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Nutrition and Sport: Scientific Foundations of Food as Support for Athletic Performance

Nutrition and Sports: Scientific Foundations of Diet as Support for Athletic Performance

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Summary

Sports nutrition is emerging as a strategic element in improving performance, recovery, and preventing injuries in athletes and other physical activity practitioners. This article offers a scientific analysis of the role of nutrition in modulating physical performance, exploring the metabolic and physiological foundations that justify specific nutritional strategies in different sports. Based on literature up to 2021, the text discusses the main macronutrients and micronutrients, the importance of hydration, the use of nutritional supplements, and dietary periodization as tools to optimize training response. Finally, it highlights the importance of an individualized approach and multidisciplinary work.

Keywords: sports nutrition; physical performance; supplementation; dietary periodization; muscle recovery

Abstract

Sports nutrition emerges as a strategic element in improving performance, recovery, and injury prevention for athletes and physically active individuals. This article presents a scientific analysis of the role of diet in modulating physical performance, exploring the metabolic and physiological foundations that support specific dietary strategies for different sports. Based on literature up to 2021, the text discusses the main macro and micronutrients, the importance of hydration, the use of nutritional supplements, and dietary periodization as tools to optimize training response. Finally, the relevance of individualized approaches and multidisciplinary care is emphasized.

Keywords: sports nutrition; physical performance; supplementation; dietary periodization; muscle recovery

1. Introduction

The relationship between nutrition and sports has been extensively studied in recent decades, demonstrating its importance in supporting the energy and metabolic demands of athletes. Adequate nutrient intake is crucial for maintaining cellular integrity, optimizing energy production, and promoting post-exercise recovery, in addition to reducing the risk of injuries and illnesses related to physical stress (Rodrigues et al., 2018).

Factors that influence nutritional needs in sport include the modality, intensity, duration of exercise, individual physiological and metabolic characteristics, as well as the athlete's health status and goals. Therefore, nutritional prescriptions must be carefully individualized to meet the specific needs of each context (Maughan et al., 2011).

In addition to providing energy support, sports nutrition modulates inflammatory processes, promotes redox balance, and strengthens the immune system, all crucial aspects for maintaining the health of athletes undergoing intense training (Smith et al., 2015). Therefore, a thorough understanding of biochemical and physiological mechanisms is essential for developing effective nutritional strategies.

Monitoring by specialized professionals, such as sports nutritionists, is essential to adapt the diet to specific needs, considering behavioral aspects that influence adherence and effectiveness of nutritional interventions (Phillips & Van Loon, 2011).

This article aims to review and deepen the scientific understanding of the main nutrients, hydration, supplementation and nutritional periodization in sport, based on scientific evidence up to 2021, highlighting the importance of personalization and a multidisciplinary approach to optimizing athlete performance and health.

Finally, sports nutrition is a constantly evolving field, and continuous scientific updating is essential to ensure safe, ethical, and evidence-based practices.

2. Macronutrients and Their Functions in Exercise

Macronutrients—carbohydrates, proteins, and lipids—are essential for energy supply and metabolic support during sports. Carbohydrates represent the primary energy source during moderate- to high-intensity exercise, being rapidly metabolized into glucose for the production of ATP, which is essential for muscle contraction and metabolic processes (Burke et al., 2011).

The recommended carbohydrate intake varies according to the modality, intensity and duration of the exercise, generally between 5 and 12 g/kg/day, to ensure adequate replacement of muscle glycogen and maintenance of performance (Jeukendrup, 2017).

Proteins are essential for muscle repair and synthesis, especially in the post-exercise period, when there is an increased demand for essential amino acids, especially leucine, to stimulate protein synthesis and hypertrophy (Phillips et al., 2011). The recommended intake is between 1.2 and 2.0 g/kg/day, with a focus on proteins with high biological value.

Lipids play a key role in energy production during prolonged exercise and in regulating inflammatory processes. Intake should represent 20–35% of total daily energy, with a focus on unsaturated fats that promote cardiovascular and immune health (Rodrigues et al., 2018).

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The balance between macronutrients, as well as the adequate distribution and timing of intake, are fundamental to maximizing performance, optimizing recovery and preserving the athlete's physiological integrity (Moore et al., 2015).

Periodizing macronutrient consumption, combined with the timing of the training cycle, is an effective strategy for enhancing metabolic adaptations and promoting gains in strength and muscular endurance.

3. Micronutrients and Hydration

Micronutrients, although required in smaller quantities, are crucial for metabolic processes, muscle contraction, nerve transmission, and immune function. Minerals such as iron, calcium, magnesium, and B vitamins and D play a significant role in energy production and maintaining homeostasis (Thomas et al., 2016).

