

OPTIMAL NUTRITION FOR EXERCISE

Optimal nutrition for exercise is crucial for enhancing performance, supporting recovery, and maintaining overall health. Properly fuelling the body before, during, and after exercise can help optimize the benefits of physical activity, whether you're an elite athlete or someone engaging in regular physical activity. Nutritional components necessary for exercise, includes **macronutrients** (carbohydrates, proteins, and fats), **micronutrients** (vitamins and minerals), **hydration, and timing strategies**.

Optimum nutrition may help maximize physical performance by;

1. Maximising energy store.
2. Achieving ideal weight for performance.
3. Ensuring sufficient intake of vitamins and minerals.
4. Maintain adequate hydration.
5. Optimising pre competition and competition food.

1. MACRONUTRIENTS FOR EXERCISE

Macronutrients are nutrients that provide calories or energy to the body. The purpose of macronutrients is to promote healthy cellular growth, metabolism, and to maintain normal bodily functions. The macronutrients, as suggested by the name “macro,” are needed in the body in large amounts to provide the full and proper effect. There are three types of macronutrients: carbohydrates, proteins, and fats.

Carbohydrates

- Carbohydrates are the body’s primary energy source during exercise. They are stored in the muscles and liver as glycogen, which provides quick energy. Carbohydrates can be simple (e.g., sugars) or complex (e.g., starches and fiber).
- Complex carbohydrates are found in foods such as pasta, whole grain breads, and rice. They provide energy, fiber, vitamins, and minerals. These foods are low in fat.
- Simple carbohydrate such as sugars found in soft drinks, jams and jellies, and candy provide a lot of calories, but they do not provide vitamins, minerals, and other nutrients.
- The average amount of energy available from stored carbohydrates is only 8.4 kilojoule i.e. 2000 kcal which will provide fuel for a run of approximately 40km.
- Endurance training increases the capacity of the muscles to store glycogen. Untrained individuals have muscle glycogen store of 80-90 mmol/kg whereas trained individual may have glycogen store as high as 130-135 mmol/kg.

Role in Exercise:

- Carbohydrates provide energy for both aerobic (endurance) and anaerobic (strength and high-intensity) activities.
- During prolonged exercise, muscle glycogen stores are depleted, and carbohydrate consumption can delay fatigue and enhance endurance.

Recommended Intake:

- For moderate-intensity exercise, aim for 3-5 grams of carbohydrates per kilogram of body weight per day.
- For high-intensity or endurance sports, intake may increase to 6-10 grams per kilogram of body weight, depending on training volume.

Sources:

- Whole grains (e.g., oats, quinoa, brown rice)
- Fruits and vegetables
- Legumes (e.g., beans, lentils)
- Dairy products (e.g., yogurt, milk)
- Sports drinks (for rapid glycogen replenishment post-exercise)

Proteins

- Proteins are essential for muscle repair and growth. They are made up of amino acids, some of which are considered essential because the body cannot produce them.
- Protein can also be used by the body for energy, but only after carbohydrate stores have been used up. Just like carbohydrates, proteins provide the body with 4 calories per gram. Proteins are most commonly found in animal products, nuts, and beans.
- The recommended daily intake of protein for a sedentary person is 0.8 gm/kg/day. The protein requirement of an athlete adult is considerably higher than those for sedentary individuals i.e. approximately 1.2-1.7 gm/kg/day.

Role in Exercise:

- Protein is critical for recovery, muscle building, and repair after resistance training or any exercise that causes muscle stress.
- Protein intake also helps maintain **lean muscle mass (Fat-Free Mass)**, particularly during periods of calorie restriction or intense training.

Recommended Intake:

- General recommendations are 1.2 to 2.0 grams of protein per kilogram of body weight per day for those engaging in moderate to intense exercise.
- For muscle building, higher protein intake may be necessary (around 1.6-2.2 g/kg).

