

Reflection on sports nutrition: Where we come from, where we are, and where we are headed

Reflexão sobre a nutrição esportiva: de onde viemos, onde estamos e para onde vamos

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ABSTRACT

From a historical perspective of athletes' eating practices, the advancement of science and the provision of food in the modern Olympic Games, the author seeks to show that many challenges in practicing Sports Nutrition have their roots in how these processes were built. This essay aims to provide arguments for a reflection on the work of dietitians in the sports' scenario considering the growth of interest in this area, as well as the hosting of major sports events in Brazil. The professional training and the skills required to work in this area, as well as the eating practices of athletes, often far from the nutritional recommendations but heavily laden with symbolism and representations, making it important for their identity within their peer group, are among the current challenges that can be emphasized. As the main prospects for the comprehensive care of athletes, the author highlights the importance of adopting an interdisciplinary approach, and of dietitians fully understanding the meaning of nutrition for athletes in order to address the gap between their food practices and the recommendations.

Keywords: Culture. Feeding. Feeding behavior. Sports.

RESUMO

A partir do percurso histórico das práticas alimentares de atletas, da evolução da ciência e da oferta de alimentos nos Jogos Olímpicos modernos, este ensaio tem como objetivo trazer elementos para a reflexão sobre a atuação dos nutricionistas na área esportiva, frente ao crescimento do interesse pela área e à realização de importantes

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eventos esportivos no Brasil. Procura-se mostrar como muitos dos desafios da atuação nessa área têm suas raízes na maneira como tais processos foram construídos. Dentre os desafios atuais, ressaltam-se a formação para a área e as competências necessárias para a atuação, além do fato de as práticas alimentares de atletas serem, muitas vezes, distantes das recomendações nutricionais e fortemente carregadas de simbolismo e representações, o que é fator importante para a identidade com seu grupo esportivo. Como principais perspectivas para o cuidado integral do atleta, aponta-se a importância de o nutricionista adotar uma abordagem interdisciplinar e compreender plenamente o significado da alimentação para o atleta, a fim de reduzir a distância entre as práticas alimentares deste e as recomendações daquele.

Palavras-chave: Cultura. Alimentação. Comportamento alimentar. Esporte.

INTRODUCTION

The influence of nutritional aspects on sports performance is already widely evidenced¹, and nutritional recommendations for athletes should aim to guarantee the best performance²⁻⁴, while taking into account the need for promoting and maintaining health^{1,5}.

Brazil is a country with a strong interest in sports, mainly soccer, the importance of which goes beyond mere play and soccer can be considered an essential constituent of the Brazilian identity⁶. However, the results of the *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico* (Vigitel)⁷ study indicate that 48.7% of Brazilian adults do not achieve a sufficient level of weekly physical activity, defined as the sum of moderate-intensity physical activity spent in leisure time, commuting, and occupational activity equivalent to 150 minutes/week⁷. Furthermore, the proportion of physically inactive people, defined as individuals who report not having practiced any leisure-time physical activity in the last three months, do not perform occupational effort/heavy cleaning, and do not commute by foot or bicycle for at least 10 minutes per commuting is of 15.6%⁷. Although hosting the Olympic and Paralympic Games in Brazil in 2016 does not guarantee that the population will increase its interest in exercising⁸, it can leave a health legacy, which includes the establishment of groups of professionals and specialists⁹, and the construction of centers¹⁰, which may both promote physical activity and improve elite sports performance.

Despite the fact that regular exercise can bring numerous health benefits, this is not always

the case for high performance sports. Overtraining, stress and anxiety, dissatisfaction with body image, risk of injury, and diets that do not meet nutritional demands stand as some of the challenges in athletes' care^{5,11}. Nonetheless, there are a few initiatives led by clubs and other sports institutions that guarantee infrastructure and comprehensive care to all athletes, especially in the youth teams.

The actions related to Sports Nutrition target a heterogeneous audience that ranges from individuals who adopt a physically active lifestyle, opting for structured exercise programs, to the aspiring athlete, and finally the high performance athletes, constantly seeking to achieve their best results in competitions. The life cycle, sex, type of sport, involvement (frequency, schedule, duration, and intensity of training), goals (mass and body composition, results) and competition calendar have to be taken into consideration, which require dietitians to have a broad understanding of nutritional requirements, as well as how to best apply them to each situation.

Thus, the objective of this essay is to reflect on this area of expertise, focusing on the context of competitive sport, rescuing its trajectory, some current challenges and future prospects.

From where we come

The search for a competitive advantage and the first scientific discoveries

The concern for what to eat for good sports performance long predates sports science.

