

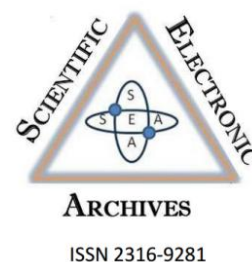
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Vegetarian diet and the relationship with sport

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Abstract. The relationship between the vegetarian diet and sports performance is very much investigated since there are many doubts about its results, justified by the main protein source of the diet being of vegetable origin, which, consequently, raises more attention on the levels of some vitamins and minerals, immune function, hormonal relationships and even on the nutritional needs for athletes. Immune functions are also very much emphasized, because they may present small alterations related to prolonged overtraining, causing chronic performance reduction. However, vegetarian diets associated with moderate and regulating workouts have a positive result. Vegetarians have a low level of creatine in their bodies, because this amino acid is more present in animal foods. This may affect a higher performance in supra-maximal workouts; however, a good creatine supplementation is a good alternative. Thus, this study aimed to understand the effectiveness of vegetarian diet associated with sport performance. This work was an exploratory literature review, with a qualitative approach. Several articles were investigated from 2002 to 2018, in Scielo and Medline databases. However, it was possible to review that the aerobic capacity of vegetarian and omnivorous athletes did not present differences, and with the monitoring of routine tests and a good professional nutritionist, these results can be very well controlled.

Keywords: Performance, Exercise, Vegetarians.

Introduction

In recent years, the search for a healthy lifestyle has increased through regular physical activity and nutritional guidance. Those who follow a vegetarian diet, by choice, have done so due to its benefits, and it has been notable for the reductions in deaths from heart attacks, heart diseases in general, low levels of cholesterol in the blood, lower risk of developing prostate and large intestine cancer, and reduction in obesity and associated diseases (FERREIRA, BURINI, MAIA, 2006).

The vegetarian diet is characterized by not eating foods of animal origin and their derivatives, and may be evidenced by the high consumption of carbohydrates, fiber, magnesium, potassium, folate, and antioxidants, and may have deficiencies in essential amino acids and fatty acids, calcium, zinc, iron, and cobalamin. In relation to performance in strength activities, researches indicate that vegetarians and non-vegetarians show similar aerobic performance. Thus, the practice of vegetarian diets can be harmonized with sports

practice, as long as it is a well-planned diet to avoid nutritional deficiencies (HALL, 2014).

It is important to emphasize that the adoption of vegetarian practices conciliated with sports performance points to a lower risk of altered blood pressure and ischemic heart disease, 24% lower prevalence compared to omnivores with body mass index (BMI) similar to each other (TEIXEIRA *et al*, 2006).

It is understood that the association of this diet with sports performance brings benefits, but more attention should be paid to avoid nutritional deficiencies⁸. Thus, the relevance of this study was to highlight that the nutritionist is the professional qualified to nutritionally guide the diet associated with sports performance. Thus, the overall objective was to understand the efficacy of vegetarian diets associated with sports performance.

Methods

This study was an exploratory literature review, with a qualitative approach. The literature review is the conceptual structuring that will support

the development of the research, analyzing and surveying what has already been published on the chosen theme. The exploratory approach is aimed at clarifying what the topic is about and facilitates the delimitation of the research topic. The qualitative approach is to interpret the phenomenon we observe by formulating the problem, data collection, data evaluation, data analysis and interpretation, presentation of the results, and conclusions (MARCONI, LAKATOS, 2008).

Data collection occurred between August to November 2018 from the Scientific Electronic Library Online (Scielo) and Medical Literature Analysis and Retrieval System Online (Medline) databases. As such, thirteen scientific articles of national origin were analyzed and collected between the period from 2002 to 2018 from the combination of the following key words vegetarian, exercise and performance. The great majority of the studies had as main objective to know the reality and wide variety of vegetarian practices, associated with sports performance, both in aerobic activities and in muscular strength activities. Based on that, many of them, brought the discussion about the accompaniment of the appropriate professional of the area, to avoid any kind of nutritional deficiency.

