

Fueling for Performance Reading

Lesson 2: Nutrient Detective Lab



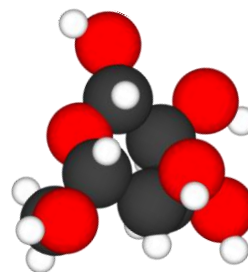
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INTRODUCTION

Athletes have many strategies they can use when fueling for performance. Nutrition can play a crucial role in optimizing training sessions as well as with recovery and metabolic adaptation. Michael Pollen summarized healthy eating in his book *In Defense of Food* with “Eat (real) food, mostly vegetables, not too much.” Athletes should be able to obtain both adequate macronutrients (protein, carbohydrates, fats) and micronutrients through a variety of foods. Sports medicine providers should help athletes navigate the many facets of sports nutrition, including food composition, nutrient timing, supplement use, and energy balance. Additionally, athletes’ nutritional requirements may vary widely depending on sport, position, timing of season, and training vs. rest day. Most athletes will plan to either gain lean muscle mass, lose fat, or maintain their current body composition while not impeding their performance on the field. It can be difficult for an athlete to navigate all the various “fad diets” and “healthy” choices when shopping or eating outside the home. Athletes also need to be educated on the detrimental effects of rapid weight loss strategies for competitive advantage, especially in sports such as wrestling and gymnastics. Detrimental effects include hypohydration and loss of glycogen stores and/or lean muscle mass.

MACRONUTRIENTS

The 3 main macronutrients are protein, carbohydrate, and fat. It is important for athletes to consume the optimal ratio of macronutrients in their diet based on their training goals, such as gaining muscle or losing fat while maintaining lean mass. Food quality is also very important, as whole foods should be consumed whenever possible versus packaged foods and bars or shakes.

PROTEIN

Proteins are important for many body processes. Not only are they the building blocks of muscle, tendons, and other soft tissues, but they also are essential for building enzymes, hormones, and neurotransmitters for many bodily functions.

Proteins are composed of both essential and nonessential amino acids, with the former only being fully obtained through proper nutrition as our bodies cannot produce them. There is much debate on how much protein is needed for athletes. The dietary reference intake (DRI) for protein is 0.8 g per kilogram body weight (0.36 g/lb) for sedentary individuals. This equates to about 56 grams of protein per day for an average man. Many studies have shown that athletes have higher daily protein requirements. There are many instances where higher daily protein intake is beneficial for athletes; examples include strength training, maintaining lean mass in a caloric deficit, and during injury recovery. The American College of Sports Medicine (ACSM), International Society for Sports Nutrition (ISSN), and International Olympic Committee (IOC) provide a consensus that the daily protein requirements of athletes range between 1.2 and 2.0 g per kilogram body weight per day, which is well above the DRI and would equate to 84 to 140 grams of protein per pound per day for the average man. The IOC recommends 1.8 to 2.7 g per kilogram body weight per day when an athlete is trying to lose fat while gaining lean mass in a slight caloric deficit and proper training program.

Overall, athletes should consume approximately 15% to 30% of their calories from protein sources. Some authors have discussed the deleterious effects of high-protein diets, including kidney failure and osteoporosis, but there are no well-done studies to support this at this time. Protein-restricted diets are reserved for those with decreased renal function, as an athlete with normal kidney function should be able to eat the amount of protein using the above guidelines without deleterious effects. Recommended sources of protein for athletes include lean meats and fish, cottage cheese, eggs, plain Greek yogurt, and protein shakes. Good sources of protein for vegan athletes include lentils, tempeh, chickpeas, black beans, quinoa, almonds, and plant-based protein shakes.