The few records about the food intake of Greek and Roman athletes indicate a mixture of reality and myth. Initially, records describe a diet similar to that of the general population, consisting of whole grains, fruits, cheeses, and wine diluted with water, and the sporadic fish and meat^{12,13}. However, goat meat was recommended for the jumpers and bull meat for runners^{13,14}, clearly an allusion to the principle of incorporation, which dictates that those who eat a certain food incorporate the properties of such food¹⁵.

While the Spartan athlete Charmis consumed dried figs shortly before competitions to improve performance^{16,17}, the introduction of meat as part of a training diet is attributed to the prominent long distance runner, Dromeus of Stymphalos. The consumption of "nine kilos of meat, nine kilos of bread, and nine liters of wine"¹⁸ (p.875S) before competitions is attributed to the fighter Milo of Croton, reinforcing the myth idea^{13,18}.

Competitive sports have taken a new dimension with the holding of the first Olympic Games of the modern era in Athens in 1896. The search for a competitive edge manifested itself both in food strategies and in the several substances used by athletes for their possible ergogenic potential¹⁷. For example, marathon runners from the first edition of the Olympic Games did not eat the night before the event¹⁹, and the marathon winner of the second edition of the Games consumed egg whites, brandy, and strychnine during the run²⁰. Among the substances used by athletes, caffeine, alcoholic beverages, and ether stand out¹⁷.

Notwithstanding, until then, little was known about the topic from a scientific perspective, based on solid evidence, although one of the first studies linking nutrition and sport was published by von Liebig in 1842. In this study the author mistakenly suggested that muscle protein stores were the main energy fuel during exercise¹³. Furthermore, vitamins were identified at the beginning of the twentieth century and associated with many diseases, which were poorly

understood until then, and studies on metabolism and the role of macronutrients were conducted in physiology laboratories¹³.

During the 1920s and 1930s, Scandinavian studies showed the influence of diet and the use of carbohydrates and fats as substrates in exercise^{21,22}. One of the first studies about the role of carbohydrates was conducted in 1924 with runners. This study found an association between low blood glucose and the symptoms of fatigue and confusion^{13,20}. However, it was only in the 1960s that the knowledge on the role of glycogen stores as a limiting factor in the ability to perform longstanding exercise was consolidated²³, and manipulation of carbohydrates in the diet of athletes started to be adopted as a strategy, known as carbo loading¹³. The development of carbohydrate-based drinks for athletes to be consumed during exercise also began during this decade. As from 1940, studies indicated the relationship between of protein intake and muscle mass gain, and the first protein supplements appeared, soon to become popular¹³.

Interest in nutritional supplements with ergogenic potential extended to vitamins in the 1930s, evolving from multivitamins to the use of isolated vitamins. In subsequent decades, the list of investigated nutritional substances grew exponentially, including antioxidant substances (e.g., vitamins, minerals, phytochemicals, etc.), protein-related substances (e.g., creatine, branched-chain amino acids, leucine, arginine, etc.), and stimulants (e.g., caffeine), among others¹³.

The search for a competitive edge also involving other classes of substances strongly defines the history of sports. For example, the consumption of organs, especially testicles, was also a common practice, extending from ancient Egypt (1400 B.C.) to the Middle Ages¹⁶. This can be considered the precursor of steroid use, the milestone being the production of testicular extracts in 1889, and culminating with the massive use of steroids in the Olympic Games of Tokyo/1964^{16,17}. Strychnine, used in the early modern Games, which in small doses acted as a

stimulant (but in large doses acted as a poison), was replaced by amphetamines in the 1930s, becoming popular mainly after the Second World War¹⁶. The use of substances for improving performance began to be considered inappropriate after the war, and the first doping tests were introduced in sports in the 1960s^{17,24}.

The evolution of consumption and food supply in competitions

Observing how the intake and supply of food has evolved during the Olympic Games provides valuable information to understand how food provision gradually became valued^{19,20} and how this trajectory is also related to many dietary practices identified among athletes of the past.

In the first editions of the Games, little was offered to athletes. In Athens (1896), catering was available only for the dignitaries, and the athletes were responsible for their own food¹⁹. In Saint Louis (1904) well water was offered to running athletes (only available from the 19th kilometer) to avoid dehydration problems, but many had gastrointestinal problems¹⁹.

In Paris (1924), a dining hall was organized to serve three meals a day. But the Olympic village concept was only put into practice in Los Angeles (1932) with a food service divided into 31 dining halls to meet different cultural demands¹⁹.