Vegetarian Diets

There are several reasons for adopting a vegetarian diet, since this lifestyle is based not only on a simple choice about food, but also on rational and emotional factors, based on reasons such as animal rights, health and environmental benefits. In Brazil, according to the Brazilian Vegetarian Society, it shows that about 50% of people end up adopting the vegetarian diet because they do not agree with the mistreatment of animals; they believe that taking the life of another creature is completely wrong^{8,1}. Other people are in favor of the diet because they think about the environmental damage caused by the production of these animals, the main factor in this case being deforestation and the contamination of water sources, among others³. Another very common reason for being part of this lifestyle are the health benefits of vegetarian food compared to omnivorous ones, because it reduces the risk of non-transmissible chronic diseases and the risk of total mortality (FERREIRA, BURINI, MAIA, 2006; ABONIZIO, 2016).

The Vegetarian Diet is based on a predominantly plant-based diet; however, there are different groups of vegetarians, among them the vegans. This group does not eat any type of food that is made from animal products or even their derivatives. They have an ethical reason that is totally against any kind of animal exploitation (LENZ, SLYWITCH, COUCEIRO, 2008; MARANGON, OBEID, 2015).

Another group classified within the vegetarian diet are the lactovegetarians, who exclude all types of meat and eggs from the diet; however, they consume milk and its derivatives (COSTA, VAISBERG, 2002; GOMES, SILVA,

CARMO, 2006). Ovolactovegetarians are also one of the classifications within this diet; the difference between this group is that they also exclude all types of meat from their diet, but unlike vegans and lactovegetarians, they consume eggs, milk, and their byproducts (MORALEJO, 2014; GOMES, SILVA, CARMO, 2006).

Although there are small differences between the classifications, both present an excellent physical and mental quality of life standard, a situation that has been proven by scientific research (HALL, 2014).

Nutritional needs for athletes

Adequate nutritional needs is such an important factor when it comes to athletes. According to the American College of Sports Medicine (ACSM), low energy intake can result in loss of muscle mass, disturbances in the menstrual cycle of athletes, loss of bone mass, and increased risk of developing fatigue and injuries. The adequate energy intake of endurance athletes should be from 3,000 to 5,000 kcal/day, and strength athletes usually need at least 50 kcal/kg/day, which represents 3,500 kcal/day for a 70 kg individual (TEIXEIRA *et al*, 2006; BIESEK, ALVES, GUERRA, 2015).

A well-planned strategy is to know how to adapt what is recommended for each audience, according to their particularities. However, the role of the professional nutritionist is to correctly plan an appropriate vegetarian diet for the nutritional needs of the athlete, because regardless of the type of diet chosen by the athlete, if he/she reaches the appropriate energy needs, his/her performance will not be affected (FERREIRA, BURINI, MAIA, 2006; PANZA *et al*, 2007).

Carbohydrates

Carbohydrates have several functions for the body, including energy and structural functions. Currently, there are still professionals who remove carbohydrates from their diets without even being aware of how much this may end up harming the proper functioning of the body (MORALEJO, 2014; FONTAN, AMADIO, 2015).

In general, vegetarian diets usually have a high carbohydrate content, thus providing a greater substrate for glycogen synthesis. Athletes need a high-carbohydrate diet to facilitate hepatic and muscle glycogen synthesis. The carbohydrate recommendation should be in the range of 6-10g/kg body weight per day or 60-70%. However, this need will also depend on the individuality of the athletes, putting into practice, energy expenditure, gender, athlete's modality, and also the environmental conditions (FERREIRA *et al*, 2006; FONTAN, AMADIO, 2015).

There is a huge choice of carbohydrates to be consumed before training; however, one of the main observations regarding the choice of carbohydrate is entirely linked to the glycemic index (GI). The glycemic index is nothing more than the

speed that a food causes the release of glucose into the bloodstream. It is classified as low when the rate is < 55; medium between 56-69, and high when > 70. Some studies have already proven the positive results related to the consumption of low glycemic index carbohydrates before workouts (FONTAN, AMADIO, 2015).

The vast majority of athletes end up opting for carbohydrate-based sports supplements, such as maltodextrin, glucose, fructose, sucrose, and even some sports drinks, gels, and energy drinks. Although the results show a good efficiency, adequate main food sources can still be introduced (FONTAN, AMADIO, 2015).

