Sports Nutrition for the Active Individual with PKU

Proper fueling is an essential part of a training program. A well-fueled individual has:

- The energy needed to **perform, strengthen muscles, and maintain bone**
- The fuel and nutrients needed for **muscle recovery**
- Fuel for **the brain** which delays fatigue and allows for strategizing
- The ability to regulate **body temperature** (fluids and electrolytes)
- The right combination of nutrients (protein, fat, carbohydrate) at the right times to allow for proper fueling and recovery

This tip sheet takes established sports nutrition guidelines and applies them to the athlete with PKU. It is important to note that we know very little about the way physical activity affects metabolic control, and that each individual will need to work closely with his or her metabolic dietitian to develop the strategy that works best.

Protein Needs for the Athlete

Protein, an essential nutrient, is important for building and maintaining muscle. However, regardless of whether or not an individual has PKU, the body can only use a certain amount. **Eating more than the body can use will NOT build more muscle.**

The average healthy PKU adult taking an amino acid formula needs about 1 g protein per kg body weight per day. For a person weighing 70 kilogram (kg) (154 pounds), that would mean about 70 grams (g) protein every day.

For most recreational athletes, this amount of protein is ample. Those who need more include:

- Anyone restricting calories, as some protein will be broken down and used for energy
- Athletes engaged in high intensity long duration activity, either endurance (aerobic) or strength training

How much more?

Ideally it is best to work with your metabolic and/or sports nutrition dietitian to individualize a plan based on your exercise program. **A suggested starting point is to aim for 1.2-1.4g protein per kg.** Additional protein will not be stored by the body or used to build muscle. Focusing too much on taking in large amounts of protein may result in inadequate carbohydrate intake, which can compromise performance. Competitive athletes who are training several hours per day and/or restricting calories may need up to 2g protein per kg body weight**.** Not eating enough calories/carbohydrates "wastes" protein as it is broken down and used for energy.

Timing of Protein Intake

Spreading intake of protein throughout the day is optimal. For those on medical formulas, this is easy. Aim for 15-25 grams 3-4x/day depending on your total needs. Plan to have 1 serving within 3 hours before and 1 hour after exercise. This will help with muscle repair and growth, and help you recover for your next training session.

Are protein supplements helpful?

Commercial protein shakes and supplements contain large amounts of phenylalanine and cannot be used by people with PKU as they will raise blood phenylalanine levels. **The only way to increase protein intake is through PKU formula.** Athletes with PKU are not at any disadvantage, as sports scientists advise that there is no benefit to consuming protein shakes or bars over real food and formula.

Carbohydrate and Physical Activity

Carbohydrates (sugars) are a key source of energy for muscles during exercise and also fuel the brain. They are stored in the liver and muscle in the form of glycogen. During exercise, glycogen is broken down, releasing sugar molecules which are used as fuel by working muscles. Liver glycogen is broken down between meals, releasing sugar into the bloodstream and preventing blood sugar levels from dropping. Eating nutritious, carbohydrate-rich foods throughout the day as part of a well-balanced diet will give you the energy you need to perform your best. Healthy choices include low protein breads, cereals and pastas, vegetables and fruits/juice, and your PKU formula. Sports drinks and gels contain carbohydrate and can give your exercise a boost if you can't get enough from other sources. They can be helpful during exercise sessions lasting longer than one hour. **It is essential to include adequate carbohydrate to prevent the breakdown of muscle tissue for fuel, which can raise phe levels in the blood.**

Carbohydrates before Exercise

- Include carbohydrate foods in your pre-exercise meal or snack.
- Eat a meal 3-4 hours before or snack 1-2 hours before you exercise so that you're not too hungry or full.
- This meal/snack should be high in carbohydrates and low in fat and fiber so it is easily digested.

Examples: Bowl of cereal with banana and rice milk, ½ bagel and 1 cup of juice, or bread with jam

Athletes who have a "nervous stomach" before competition may find liquid meals (e.g. Smoothies) easier to tolerate. Pre-competition meals should include one to two glasses of plain water.

Carbohydrates during Exercise

For exercise lasting 45 minutes or less, no additional carbohydrates are needed.

For longer duration exercise, consuming carbohydrates allows the athlete to work longer and harder before becoming exhausted.

- Aim for 30 to 90 grams of carbohydrates per hour (1 to 3 large bananas or 15 to 48 ounces of a 6 to 7% carbohydrate sports drink such as Gatorade)
- Salted pretzels and crackers or sports gels will also provide carbohydrate, but must be taken with ample water (8 oz. for every 15 grams carbohydrate) to prevent stomach upset

Carbohydrates after Exercise

Eating a carbohydrate-rich meal or snack 15-30 minutes after intense exercise lasting more than an hour will help refill your glycogen stores so you are ready for your next exercise session. This is especially important if you exercise or compete twice on the same day, or exercise on consecutive days.