In Berlin (1936) there was a three-story catering complex, with 40 kitchens and 40 dining halls, and the menu was defined by chefs after discussion with coaches and physicians. There was water available for long distance runners every three kilometers. In these Games, Schenk held the first study about what the "world's best athletes" consumed. Data from 42 of the 49 attending countries indicated that 50% of the countries had daily intakes higher than 800 g of meat/day/person. Fruits were also popular (83% of the countries had a consumption of more than 500 g of fruits/day/person); while the consumption of some carbohydrate sources was lower than that

of meat. The reported supplements were lecithin, glucose, and malt. Alcohol consumption was not unusual (*i.g.*, wine consumption was common among the French and Italians)^{12,19}.

This trend continued in the 1948 London Games, although these Games have been known for the austerity, as the food available was insufficient, and many countries provided food for their own teams or donated to other countries, strongly contrasting with the abundance observed in the Games of London in 1908²⁵. In London, Berry *et al.*²⁶ evaluated the dietary intake of 28 athletes from different sports and nationalities for four days, using duplicate chemical analysis of the foods consumed. The authors identified a high intake of protein, mainly from eggs (2 to 3 units/day) and meat (453 to 680 g/day). Twenty athletes interviewed about their habits in preparation for competitions reported quite heterogeneous strategies: some maintained their habits, while others increased or decreased food intake. On the day of the competition, most avoided fatty foods and several included or increased the amount of protein foods (steak, egg, and milk). Some reported using sugar, glucose, or salt, and three, vitamin supplements²⁶.

In the Olympics of Helsinki (1952), a central restaurant was organized to provide Latin American, British, American, Scandinavian, Asian, and Central European cuisines. In this edition of the Games, foods with higher intake included meat, milk, butter, fruits, and vegetables, while fatty foods were avoided. Honey, maltose, and grape sugar were considered important for performance^{19,27}.

In the Los Angeles Games (1984), food provision involved the planning and implementation of the menus by the catering company, resulting in the development of a complex logistics operation of food purchasing, transportation, and human resources. After the Games, a final report suggested that dieticians should be involved in the preparation of the menus in future games^{19,28}. In Atlanta (1996) 100 years after the first edition of the Games, with the participation of about 10

thousand athletes and more than one million meals served, once again the favorite food was meat - 6,000 steaks/day (8-10 units/athlete) were served²⁹. In addition to the meals served in dining halls, snacks were provided to athletes in both training and competition venues¹⁹.

With the increasing number of athletes and delegations, food service tasks became an increasingly challenging activity. Besides the large-scale food production, the variety of cultures, the energy and different nutrient requirements of each sport, and the need of special diets (e.g., allergic athletes) became aspects to be considered in menu creation²⁸. In the Sydney Olympics (2000), a team of ten dietitians developed a 10-day cycle menu with 1,500 items and 345 recipes, paying special attention to carbohydrate sources and the use of different food preparation techniques (e.g., roasted, grilled, steamed, and poached) for the production of low-fat (<10 g/portion) recipes²⁸. The menu was based on a literature review, as well as focus groups with migrants (e.g., African and Eastern Europe countries). Detailed nutritional information about the recipes and ingredients were available for every meal and on an internet site. Dietitians were available to assist in food choices²⁸.

London (2012) faced another big challenge: to meet the requirements of athletes who respected the 30 days of Ramadan fasting, which coincided with the date of the Games and created the need of a special catering service for these athletes³⁰.

Where we are

The sport dietitian: competences

The Brazilian *Conselho Federal de Nutricionistas* (CFN, Federal Council of Dietitians) considers sports nutrition one of the main seven areas of nutrition expertise. In its research about fields of activity, the results pointed out to the increased interest in the sports nutrition area³¹. Although the professionals who choose this area

still represent a smaller proportion in relation to other areas of expertise (1.2 to 6.1% depending on the region), and show concern regarding the prospect of functional growth and the imposed challenges, it is believed that Sports Nutrition lives an especial moment³¹.

According to CFN Resolution nº 380³², the competences and activities of the sports dietitian include assistance to individuals and groups based on the identification of the clients' profile in accordance with their training, and the dietary monitoring of their nutritional status, including the request for the necessary laboratory tests. The dietary plan should be established according to the sport practiced and phase (periodization, competitive period). Dietitians may prescribe nutritional supplements necessary to complement the diet, and should keep individualized record of prescription and evolution, as well as prepare an annual work plan, covering the procedures adopted for the development of all the skills³². The professional is also responsible for the development of food and nutrition educational programs, integration of the multidisciplinary team, cooperation with the sanitary inspection authorities, and coordination and supervision of the activities of Food and Nutrition Units that cater to athletes^{32,33}.