Iron deficiency, for example, can compromise oxygen transport capacity, reducing aerobic performance, making periodic assessment of nutritional status essential for the prevention and treatment of deficiencies (Thomas et al., 2016).

Adequate hydration is vital for maintaining physical performance and health. Losing just 2% of body weight through dehydration can negatively impact performance, increasing fatigue and the risk of injury (Sawka et al., 2007).

Planned fluid intake before, during, and after exercise is recommended, with adequate electrolyte replacement, especially during long workouts or those performed in hot and humid environments. Sports drinks containing carbohydrates and sodium may be recommended to maintain electrolyte balance and provide energy for activities lasting longer than one hour (Sawka et al., 2007).

Furthermore, some micronutrients act as enzymatic cofactors in antioxidant processes, contributing to the mitigation of oxidative stress associated with intense exercise, aiding in the recovery and prevention of muscle injuries (Smith et al., 2015).

Monitoring hydroelectrolytic and nutritional status should be routine for athletes to ensure the effectiveness of nutritional strategies and the maintenance of overall health.

4. Nutritional Supplementation in Sports

Nutritional supplementation is a complementary resource that, when properly guided, can contribute to improved performance, recovery, and injury prevention. It is essential that its use be based on scientific evidence and professional supervision to avoid health risks and doping (Kerksick et al., 2018).

Creatine, caffeine, whey protein, BCAAs, and beta-alanine are some of the most scientifically supported supplements for various athletic goals. Creatine is effective for strength and explosive muscle training, increasing the availability of phosphocreatine for rapid ATP regeneration (Kerksick et al., 2018).

Caffeine acts as a stimulant of the central nervous system, improving alertness, resistance and fatigue tolerance in aerobic and anaerobic modalities (Kerksick et al., 2018).

Whey protein is indicated for post-workout protein support, stimulating protein synthesis and muscle repair. BCAAs, on the other hand, have controversial effects and are most effective in combination with other essential amino acids (Saunders et al., 2017).

Beta-alanine acts as an intracellular buffer, delaying muscle fatigue during high-intensity, short-duration exercise (Saunders et al., 2017).

Individualizing supplementation, considering specific needs, training phase and athlete profile, is crucial to maximize benefits and avoid adverse effects.

5. Nutritional Periodization and Advanced Strategies

Nutritional periodization consists of dynamically adjusting nutrition according to the phases of the training, competition, and recovery cycle, aiming to optimize physiological and metabolic adaptation. Strategies such as carbohydrate manipulation during training with low glycogen availability ("train low") promote mitochondrial adaptations that can increase endurance (Marquet et al., 2016).

However, such strategies must be applied with caution and professional supervision, as they can compromise performance if poorly implemented.

Advanced approaches, such as intermittent fasting and ketogenic diets, present controversial evidence in athletes, requiring individualized assessment of benefits and risks (Paoli, 2014).

In endurance sports, fasting training can favor metabolic adaptations, but adequate planning is necessary to avoid energy deficits that impair performance (Stannard & Thomson, 2008).

The integrated work of nutritionists, trainers, and doctors is essential to personalize these strategies, ensuring safety and effectiveness.

Educating athletes about the fundamentals of sports nutrition and its strategies is essential to promote adherence, autonomy, and better long-term results.

6. Conclusion

Sports nutrition represents one of the fundamental pillars for achieving optimal athletic performance, acting comprehensively in recovery, injury prevention, and health maintenance. The complexity of nutritional demands requires a personalized approach that considers individual specificities, the type of sport, the intensity and volume of training, as well as the environmental and psychological factors involved. This

Individualization is crucial to maximize the positive effects of nutrition and minimize potential risks, promoting efficient and sustainable physiological adaptations.

Furthermore, sports nutrition transcends the energy aspect, incorporating the modulating role of nutrients in the inflammatory response, oxidative balance, and immune function, contributing to athletes' athletic longevity and quality of life. Adequate hydration and scientifically guided supplementation complement these strategies, offering support during training and competition.

Nutritional periodization, which adjusts macronutrient, micronutrient, and fluid intake according to training cycles, is emerging as an advanced tool for optimizing performance and accelerating recovery. Its correct implementation requires careful evaluation. Innovative nutritional strategies, such as training in a state of low energy availability, must be conducted under specialized supervision to avoid adverse effects and ensure metabolic benefits.

Interdisciplinary work, involving nutritionists, physical trainers, doctors, and other professionals, is essential for comprehensive and safe monitoring that considers the athlete's overall needs and promotes their continuous development. Furthermore, nutritional education is essential to fostering athlete autonomy, reinforcing adherence to and sustainability of healthy practices.

Finally, sports nutrition, based on up-to-date scientific evidence and respecting individualities, is consolidated as an essential component not only for athletic performance, but also for promoting overall health, longevity and quality of life, essential factors for amateur and professional athletes at all stages of life.

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