For the casual exerciser, this means packing a piece of fruit, fruit juice, or a fluid replacement beverage for a post-workout snack, and then eating a mixed high carbohydrate and protein meal (such as low protein pasta with vegetable sauce and your PKU formula) shortly thereafter. For the athlete in heavy training, a meal containing 1.2g carbohydrate per kg body weight is recommended, followed by additional carbohydrate snacks every 2 to 4 hours. Some PKU formulas do contain adequate carbohydrate. Talk to your dietitian to make sure you are getting enough carbohydrate from formula and food combined.

Examples of some healthy post-exercise meals or snacks include:

- a sandwich, an apple, and PKU formula
- sweet potato, mixed vegetables and PKU formula
- a smoothie with bananas, berries, and PKU formula
- Soup with low protein toast and vegetable sticks, and PKU formula

Carbohydrate Content of Some Common Foods

Food	Serving Size	Carbohydrate (g)	Phe (mg)	Protein (g)
Bagel, Cambrooke plain	1 whole (90 g)	25	21	0.4
Banana	1 medium (118 g)	27	58	1.3
Crackers, saltine	7 crackers (20 g)	15	85	1.9
Loprofin crackers	5 crackers (31g)	24	3	0.1
Pretzels	18 g (about 30 sticks)	15	94	1.8
Raisins, seedless	1 small box (42 g)	33	27	1.3
Sports drink (fruit flav)	500 mL (2 cups)	25 to 40	0	0
Energy gel	1 package	20 to 30	Up to 25	Up to 0.5
Energy chews	8 chews	32	0	0

Reference: Canadian Nutrient File (2010); individual manufacturers; Metabolic Pro

Hydration

Fluid needs are highly variable. Being active increases the amount of fluid you need as some is lost through sweat and respiration. Intense exercise in a hot, humid climate can result in as much as 0.3 to 2.4 L (about 1¼ to 10 cups) of sweat per hour. You can also sweat a lot in cold-weather sports like hockey and skiing and even in water sports like swimming or water polo.

A loss of 2% of your body weight (e.g. 2.4 pounds in a 120 pound person) can negatively affect performance. You will feel more tired and have to slow down.

Signs of dehydration are dizziness, headache, and muscle cramps. Severe dehydration can increase the risk for heat illness and heat stroke as the body is unable to cool itself. **Thirst is not a good indicator of fluid needs during exercise, so you must know your own fluid needs and drink to a schedule.**

Steps you can take:

Drink throughout the day so that your urine is light colored and regular. Plenty of pale yellow (e.g. lemonade colour) urine is a sign you are well hydrated. A smaller volume of dark yellow (e.g. apple juice colour) urine could indicate dehydration.

Choose water most of the time. 100% fruit juice, PKU formula, tea, coffee, and sports drinks also provide fluids and may also provide needed carbohydrates. High water containing foods like fruit, vegetables also contribute to fluid needs.

Sports drinks can be useful in the following situations:

- During intense exercise
- Exercise lasting longer than one hour
- Exercise that takes place in hot or humid weather
- Exercise performed wearing heavy sports equipment such as those used in football and hockey
- When participating in more than one sporting event per day, such as in a soccer tournament
- When needing extra calories

In addition to providing fluids, sports drinks provide energy (carbohydrates) for your muscles and brain and electrolytes (salts) to replace what you lose during exercise.

- Avoid carbonated soft drinks, full-strength juice, fruit drinks or caffeinated energy drinks during intense exercise. These drinks prevent you from drinking enough to be hydrated as they may cause stomach upset and are too high in sugar for best absorption.

Do not overdrink. Too much fluid can dilute the amount of sodium in your blood. It is important to drink to a schedule rather than thirst. **Knowing your own fluid needs will help prevent dehydration and over hydration.**

Exercising for weight loss:

Weight loss occurs when you take in fewer calories than your body needs. It is important to note that a pound lost on the scale reflects a combination of fat, water, and muscle. **Slower weight loss (<1% per week) will minimize the loss of water and muscle, an important consideration for those with PKU.** It is important not to dramatically decrease the amount of calories you eat, and to include adequate carbohydrate. Losing weight too quickly can cause an increase in phe levels. Losing weight should be done during the off season as weight loss in-season can compromise performance.

References:

Protein in Sports Nutrition. Dietitians of Canada – updated: 2016-01-20 .

Carbohydrates in Sports Nutrition. Dietitians of Canada – updated: 2016-01-20.

Sport Hydration, Get the facts. Dietitians of Canada: updated 2016-01-25.

Eat Better, Perform Better – Sports Nutrition Guidelines for the Vegetarian. http://www.vrg.org/nutshell/athletes.htm

Nutrition and Athletic Performance. Position of Dietitians of Canada, the Academy of Nutrition and Dietetics and the American College of Sports Medicine. Feb 2016 (Revised December 2016).

