sufficient, eating fat with carbs does not decrease the overall rate of glycogen restoration during recovery. Also, the presence of some fat appears to help enhance the utilization of amino acids for muscle protein synthesis. This approach may also offer the advantage of minimizing the need to make further dietary adjustments during other meals and snacks in the recovery period in order to meet muscle lipid needs.





## CONCLUSION:

- Please give out the handouts and product samples. The handout reviews key points. Suggest that they put it somewhere handy, like on the refrigerator, to refer to it often. Remember — all of your great coaching will be wasted if your athletes go home and forget what you just talked about
- Tell athletes they can learn more about sports nutrition at [powerbar.com](http://powerbar.com). Encourage athletes to consider signing up for the *POWERBAR Nutrition Edge* newsletter, which gives tips, up-to-date sports nutrition information, nutrition calculators, POWERCOACH™, and special offers