However, in the perception of professionals in this area, these skills are even broader. In a study with 14 sport dietitians (Brazil, Spain, Australia, and United States) interviewed by Bellotto & Linares³³, 147 skills were identified and classified into four macro categories: technical, methodological, participatory, and personal. Some of the most valued skills in this study refer to the knowledge of the discipline and topics most relevant to their work, both from a theoretical and a practical perspective: nutritional assessment; food and nutrition education; hydration; food composition, and nutritional recommendations. In addition, they emphasized the importance of other knowledge related to exercise: exercise physiology; characteristics of physical preparation and sport discipline (training load, frequency, and

schedule); food supplements and ergogenic aids; recovery methods of energy systems; nutritional demands according to performance and health goals. Respondent dietitians also stressed the importance of considering the individual characteristics for planning/guiding and further evaluation of the effectiveness of targeted strategies, with adjustments according to changes in training and need for weight control, in addition to interdisciplinary work and referrals to other professionals when necessary. The constant updating and development of various skills related to the educational process, such as knowing how to communicate and relate to, to offer concrete and applicable guidelines, to be persistent and patient, and to be aware of ethical conduct were also pointed out³³.

This survey, which highlighted the need for solid and complete qualification, can be a guide for the sports nutrition curriculum of Brazilian universities, which have very different teaching proposals for this area³³: Nutrition undergraduate programs offer the contents in specific or elective disciplines, and the courses have varied workloads (hours); or the contents complement non-specific disciplines.

Furthermore, it is essential to develop skills that go beyond the technical aspects and that give dietitians the ability to integrate multidisciplinary teams and adopt an interdisciplinary approach in the care of athletes.

Eating habits of athletes and their ways of eating

Scientific knowledge increasingly allows nutritional recommendations to be adapted to the peculiarities of different sports²⁻⁴. However, many studies show that athletes from different countries, ages, and sports do not consume diets in line with these nutritional recommendations^{5,34}. Several factors can explain this dichotomy: results of new studies that lead to changes in the recommendations do not always reach athletes quickly; often athletes follow information disseminated through

social networks and media or by unqualified colleagues and professionals³⁵, which creates a nutritional cacophony. Furthermore, like the recommendations that target a healthy diet for the general population³⁶, there may be very strict dietary norms also for athletes, with recommendations presented in a homogenized way, disregarding cultural aspects, which leads athletes to reject them.

Regardless of compliance with the nutritional recommendations, athletes seem to share some eating behaviors. Within the dimension of sport, culture includes athletes' convictions and attitudes towards food³⁷, which go beyond the relationship of nutrition and performance and includes their lifestyles in different contexts and feelings of identity.

Food is a key factor in the construction of identity, which is formed from mental images attributed to oneself, from the interactions with people, groups and objects. That means that the meanings acquired, the uses determined, and the speeches generated are the result of social life³⁸. According to Fischler¹⁵, apart from incorporating the properties of foods when eaten, there is a contrast in which "the absorption of a food incorporates the eater into a culinary system and therefore into the group which practices it" (p.279). This embodiment is the basis for the collective identity, while indicating diversity¹⁵.

This helps to understand why there are a number of characteristic eating behaviors among groups of athletes, which appear to be independent of their origin and culture. Feeding practices are standardized by the sports group and seem to express the culture of that particular group. For example, bodybuilders and fitness center athletes adopt "diets to grow", typically hyperproteic³⁹. Among combat athletes, strategies for rapid weight loss are commonly adopted, such as self-induced dehydration to reach the weight class in which they compete⁴⁰, while athletes in sports with an aesthetic component adopt extremely restrictive diets^{1,5,41}. Among rugby players from southwestern France, food reflects the affirmation

of their status. These athletes prefer hearty meals, emphasizing meats, as well as the use of high amounts of protein supplements, because "more proteins build more muscle" (p.2) based on the precepts of a diet supported by the principle of incorporation⁴².

It is also common to see athletes attributing magical properties to some foods and supplements, believing that it will ensure that they achieve their goals, be it of weight loss/body composition, be it to instantly improve performance, overriding all other factors, including technical work. An example of beliefs, especially among bodybuilders, is that eating "white proteins" (chicken, ricotta), "light and lean" can "avoid weight gain and promote growth"³⁹. It is true that such protein sources have a lower fat content and high biological value protein, and are good choices for meals. However, what the studies suggest is the assignment of the property "to make grow", which encourages consumption over other sources. There is also the attribution of particular value to some foods¹⁴ - for example, the consumption of pasta before competitions - although it is a good strategy, it may be replaced by other foods with similar composition.

