

**SIGNIFICANCE OF MACRONUTRIENTS IN PERFORMANCE
ENHANCEMENT FOR ATHLETES****Naveen Kumar Verma**

(Research Scholar)

Department of Physical Education, University of Lucknow

Dr. Chetna Samant Tomar

(Professor)

Department of Physical Education, Khun Khun Ji Girls P.G. College, University of Lucknow

ABSTRACT

Optimal nutrition is vigorous for enhancing athletic performance and recovery. An athlete's dietary needs depend on factors such as the type of sport, personal goals, and environmental conditions. A balanced diet is crucial for both training and competition, with specific nutritional strategies before, during, and after exercise. Carbohydrate consumption during exercise helps maintain carbohydrate oxidation, prevent hypoglycemia, and support the central nervous system. Although training with low carbohydrate availability may offer metabolic benefits, its impact on performance is still debated. Protein intake, particularly post-exercise, is key for muscle recovery and tissue repair. Hydration is another critical element. Athletes should aim to limit fluid losses to no more than 2% of body weight during exercise. Meeting energy and macronutrient needs, especially carbohydrates and protein, is essential for maintaining body weight, replenishing glycogen stores, and repairing tissues during high physical activity. Adequate fat intake is also necessary to supply essential fatty acids, fat-soluble vitamins, and energy. Consuming proper food and fluids before, during, and after exercise helps stabilize blood glucose, optimize performance, and enhance recovery. Sports drinks containing carbohydrates and electrolytes can help prevent dehydration, support muscle fuel, and reduce the risk of hyponatremia during prolonged exercise. Athletes should consult a registered dietitian or nutritionist to ensure their nutrition supports their training and performance goals. Proper dietary guidance is key to maximizing both short-term performance and long-term health.

Keywords:

Sports Activities, Performance, Enhanced Performance, Nutrition, Hydration

INTRODUCTION

Nutrition plays a crucial role in athletic performance, providing the energy necessary to perform activities, enhance strength, and support recovery. What athletes eat, as well as when they eat, significantly affects their training, performance, and recovery. Timing and food choices throughout the day are essential to optimize performance levels and the body's ability to recover after exercise. Athletes must be mindful of what they eat and drink before a competition to maximize their physical potential. A well-balanced diet is vital for athletes, consisting of a variety of foods in adequate amounts to meet daily energy needs. Carbohydrates should account for 60-70% of daily energy intake, while protein should make up around 12-15%, with the remaining energy coming from fats. Proper fueling before, during, and after exercise is essential for maintaining energy levels and promoting recovery. The importance of nutrition in sports performance cannot be overstated. According to Greany and Jeukendrup, proper nutrition supports everything from fueling during exercise to muscle building and recovery post-competition. A well-planned diet provides the foundation for success in any sport by enhancing physical performance and ensuring optimal recovery, making nutrition a key factor in athletic achievement.

Nutrients

Proteins: Proteins are essential for muscle growth and recovery, as they repair muscles damaged during exercise, helping them become stronger. Proteins consist of 20 amino acids, nine of which are essential and must be obtained through diet. These essential amino acids are primarily found in animal products like meat, milk, and eggs. Without them, muscle repair and growth

cannot occur. Athletes need between 0.55 and 0.91 grams of protein per pound of body weight daily, as recommended by the Academy of Nutrition and Dietetics. To determine protein needs, multiply your body weight by 0.55 and 0.91.

Protein quality: There are 20 amino acids, consisting of 9 essential amino acids (EAAs) and 11 non-essential amino acids (NEAAs). EAAs must be obtained from the diet since the body cannot produce them. Protein quality is often assessed through methods like Chemical Score, Protein Efficiency Ratio, Biological Value, and PDCAAS (protein digestibility-corrected amino acids), with the ultimate goal being muscle protein synthesis (MPS) and hypertrophy. Research shows animal and dairy-based proteins, which are rich in EAAs, promote greater MPS (muscle protein synthesis) and hypertrophy following resistance training compared to vegetarian proteins, which may lack one or more EAAs. Some studies suggest that EAAs alone can stimulate MPS as effectively as whole proteins with the same EAA content, though the impact of larger meals and amino acid delivery must be considered. However, other studies show that whole protein sources, like whey, are more effective in stimulating muscle protein accrual than EAAs alone. The branched-chain amino acids (BCAAs) leucine, isoleucine, and valine play a critical role in protein metabolism and muscle MPS, with leucine being particularly influential. Leucine supplementation can extend protein synthesis when taken post-exercise. However, while leucine is important, a balanced intake of all EAAs from high-quality protein sources is key to sustaining MPS over time.