Sources:

- Lean meats (chicken, turkey, beef)
- Fish and seafood
- Eggs
- Plant-based options (tofu, tempeh, legumes, quinoa, nuts, seeds)

Fats

- Fats are collectively referred as triglycerides. A triglyceride composed of glycerol and three fatty acids. Fats provide essential elements of cell membranes and also provide the body with the ability to absorb fat-soluble vitamins A, D, and E & K.
- They also provide the highest calorie count, providing the body with 9 calories per gram instead of the 4 provided by one gram of either carbohydrate or protein.
- Approximately 98% of dietary lipid exists as triglycerides while 90% of total body fat resides in adipose tissues. Fat provides body's largest store of potential energy.
- The energy store capacity of fat is more than twice equivalent quantity of carbohydrates and proteins.
- For high intensity short duration exercise i.e. 1-2 min almost all energy supplied from glycogen stored in the skeletal muscle.
- Carbohydrate is the only nutrient that provides energy when the muscles have insufficient oxygen for their needs. This type of exercise is called anaerobic exercise and produces lactic acid.

Role in Exercise:

- While carbohydrates provide quick energy, fats are used during prolonged, low- to moderate-intensity exercise.
- Fatty acids, particularly omega-3 fatty acids, support inflammation reduction, which can help with recovery.

Recommended Intake:

- Fats should make up around 20-35% of your total caloric intake.
- Focus on unsaturated fats (from plant-based sources and fatty fish) and avoid trans fats.

Sources:

- Avocados
- Nuts and seeds
- Olive oil and other vegetable oils
- Fatty fish (salmon, mackerel, sardines)
- Nut butters

2. MICRONUTRIENTS FOR EXERCISE

- Micronutrients are chemical elements consist of thirteen organic essential vitamins and seven inorganic minerals. Micronutrients play an important role in energy production, haemoglobin synthesis, healthy growth, bone and immune health, and maintain normal metabolism. As the name “micro” suggests, these chemical elements are only required to exist in small amounts to provide ample effects.
- The thirteen essential vitamins fall into one of two categories, water-soluble and fat-soluble. The water-soluble vitamins, the eight vitamins which consists the vitamin B complex and vitamin C, must be consumed daily as the body is unable to store. In contrast, the fat-soluble vitamins, vitamin A, D, E & K can be stored in the body’s adipose tissue and therefore does not have to be consumed on daily basis to maintain the correct levels in the body.
- Minerals are inorganic nutrients that also play a key role in ensuring an athlete’s health. The seven minerals needed to maintain accurate energy and hydration levels include:
 1. **Calcium & vitamin D-** Body needs calcium to build and maintain strong bones. Your heart, muscle s and nerves also need calcium to function properly. Vitamin D also plays a role in reducing inflammation and muscle recovery. All athletes should get 1,200 to 1,500 mg of calcium daily from food or supplements.
 2. **Iron** - Iron is a trace mineral that is highly significant to endurance athletes. Iron is critical to optimal athletic performance because of its role in energy metabolism, oxygen transport, and acid-base balance. Deficiency can lead to fatigue and decreased exercise performance.
 3. **Zinc** - For athletes, zinc is an important supplement for optimal performance that prevents early onset fatigue during workouts. The mineral does this by binding to insulin to ensure proper glycogen storage which controls the amount of insulin needing to be produced by the pancreas.
 4. **Magnesium** - Magnesium helps the muscles to relax after your workout, which counteracts the role that calcium plays in contracting the muscles. A lack of magnesium can affect this delicate balance and you're likely to feel the effects of this as sore muscles.
 5. **Sodium** - It is important to maintain fluid balance in the body and is also lost in the sweat at a much greater quantity than other electrolytes (such as potassium and magnesium). It regulates muscle contraction, nerve function and blood volume. “Low sodium levels can cause dehydration, muscles cramps or even organ failure.

6. **Chloride**- Chloride is one of the most important electrolytes in the blood. Losing sodium and chloride can reduce power, strength, agility, skill, and concentration, all of which are essential for elite athletes.
7. **Potassium** - Athletes should be especially concerned with their potassium intake. It is responsible for regulating total body water and stabilizing controlled and automatic muscle contractions. It is lost through sweat and urine.