It is common for athletes to believe that high doses of nutrients or supplements have greater effect and benefit ("more is better")³⁷. Currently the intake of dietary supplements varies from 40.0 to 70.0%¹⁶ in different countries, sports, age, and competitive level⁴³⁻⁴⁵. Some problems have been identified with this practice - a study showed that the type of supplement used and the reasons for its use are not always congruent, indicating athletes' insufficient knowledge on the topic⁴⁶. Even worse is the fact that 10.0-15.0% of nutritional supplements may be tampered with substances that can be considered doping agents²⁴. Outram & Stewart²⁴ estimate that 6.4 to 8.8% of the identified doping cases can be attributed to the use of these supplements. Currently athletes are strictly monitored in competitions and the World Anti-Doping Agency annually publishes a list of prohibited substances^{17,24}.

From athletes' different eating habits, it is possible to reason that, in general, every sports group may share peculiar dietary habits, based on individual beliefs and individual representations, and shared values, which are aggregate to define the group's identity and contribute to their socialization in their context. On the other hand, there are situations where there is a process of individualization of eating, in which athletes, by conviction or need of restrictions (religious, philosophical, and/or for health reasons) or other reasons (pleasure, beliefs, personal goals, economic, and sociocultural etc.), will adopt different diets from their sport group.

Both a result of a group identity process or individualization, the *décalage*, or gap between the recommendations and intake, reflected in the different ways athletes eat, represent choices defined by factors that go far beyond what is currently known about nutrition and sports performance and must be considered by dietitians.

Where we are headed

Sports nutrition is constantly evolving. Recent approaches suggest some directions for future research in the area, for example, the interest in better understanding the mechanisms involved in the activation of central nervous system receptors in response to the contact of oral and gastrointestinal mucosa with carbohydrates and other stimuli (e.g., bitter, cold)⁴⁷; also, the interest in molecular biology and an understanding of the role of nutrients in the activation or inhibition of cell signaling and transcription of genes that interfere with the adaptive process of skeletal muscle to training⁴⁸. Although these principles initially aim to improve sports performance, some of them may be applied to other physically active groups (e.g., for the gain and repair of muscle mass in patients with sarcopenia and rehabilitation after injury or surgery)⁴⁹.

The evidence of the studies in those areas will provide important elements for increasingly individualized and appropriate nutrition guidance according to training periodization^{4,49}, which will meet athletes' tireless pursuit of a competitive advantage. However, it is essential that athletes' care, dietary planning, and food and nutrition educational activities are able to translate science, while highlighting their identity and other sociocultural aspects related to food. The development of studies to deepen the understanding of the process of athletes' food choices and the many factors involved are important to support these actions.

The analysis of food supply in the last Olympic Games indicated that for the next editions, one must go beyond the concern with offering variety, food safety, and sensory characteristics of meals³⁰. Food services should be able to meet the specific needs of different groups, with special attention to cultural aspects, availability of information, and sustainability³⁰.

The importance of comprehensive care of the athlete and interdisciplinarity as a means to achieve it is worth mentioning. Interdisciplinarity is based on a philosophy of teamwork that aims to break the fragmentation of disciplines in order to develop group thinking to respond with the complexity of the problems⁵⁰. Sports dietitians are charged with the task of contributing to their specific knowledge, but in a harmoniously integrated manner and in cooperation with other disciplines.

FINAL CONSIDERATIONS

History provides important elements to understand how divergences between eating practices and scientific knowledge in sports nutrition emerged. It is essential to understand these aspects and other factors involved in food choices. By understanding the meaning of food and eating for athletes, dietitians will be able to reduce the gap between their way of eating and

the recommendations, always aiming to make them autonomous in their decisions.

The challenges for those who choose the sports nutrition area are not few, starting with professional qualification. These professionals should be able to apply their knowledge - of the social, biological, health, food, and nutrition sciences - in the best way to adjust it to the wide range of possibilities when it comes to people who exercise. Sports dietitians will encounter anything from those seeking a more active lifestyle for health promotion to the elite athlete; from individual dietary planning to the administration of food services that cater to the sports community. In addition, dietitians should be prepared to integrate multi/interdisciplinary teams to ensure a comprehensive care for athletes.

Although this essay is limited in pointing out just a few starting ideas, it aims to encourage reflections on the complex scenario of sports nutrition and to contribute to the professional practice of dietitians interested in this area.

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