Dear Alice,

I am a second year Nutrition student and have a question about protein and endurance athletes. Why are their protein requirements greater than they are for resistance athletes? Is it because the muscle glycogen stores get depleted over a long period of time with intense exercise? If so, should they consume more carbohydrates than resistance athletes, with a low glycemic index prior to their workout?

Liiisa

**Answer**

Dear Liiisa,

You're definitely on the right track! Glycogen stores do get used up during intense exercise, especially during prolonged periods of training. While the nutritional needs of endurance and resistance athletes may differ because they engage in different types of physical activity, an athlete's optimal protein and carbohydrate requirements might also need to be adjusted for a variety of other reasons as well, such as improving recovery time or increasing muscle mass. What's more, not only is the amount of carbohydrates and protein essential to peak performance, how meals and snacks are spaced throughout the day can also affect how the body responds to these nutrients (more on this later). Some additional considerations may also include an athlete's age, fitness level, type and intensity of training, body size and composition, and performance goals.

First, a quick review of biochemistry: carbohydrates, in the form of glucose, are the primary fuel source for aerobic activity, a.k.a. endurance activity. During periods of rest, the body stores glucose in muscle tissue (and the liver) as glycogen. If glycogen starts to run low during intense activity, the body may resort to burning protein for energy instead, which can happen when someone works out at a moderate intensity for 90 minutes or more without taking in any new carbohydrates. When the body burns protein for fuel, physical activity can get really tough, resulting in exhaustion and fatigue. In running, this is often called ?hitting the wall? - that moment when you feel like you just don't have the energy to keep going.

Although carbohydrates are often emphasized for *endurance athletics* because they train aerobically for extended periods of time, protein is still essential for maintaining energy levels
and muscle repair. These athletes need plenty of glycogen from the get-go to make it through a lengthy training session. But once they’ve pushed their muscles to use up what’s left of their carbohydrate storage, their bodies could start to use protein as fuel. As you suggested, if an endurance athlete works at this high of an intensity for long periods of time or trains very frequently, their protein needs increase to maintain their existing muscle mass and avoid that dreaded wall.

To minimize recovery time and speed up muscle repair, it’s recommended that protein be ingested 30 to 60 minutes after a session of endurance work. In competitive settings where the recovery time is less than eight hours, a snack or meal with a one to three ratio of protein to carbohydrates has been shown to be most beneficial when consumed within the first few hours after finishing. This is because enzymes that promote glycogen storage hit their peak performance one to two hours post physical activity? having a carbo-licious snack during this time window can help stoke up glycogen stores and spare protein breakdown. But this post-workout window isn’t the only time to top off the tank? it’s recommended that an athlete’s total daily requirement of protein and carbohydrates be met as meals and snacks throughout the entire day, spaced three to four hours apart. This aids the body in recuperating from the last endurance workout and priming it for the next endurance session.

For **resistance athletes** who primarily engage in weight lifting activities, an optimal balance of carbohydrates and protein is still necessary for optimal training. Because resistance training is not an aerobic activity, resistance athletes typically don’t burn as many calories as endurance athletes. However, studies have shown that starting out a session of strength training with a full cache of glycogen in the muscles is just as critical to high performance. The timing of carbohydrate intake for resistance athletes hasn’t been studied as well as for endurance, but eating typical amounts of carbs with balanced meals and snacks throughout the day is probably sufficient. As for the specific protein needs of resistance athletes, *how much* depends on whether or not they are trying to build or maintain muscle mass. In either case, evidence suggests that consuming protein within one to two hours right after a resistance workout is critical for muscle recovery and repair, especially if the athlete didn’t eat in the one to two hours prior to starting to workout.

Long story short: each individual athlete has unique carbohydrate and protein needs that ultimately depend on their specific body type, training regiment, and fitness goals. The following are some general guidelines for protein and carbohydrate intake:

To calculate recommended daily protein intake, consider a person’s level of physical activity (see list below). Multiply the recommended grams of protein per kilogram of body weight (g/kg) by a person’s weight in kilograms (kg). It’s recommended that adults not exceed 2.0 g of protein per kilogram body weight, regardless of activity level.

- For those who are mostly sedentary or only engage in light physical activity: 0.8 g/kg
- For a recreational athlete: 1.0 to 1.5 g/kg
- For a high intensity endurance athlete: 1.2 to 1.6 g/kg
- For a resistance trainer who wants to maintain muscle mass: 1.0 g/kg
- For a resistance trainer who wants to increase muscle mass: 1.5 to 1.7 g/kg

To calculate recommended daily carbohydrate intake, multiply the recommended grams of carbohydrates per kilogram of body weight (g/kg) by a person’s weight in kilograms (kg):

- For an endurance athlete: 6.0 to 10.0 g/kg
For a fitness athlete, including resistance training: 4.0 to 6.0 g/kg.

Also, it may help to keep in mind that the body requires a balance of many other nutrients, including fats, vitamins, and minerals to perform its best. In addition to carbohydrate and protein intake, an athlete needs to consume enough total calories (in the form of carbs, proteins, or fats) to fuel training as well as the activities of daily living; otherwise, protein will still be burned as fuel instead of being used for muscle-tissue repair and other essential functions. For resistance athletes trying to build muscle mass, a diet with sufficient calories helps to support and sustain those gains. Finally, drinking enough water to maintain fluid and electrolyte balance is also critical for every workout, whether you’re sweating it out on the squat rack or the racetrack. If you want more information about your specific nutrient needs, consider chatting with a registered dietitian or a health care provider to learn more. For more tips and resources on balancing proteins, carbs, or maximizing athletic performance, check out the related Q&As.

Here’s hoping this information fueled the fire for knowledge and physical activity!

Alice!

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