Sources:

- Iron: Red meat, spinach, legumes, fortified cereals
- Calcium: Dairy products, fortified plant milks, leafy greens
- Vitamin D: Sunlight, fortified dairy, fatty fish, egg yolks
- Magnesium: Nuts, seeds, whole grains, leafy greens
- Potassium and Sodium: Bananas, potatoes, leafy greens, salt, sports drinks

3. Hydration

- Hydration is essential for optimal performance, as dehydration can impair strength, endurance, and recovery. It also increases the risk of injury.
- Water contributes 65-75% of the weight of the muscles & 10% of fat mass. It serves as body's transport medium.
- Water has tremendous heat stabilizing qualities because it absorb considerable amount of heat with small changes in temperature. It maintains a stable body temperature during environmental heat and stress.
- A sedentary adult in normal environment needs about 2.5 lit of water intake per day.
- Excessive water intake under certain exercise can cause a complication called **hyponatremia**. Hyponatremia is a condition where sodium levels in the blood are lower than normal. In many cases, too much water in the body dilutes the sodium, causing the condition. It causes swelling of brain tissues produces headache, confusion, nausea, cramping, seizures, coma and pulmonary oedema.

General recommendations:

To prevent over hydration and risk of hyponatremia following steps should be followed:

- Drink 400-600 ml of fluid 2-3 hrs before exercise.
- Drink 150-300 ml of fluid about 30 min before exercise.
- During exercise, aim for 200-300 mL (7-10 oz) every 10-20 minutes.
- Do not drink more than 1000 ml of plain water in one hour.
- Add small amount of sodium to drinking fluid.
- Include some glucose in the rehydration drink to facilitate intestinal water uptake via glucose sodium transport mechanism.

Role in Exercise:

- During exercise, water is lost through sweat and respiration. Proper hydration helps regulate body temperature, prevent cramps, and ensure optimal cardiovascular function.
- Dehydration can lead to fatigue, decreased performance, and an increased risk of heat-related illnesses.

Hydration Strategy:

- Drink water before, during, and after exercise to maintain fluid balance.
- For longer-duration or high-intensity activities, consider consuming drinks that replenish electrolytes (e.g., sodium, potassium) lost through sweat.

NUTRITION PRINCIPLES:

- Carbohydrates make the best pre-game foods. They digest quickly and are easily taken into the muscles. High protein foods (meat, eggs, etc.) take longer to digest while fatty foods (all fried foods, hamburgers, etc.) sit in the stomach for longest and may produce a feeling of heaviness.
- Be sure to have players drink plenty of water before the game to prevent dehydration, 2-3 glasses of water up to 2 hours before any game, and more just before the game if possible.
- If a player can't eat before the game, he should try to eat additional high carbohydrate foods the day before. Players can't cram good nutrition into one day and they should eat a high carbohydrate diet every day to ensure optimal replacement of muscle glycogen.

AVERAGE DIGESTION TIMES

Large meal: 3-4 hours. Smaller meal: 2-3 hours. Liquid meal: 1-2 hours.

4. Nutritional Timing for Exercise

Nutritional timing refers to the strategic consumption of food and fluids to optimize performance and recovery. The timing of meals and snacks can have a significant impact on energy levels and recovery.

Pre-Exercise Nutrition:

- A balanced meal 2-3 hours before exercise should include carbohydrates, moderate protein, and low fat.
- A small snack 30-60 minutes before exercise should focus on easily digestible carbohydrates (e.g., a banana or toast with jam).

During Exercise Nutrition:

- For exercise lasting over 60 minutes, consuming carbohydrates (e.g., sports drinks, gels, or bars) can help maintain blood glucose levels and delay fatigue.
- Hydration is essential during exercise, especially in hot or humid conditions.

Post-Exercise Nutrition:

- After exercise, it is important to consume a combination of carbohydrates and protein within 30-60 minutes to replenish glycogen stores and support muscle repair.
- A 3:1 ratio of carbohydrates to protein is ideal for recovery (e.g., a protein shake with fruit or a chicken sandwich).

References

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