Food is high in protein eggs, chicken, turkey, cottage cheese, yogurt, kefir, milk, lean beef, fish, legumes (peas, beans, lentils), and nuts.

Recommendation of protein intake based on the athlete in different types of exercise and goals.

Type of training or exercise	The recommended amount of protein is typically expressed in g/kg of body weight
Preserving and building muscle mass	1.4-2.0 g/kg of body weight
During caloric deficit periods	2.3-3.1 g/kg fat-free mass
Endurance exercise	1.2-2.0 g/kg of
Strength exercise	1.6-2.8 g/kg of
Gain (muscle) strength	1.6-2.2 g/kg of

Carbohydrate:

The primary role of carbohydrates is to supply energy for overall health. Carbohydrates are converted into glucose, which serves as a readily available energy source that the body can utilize quickly and effectively. These nutrients play a vital role as fuel for exercise and physical activities. The liver and muscles store carbohydrates in the form of glycogen, which can be tapped into by the brain and muscles during physical exertion. Selecting appropriate foods guarantees the body has enough energy for activities and aids in recovery. Carbohydrates provide 4 kilocalories for every gram. Foods rich in starch are key sources of carbohydrates in our diets. Wholegrain varieties also contribute fiber, which is essential for digestive health, as well as a range of vitamins and minerals, including B vitamins, iron, calcium, and folate. Foods loaded with carbohydrates and nutrients include bread, breakfast cereals, porridge oats, pasta, noodles, rice, couscous, potatoes (with their skins on), and other starchy vegetables such as sweetcorn, beans, and pulses.

The approximate requirements for carbohydrates.

Exercise intensity	Minutes of activity per day	Recommended carbohydrate intake (g/kg)
Low	<60	3-5
Moderate	60	5-7
High	60-180	6-10
Very high	>180	8-12

Fat is a crucial nutrient that serves as the body's primary energy source. However, excessive fat intake can lead to weight gain due to an energy surplus. To maintain a balanced diet, fat should make up no more than 35% of total energy intake, with saturated fats limited to 11%. Fat provides 9 kcal per gram, more than carbohydrates and proteins. Foods contain a mix of saturated and unsaturated fats, with unsaturated fats being healthier. To reduce saturated fat intake, limit foods like pastries, chocolate, fried foods, ice cream, butter, and hard cheeses. Focus on choosing foods high in unsaturated fats. Fat is a key energy source during physical activity, with extensive stores in adipose tissue and intramuscular triacylglycerols. Both fats and carbohydrates are utilized together, but fat oxidation increases during moderate-intensity exercise, especially with lower carbohydrate intake. A high-carb, low-fat diet reduces fat oxidation, while a low-carb, high-fat diet promotes it, though evidence supporting long-term high-fat diets for improved sports performance is limited. Carbohydrates are more efficient for energy production, but fats provide essential nutrients, including fat-soluble vitamins A, D, E, and K. The type and amount of fats consumed are critical. The ACSM recommends that fats make up 20-35% of total calories, with 7-10% from saturated fats, 10% from polyunsaturated fats, and 10-15% from monounsaturated fats. A healthy omega-3/omega-6 ratio (2:1 to 4:1) is essential, with increased omega-3 intake from fatty fish like salmon and sardines. Reducing meat consumption and including more lean protein can improve fat quality and balance.