CARBOHYDRATES

Carbohydrates are the main energy source during high-intensity activity for the central nervous system as well as muscular work. Carbohydrates have been vilified in the media lately with their link to the obesity epidemic and possible gut inflammation. This has also led to the explosion of available gluten-free products, but the vast majority of people do not need to avoid gluten as there are many health benefits to eating a diet rich in whole grains. This can lead to a lot of confusion for an athlete trying to make good food choices to fuel his or her body. Carbohydrates are not all created equal, as there is a vast difference between eating a bowl of oatmeal versus a bowl of ice cream. Whole grains, fruits, vegetables, and legumes are highly nutritious foods that are rich in antioxidants, fiber, vitamins, and minerals, while processed sugars abundant in the Western diet can be quite detrimental to health.

Athletes have varied carbohydrate requirements based on training intensity, type of workout, and timing during their season. In general, athletes will need to consume 3 to 5 g per kilogram of body weight daily for light activity and upward of 8 to 12 g per kilogram of body weight per day for intense training. A summary of requirements based on the ACSM, ISSN, and IOC recommendations is listed in Table 3.

Table 3. Summary of daily carbohydrate requirements

Organization	Physical Activity Level	g/kg BW per day
ACSM	Athletes	6-10
ISSN	General physical activity, 30-60 min/d, 3-4 times a week	3-5
	Moderate- to high-intensity volume, 2-3 h/d, 5-6 times a week	5-8
	High-volume, intense exercise, 3-6 h/d, 1-2 sessions, 5-6 times a week	8-10
IOC	Low-intensity or skill-based activities	3-5
	Moderate exercise program, ~1 h/d	5-7
	Endurance program, moderate to high intensity, 1-3 h/d	6-10
	Strength-trained athletes	4-7
	Extreme commitment, moderate to high intensity, >4-5 h/d	8-12

ACSM, American College of Sports Medicine; BW, body weight; IOC, International Olympic Committee; ISSN, International Society for Sports Nutrition.

FAT

Fat requirements for athletes are similar to those for nonathletes (20%-35% total daily calories should come from healthy fats). The IOC does not recommend consuming less than 15% to 20% of total calories from fat because it is essential for many processes in the body, including cell membrane structure, absorption of fat-soluble vitamins, hormone regulation, brain health, and energy for muscle metabolism. Athletes should focus on good sources of fat that are high in unsaturated fats and essential fatty acids. Trans fats should be avoided, and saturated fat should be less than 10% of total consumption. Healthy sources of fat include salmon, nuts and nut butters, and avocado, as well as coconut and olive oil. Athletes may also consider taking omega-3 supplements as they can also counteract inflammatory and free radical formation sustained from training.

There has been renewed interest in eating high-fat, low-carbohydrate diets in low-intensity and endurance exercise. Fat, in the form of plasma-free fatty acids, intramuscular triglycerides, and adipose tissue, provides a fuel substrate that is both relatively plentiful and increased in availability to the muscle as a result of endurance training. The body cannot extract the energy from fats fast enough for high-intensity exercise, hence the high carbohydrate mantra for athletes. However, our bodies store thousands of calories of fats that can be metabolized at an adequate rate for energy during endurance exercise.

Essentially, athletes use these diets to change their metabolism so their bodies will preferentially burn fat for fuel. This would be beneficial for ultra-endurance events to prevent some athletes from “bonking” or “hitting the wall” when their glycogen stores are depleted because their metabolism is geared toward burning carbohydrates versus fat for fuel. Athletes consuming less than 10% of their calories from carbohydrates are able to oxidize fat between 1.2 and 1.5 g/min during progressive-intensity exercise near 65% VO₂ max. A fat-burning adapted Ironman triathlete is able to use the fat stores in his or her body to fuel the race effectively at that oxidation rate for the entire race compared with a carbohydrate-burning athlete who would need to consume another 90 to 105 g per hour to maintain performance.

Studies addressing the effects of low-carbohydrate diets on the ease of weight control in athletes, the capacity to train and recover, immune function and injury risk, or hand-eye coordination or capacity to concentrate in sports are lacking. Additionally, some endurance athletes can be insulin resistant, and eating a diet high in carbohydrates may not be best for their long-term health. Some studies show that marathon runners with lower coronary risk factors have marked atherosclerosis.