Proteins

Protein is made up of small molecules called amino acids that come in 20 different types and are linked together in chains or chains of varying sequence or combination. Humans can produce 12 of 20 amino acids, called non-essential, since they do not need food to get them. The other eight are the essential ones, obtained from the food we eat (MORALEJO, 2014; MEIRELLES, VEIGA, SOARES, 2001).

Protein plays a role in oxygen transport (hemoglobin), in protecting the body against pathogens (antibodies), as a catalyst of chemical reactions (enzymes), membrane receptors, and in muscle contraction (actin and myosin), besides being essential for growth and hormone formation (HERNANDEZ et al, 2009; GOMES, SILVA, CARMO, 2006).

Therefore, protein is considered essential for those who practice physical exercise. For this reason, researchers have recently paid special attention to athletes with protein needs, because they require a higher protein intake. If the goal is to increase lean body mass, the consumption is 1.6 to 1.7 grams per kilogram of body weight per day; for endurance exercise, the suggestion is 1.2 to 1.6 grams per kilogram of body weight per day, because protein is considered an auxiliary energy supply for the exercise performed (HERNANDEZ, 2009).

Protein consumption by vegetarians usually has lower values when compared to omnivorous protein consumption. Even though vegetables have a lower supply of essential amino acids, according to studies, the vegetarian diet is adequate, because with the combination of complementary vegetables, such as legumes, seeds and greens, they can compensate for the deficiency (FERREIRA, BURINI, MAIA, 2006).

Therefore, a diet carefully planned by a professional nutritionist can help vegetarian athletes to achieve an adequate protein intake (FERREIRA, BURINI, MAIA, 2006).

Lipids

Lipids provide energy and make up elements for the cell membrane and transport of the fat-soluble vitamins A, D, and E. Fats provide approximately 25-30% of the energy. The guideline

for fatty acids, saturated, polyunsaturated, and monounsaturated is 10%. In vegetarians, fat levels are usually lower because they do not consume animal food (MORALEJO, 2014; MEIRELLES, VEIGA, SOARES, 2001).

In moderate and long-term physical activity, the energy that is obtained through oxidative processes is essential, so in physical activity, fatty acids are important for oxidative fibers of slow contraction. In view of this, lipids provide energy to muscles to perform physical activity (PERUFFO, 2015; SLYWITCH, 2012).

Immunological Functions

Most people think that vegetarian diets are related to nutritional deficiencies, and that, in a certain way, they may interfere with the proper functioning of all body systems. However, studies relate the benefits of this diet to the body, including the proper functioning of one of the main systems, the immune system, because by removing meat from the diet there is no adverse effect on this function (FERREIRA, BURINI, MAIA, 2006).

The practice of physical exercise can produce several responses to the immune system; moderate physical activity practiced regularly has a very positive response. However, intense physical exercise performed under stressful conditions may induce immunosuppressive effects after training (COSTA ROSA, 2002).

Prolonged overtraining may cause some changes that end up presenting themselves, such as chronic performance reduction, accompanied by one or more physical symptoms, like resting heart rate elevation, weight loss, decreased libido, and sleep alterations, among others (RIBEIRO, ALVARENGA, COELHO, 2008).

Muscle Creatines

Amino acids are classified between essential and non-essential. Creatine is an amino acid that is included in the second group, the non-essential ones, because its production is available in our body. However, despite this bioavailability in our own organism, many foods of animal origin have an abundant source of this compound, such as meat and fish (FERREIRA, BURINI, MAIA, 2006).

Creatine is a chemical compound formed by hydrogen, nitrogen and carbon. This compound is synthesized in the kidneys, pancreas, and liver, and produced endogenously, it supplies about 1g/day. Through food, one gets on average 1g/day more of this compound, most of the creatine, can be found in the muscles of the human body. It plays a key role in providing energy, which at first is found in the form of phosphocreatine when at rest. During physical activity, phosphocreatine breaks down and becomes creatine and ATP, which has an essential function in muscle contraction, and in the good development of the athlete during sports performance (MORALEJO, 2014; SLYWITCH, 2012).

Vegetarians usually have a low level of creatine in their bodies. The main reason for this is that vegetarians do not consume foods that supply this type of amino acid. However, according to 15,14, an increase in creatine levels in the muscles and lean mass in vegetarian athletes after the supplementation of this amino acid, compared to omnivorous athletes, has been proven (MORALEJO, 2014; LENZ, SLYWITCH, COUCEIRO, 2008).