Water: For sports hydration, replacement drinks are preferable to plain water due to their carbohydrate (CHO) and sodium content, which enhance fluid absorption. Ideal sports drinks should be isotonic with the following characteristics:

- 80-35 kcal
- At least 75% of the calories should come from high-glycemic index carbohydrates
- No more than 90 grams of carbohydrates per liter
- 460-1150 mg of sodium per liter
- The osmolality of 200-300 mOsm/kg of water.
- Incorporating various carbohydrates such as glucose, sucrose, and maltodextrins can improve fluid absorption by utilizing different intestinal transporters. However, high fructose content (above 20-30%) should be avoided as it can lead to gastrointestinal issues.
- Hydration guidelines for physical exercise include:
 - Consume 400-600 ml of water 4 hours earlier exercise.
 - Drink 200-400 ml of water with 5-8% carbohydrates just before starting the activity.
 - During exercise, ingest 100-200 ml of water every 15-20 minutes.
 - After exercise, drink 150% of the body weight lost within 6 hours.
 - For low-intensity and short-duration activities, water alone is typically sufficient.
 - The ideal drink temperature is between 15 and 21°C.
 - Ensure the drink is palatable to the athlete.

Recommendations for hydration.

<i>Day before</i>	<i>Drink fluids frequently</i>
<i>Pre-event meal</i>	<i>2-3 cups water</i>
<i>2 hours before</i>	<i>2-2 1/2 cups water</i>
<i>1/2 hour before</i>	<i>2 cups water</i>
<i>Every 10-15 minutes during the event</i>	<i>1/2 cup cool (45-55 degrees) water</i>
<i>After event</i>	<i>2 cups fluid for each pound lost</i>
<i>Next day</i>	<i>Drink fluids frequently (it may take 36 hours to rehydrate completely).</i>

The Pre-Game Meal

A pre-game meal, consumed three to four hours before an event, ensures optimal digestion and energy supply. It should provide 500 to 1,000 calories, focusing on complex carbohydrates like bread, pasta, fruits, and vegetables. These foods are easily digested, provide consistent energy, and are emptied from the stomach in two to three hours. Avoid high-sugar foods, as they cause rapid spikes and crashes in blood sugar, leading to energy loss and possible

dehydration, cramping, nausea, or diarrhea. Refrain from consuming carbohydrates within 1.5 to 2 hours before the event to avoid premature glycogen depletion. Also, avoid meals high in fat, fiber, or lactose, as these are slower to digest. Hydrate adequately but avoid caffeine, which may lead to dehydration. For those who prefer, a liquid pre-game meal is an option, as it clears the stomach quickly. Always include water with this meal to stay hydrated.

Diet during training

The diet which utilized by an athlete during sports performance is called during competition diet. Sport activities that extend over a long period may require mid-activity refueling in order to enhance performance. Easily digestible, carbohydrate rich foods can help maintain sufficient energy levels throughout the duration of exercise. According to Bonci L, 2009 that Carbohydrates are needed to provide energy during exercise. Because carbohydrates are stored mostly in the muscles and liver. And during activities the store carbohydrates are utilized for the production of energy for sports performance.

During sports performance full meal cannot be consumed. However, a small, high-carbohydrate snack will need to be consumed along with adequate fluid intake from sports drinks and water. Generally, in these situations the athlete would not want to consume more than about 300 calories. The main focus is to keep the athlete hydrated and not feeling hungry, yet still leave the gastrointestinal tract empty when competition begins.

The Post-Game Meal: Post-game meal recommendations are the same regardless of age, gender, or sport. After a training session or competition, consuming a small, balanced meal within 30 minutes is beneficial. This meal should include carbohydrates, protein, and fat. Protein synthesis is most effective immediately after exercise, and carbohydrates help replenish depleted glycogen stores. However, athletes may struggle to eat during this window due to nausea or lack of hunger. Liquid options like protein-rich smoothies or beverages, such as chocolate milk, are convenient. If eating solid food is difficult, fruit, popsicles, or snacks like bagels and bananas are better than not eating. Some athletes turn to protein or amino acid supplements post-workout, but these can cause dehydration, weight gain, and stress on kidneys and liver. Athletes should consult a doctor or dietitian before using supplements. Consistent, lifelong good nutrition habits are essential, alongside proper training, to become a successful athlete.

Recommended Nutrients for Short, Moderate, and Long Duration Sports Events

Research studies have shown that an athlete's dietary needs vary depending on the type of activity. The following tables outline the nutritional requirements for athletes before, during, and after physical activity.

