

## Post-Run Recovery and The 4:1 Ratio

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What do you eat immediately after a race? If you're like most runners, you take whatever reload food is available at the finish area: a banana; a bagel; a doughnut; perhaps a package of peanut butter crackers. What about after your long run or a tough workout? Not many people eat right away, but instead focus on rehydrating, stretching, and many other things except "what to eat."

The foods that you eat in the first hour of recovery are essential to getting you on the road to your next workout or race. In addition to your stretching and rehydration regimen, you must add "glycogen reloading" to your recovery routine. More importantly, make it a habit to eat carbohydrates and protein in the 4:1 ratio within the first 30 to 60 minutes after a race or long run. That is, eat 4 grams of carbohydrates to 1 gram of protein.

The key reason for immediate consumption of this 4:1 ratio lies with something called **glycogen synthase**. Put that into your training lexicon along with fartlek, yassos, and periodization, because it is just as important.

### Muscle Recovery and Glycogen Synthesis

Runners know that carbohydrates are the most important source of energy for exercise. But it is not as simple as "eat bagel, make fuel, run." That's like saying "drill oil, pump gas, drive car." In order to be used as fuel, consumed carbohydrates first go through glycogen synthesis, the process that converts glucose into stored glycogen.

**Glycogen synthase** is the enzyme that controls glycogen synthesis. Think of it as the glue that bonds glucose molecules together into a chain to form glycogen.

So what does glycogen synthase have to do with eating right after a run? Research indicates that glycogen synthase is most active immediately after exercise, but has a relatively short life-span. Within the first hour or so after exercise, your body is very receptive to receiving carbohydrates, converting them into glycogen, and storing the glycogen in the muscles. Some studies show that muscles store two to three times more glycogen during this period than during a meal eaten several hours after a workout.

Thus, right after a run, your body is saying "give me some carbohydrates, and I will pack your muscles with energy."

### The Role of Protein in Glycogen Replenishment

When you finish a race or a workout, think of these two important reminders:

- eat 1 gram of carbohydrates per 1 pound of body weight
- eat 1 gram of protein for every 4 grams of carbohydrates (or, inversely, 4:1 carbs to protein)

Why protein? The answer lies with the role of **insulin**, the hormone that helps move carbohydrates - in the form of blood glucose - into muscle cells to be stored as glycogen. Without insulin, the glucose does not get from the blood into the muscle cells as glycogen. Although you might think that “more carbs equals more insulin which equals more stored glycogen,” that is not accurate. There is a point at which eating more carbohydrates does not result in increased amounts of insulin.

Protein, however, *can* boost insulin release, which in turn aids in the conversion of carbohydrates into muscle glycogen. Some studies indicate that consuming protein with carbohydrates produces up to 30% more stored glycogen than eating carbohydrates alone.

There is a catch to the equation: too much protein slows the digestive process, which is not the desired result when you are trying to increase the absorption of fluids and carbohydrates. The landscape thus looks something like this:

Not enough carbs = not enough glycogen production

Lots of carbs = higher glycogen production

*Plenty of carbs + right amount of protein = maximized glycogen production*

Plenty of carbs + too much protein = decreased glycogen production

As you can see, the balance is delicate and somewhat complicated for folks who have just completed a race or run and whose minds are not likely to focus on carb-to-protein ratios.

The good news is that researchers and scientists have done the work for you, and have concluded that the appropriate ratio of carbohydrates to protein is the 4:1 ratio. The better news is that there are products on the market that are specifically designed for muscle recovery, and most of them contain this 4:1 ratio of carbs to protein. But before we get to those products, let's go back and review the standard “reload” foods that you see at races.

### **Typical Reload Food: Not Enough, and Not 4:1**

Consider the following examples of post-exercise recovery foods for two hypothetical runners, and see where some of the typical post-race recovery foods fall into the picture.

#### Runners

125 pound woman: Needs 125 grams of carbohydrates and 31 grams of protein

200 pound man: Needs 200 grams of carbohydrates and 50 grams of protein

#### Foods

Banana: 25g carbs, 1g protein

Plain bagel: 35-40g carbs, 8g protein

Krispy Kreme glazed doughnut: 22g carbs, 2g protein

Peanut butter crackers: 24g carbs, 4g protein

Total: 111g of carbohydrates; 15g of protein.

Assuming that the 125-pound woman ate one of everything, that would be almost enough carbohydrates, but not enough protein. The deficiency is even greater for the 200-pound man who ate the same thing. What is worse is that most runners aren't very interested in eating a lot of food in the first hour after a race or long run.

The solution? Drink what you need in the 4:1 ratio. That is where **recovery drinks** enter the picture. Accelerade and Endurox R4 are two that you might recognize, and they are among many that contain the 4:1 ratio. You can also find this 4:1 ratio in some surprising places: Ensure (40g carbs and 9g protein) and Slim-Fast (40g carbs, 10g protein) are two good examples.

That's right. Slim-Fast. Imagine the looks on spectators' faces when they see a highly-fit runner cross the finish line and chug a Slim-Fast.