Hormonal Changes

The search for diversity during training, such as volume, intensity, and recovery, can somehow end up hindering the athlete's sports performance, causing hormonal changes during exercise. In relation to diet, the hormones concentrations may be less understood. The testosterone level in vegetarian athletes is low when compared to non-vegetarian (FERREIRA, BURINI, MAIA, 2006; ZILINSKI, GOUVINHAS, 2015).

Phytoestrogens are plant substances that are part of the phyto-complexes, these are divided into phytosterols and phytoestrogens. The phytoestrogens in soy contribute to the lowering of testosterone and androstenedione levels. Another hormone that has a low concentration level in the body, which is related to women, vegetarian athletes, is IGF-1, growth hormone released by the liver. All this may be related to the low consumption of lipids (ZILINSKI, GOUVINHAS, 2015; NELSON, 2009).

The low level of concentration of hormones in the body of athletes may cause negative effects on muscle hypertrophy and strength development during training, since these hormones are anabolic. Supplementation work based on vegetarian proteins, such as soy protein, has the ability to cause a significant increase in IGF-1 levels when compared to milk protein (ZILINSKI, GOUVINHAS, 2015; MORALEJO, 2014).

Iron

Iron was the first mineral to be considered an essential nutrient for the proper functioning of the body, in 1960. After that, many studies were made in order to learn more about the benefits of this mineral. This compound is very important for several essential functions of the body and the lack of it can cause several problems, being considered a major public health problem in the world. Many studies prove the present deficiency of this mineral, not only in athletes, regardless of their diet (BIESEK, ALVES, GUERRA, 2015; PANZA *et al*, 2007; NISHIMORI, 2008).

It plays a role in oxidative energy production, oxygen transport, mitochondrial respiration, DNA synthesis, and inactivation of harmful O² radicals. Most of the bioavailability of iron is found in animal foods, but plant sources also contain this mineral. Iron has two types of forms: heme, which is more common in

meat, and non-heme, which is more present in plant products (MORALEJO, 2014; NISHIMORI, 2008).

Plant products have some iron inhibitors, such as the phytates that are present in vegetables and legumes, the polyphenols found in wines, teas, coffee, soybeans, and calcium as well. All these products end up hindering the bioavailability of iron in the body. On the other hand, some products that are iron enhancers, such as vitamin C and carotenes, help increase the levels of non-heme iron in the body (MIRANDA *et al*, 2013).

A study conducted by MORALEJO, 2014. Comparing female track and field athletes who were semi-vegetarian and were non-vegetarian (consumed <100g of red meat per week). It was found that the amount of iron was the same for both groups, however, the group of semi-vegetarian athletes had a low intake of heme iron. Semi-vegetarian athletes also have low serum ferritin and high total iron uptake (MORALEJO, 2014; NISHIMORI, 2008). The daily iron recommendation is 8 mg for men and 11 mg for women. Vegetarian athletes can reach the adequate recommendations without even opting for supplementation. It is necessary to have a balanced and well-calculated diet, accompanied by a good professional nutritionist, so that nutritional deficiencies do not occur and hinder the good sports development of others (QUARANTA, JANUÁRIO, 2016; PANZA *et al*, 2007).

Conclusion

Nutritionists have a fundamental importance in the monitoring and nutritional development of human beings, because they have a deep physiological and anatomical knowledge to calculate and monitor the individual needs of each public. Among the various types, vegetarians practicing sports need more attention when it comes to macros and micronutrients, because as needed by athletes, vegetarians or omnivores, their needs tend to be higher.

Studies have shown to the issue of low testosterone hormone related to soy protein, which is widely consumed by vegetarians themselves. Another emphasis is related to minerals, such as iron, which in its absence can cause many problems for the proper functioning of the body, even in relation to the sources of heme iron, because they are very present in animal protein.

However, it can be concluded that vegetarian athletes can indeed obtain great results in sports performance, but they should always perform routine tests and have a good professional following up on their results, so that there is no lack of any kind of deficiency in the body's regulatory functions or lack of energy supply and protein synthesis action.

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