Showing the recommended Nutrition for Short-duration events players

<i>Nutrients</i>	<i>Percentage (%)</i>
<i>Carbohydrate</i>	<i>60</i>
<i>Proteins</i>	<i>15-25</i>
<i>Fats</i>	<i>15-25</i>

Showing the recommended Nutrition for Moderate-duration events players

<i>Nutrients</i>	<i>Percentage (%)</i>
<i>Carbohydrate</i>	<i>55-60</i>
<i>Proteins</i>	<i>15-25</i>
<i>Fats</i>	<i>15-20</i>

Showing the recommended Nutrition for Long-duration events players-

<i>Nutrients</i>	<i>Percentage (%)</i>
<i>Carbohydrate</i>	<i>60-70</i>
<i>Proteins</i>	<i>10-15</i>
<i>Fats</i>	<i>20-30</i>

IJETRM

International Journal of Engineering Technology Research & Management

Published By:

<https://www.ijetrm.com/>

Why Sports Nutrition Important?

At peak performance, athletes should be well nourished, injury-free, fit, focused, and ready to compete. Sports nutrition involves more than just meeting caloric needs or prioritizing protein for muscle growth and carbohydrates for energy. It requires a comprehensive understanding of how nutrition and eating habits impact athletic performance. Sports nutrition experts offer personalized recommendations based on an athlete's health, sport, nutrient needs, food preferences, body weight, and composition.

Proper nutrition is vital for sports performance and should be managed before, during, and after competition. According to Greany and Jeukendrup, optimal fuelling, recovery, and muscle-building are key to success in any sport. Pre- and post-exercise meals are especially important. As a general guideline, athletes should consume a meal about two hours before exercise that is rich in carbohydrates, low in fat, and moderate in protein. Carbohydrates provide the primary energy source for exercise, while protein supports muscle growth.

CONCLUSION

Athletes often look for ways to enhance performance, and nutrition plays a critical role in achieving this. A well-balanced diet impacts training, recovery, and overall success, but dietary strategies must be tailored to each athlete's specific needs and sport. Consulting a qualified nutrition professional ensures that the diet is effective and appropriate for the individual. Personalized nutrition considers factors like age, gender, training schedule, performance goals, and any medical conditions or dietary preferences. Sports Nutrition can offer benefits but should be used cautiously. They should complement, not replace, a well-rounded diet to address nutritional gaps or performance needs. Supplements should be part of an overall nutrition plan that ensures the athlete receives the nutrients necessary for optimal performance. Working with nutrition experts helps athletes identify which supplements, if any, may be beneficial based on their training and goals, minimizing risks while maximizing the effectiveness of supplementation for long-term success.

REFERENCES

- Beck, K., Thomson, J. S., Swift, R. J., & Von Hurst, P. R. (2015). Role of nutrition in performance enhancement and post exercise recovery. *Open Access Journal of Sports Medicine*, 259. <https://doi.org/10.2147/oajsm.s33605>
- C, A. P., & B P, M. (2024). The role of fueling nutrition in athletic performance. In *International Journal for Multidisciplinary Research (IJFMR)*, *International Journal for Multidisciplinary Research (IJFMR)* (Vol. 6, Issue 2, pp. 1–3) [Journal-article]. <https://www.ijfmr.com>
- Indoria, A., & Singh, N. (2016). Role of nutrition in sports: A review. *Indian Journal of Nutrition*, 3(2), 147. <https://doi.org/10.12345/2395-2326>
- Williams, C. (1995). Macronutrients and performance. *Journal of Sports Sciences*, 13(sup1), S1–S10. <https://doi.org/10.1080/02640419508732271>
- Flack, K. D., PhD, RD, Hays, H. M., BS, BA, Moreland, J. E., BS, & University of Kentucky. (n.d.-b). Protein and athletic performance. In *University of Kentucky College of Agriculture, Food and Environment* (Report No. FCS3-624). <https://publications.ca.uky.edu/sites/publications.ca.uky.edu/files/FCS3624.pdf>
- Athletes' nutritional demands: a narrative review of nutritional requirements. (2024). *Frontiers in Nutrition*, 10, 1331854. <https://doi.org/10.3389/fnut.2023.1331854>
- Khan, S., Khan, A., Khan, S., Khushdil, M., Sajid, K., & Khan, U. (2017). Diet and sports performance. 2312-5179.