Progress in Nutrition 2020; Vol. 22, N. 3: e2020045 DOI: 10.23751/pn.v22i3.10461

Original article

Mediterranean diet, sport and health

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Summary. Among the environmental factors at the base of a good sporting performance there is a correct diet. It allows our body to develop harmoniously and to keep fit, in addiction it improves the sport performances. The Mediterranean Diet, with its nutritional characteristics, is a balanced diet, universally accepted and easily applicable. The nutrition of a sportsman is similar to that of other individuals with the exception of the total calories taken, which must adequately cover the plastic and energy needs of athletes. Even subjects with chronic diseases such as diabetes or tumors can achieve good performance and, with the necessary precautions, adhere to the food plan provided by the Mediterranean Diet. The aim of the work is to promote a correct lifestyle known for over half a century but still current.

Key words: Mediterranean Diet; Food; Sport; Health.

Introduction

Physical activity has always been considered an essential tool for human health, since it allows to remain in a good physical state, so as to avoid all the problems that would otherwise arise. Playing sport combined with a healthy and varied diet constitutes, over time, the best cure and prevention of any kind of discomfort. In fact, all over the world experts in nutrition support athletes with personalized food plans, on the basis of their physical characteristics and the type of performance objectives. Today the Mediterranean diet is certainly one of the best food models to be followed.

The term "Mediterranean Diet" generally indicates a set of good eating habits characterizing a group of Countries of the Mediterranean area, and it represents a real model of life. The undisputed protagonist of this discovery was *Ancel Keys*, an American biologist and physicist who, after the end of the Second World War, focused on the effects of hunger that the war had inevitably caused, noting that in European countries the mortality rate due to heart diseases was much lower than before. Referring to studies conducted in the United States that found high mortality rates for cardiovascular diseases in middle-aged people, he concluded that diet could greatly influence the human health. To test his hypothesis, from 1958 to 1970 Keys conducted a great epidemiological study, the "*Seven Countries Study*" (SCS), recruiting a sample of over 12,000 men, aged between 40 and 59 years, from seven different countries (Italy, Yugoslavia, Greece, Holland, Finland, United States and Japan). For each participant blood pressure, eating habits, physical activity, tobacco use, weight status, electrocardiograms, cholesterol blood levels, heart rate and lung capacity were recorded (1). The collected data revealed that in Italy and Greece, where the diet was poor in saturated fatty

acids and rich in vegetables, the rate of cardiovascular diseases was very low. On the contrary, the incidence of heart failure, hypertension and stroke was high in countries such as the United States and Finland, where people followed diets rich in saturated fatty acids. These considerations led Keys to conclude that high intakes of saturated fatty acids were harmful to health.

In 1957, during the pilot study of SCS, Nicotera, a small village located in Calabria, South Italy, was chosen as the third rural area. The indigenous population of Nicotera focused its own economy almost exclusively on the agricultural cultivation of tomatoes, legumes, grapes, wheat, olive and orange trees and fish. About 80% of the locals were forced to travel daily to the land plots which, most of the time, were located outside the town. The study showed that cases of heart attack, hypertension and obesity were almost completely absent, confirming once again what Keys had intuited. In fact, the inhabitants of Nicotera were unknowingly following a dietary lifestyle defined as the "Italian Mediterranean Diet of reference" (2).

In 2010, the UNESCO (United Nations Educational Scientific and Cultural Organization) declared the Mediterranean model of life "Cultural Heritage of Humanity", highlighting its culinary practices, the enhancement of indigenous food, biodiversity and the seasonality of different foodstuffs. The common goal of many scientists, therefore, is to promote this model of lifestyle, especially among young people, to guarantee them better health (3, 4). Very briefly, the main characteristics of the "Mediterranean Diet" observed by Ancel Keys were the following:

- abundance of foods of plant origin: fruit, vegetables, pasta, bread, cereals, legumes, etc;
- prevalent consumption of fresh and seasonal foods, possibly locally sourced and freshly picked;
- use of olive oil, together with nuts, as the main source of fats;
- daily limited consumption of cheese and / or yogurt;
- weekly consumption of fish, white meat and eggs;
- very limited consumption of sweets and products rich in sugars or saturated fats;
- monthly consumption of red meat;
- abundant supply of water;
- moderate consumption of red wine.

A sportsman should not have a diet very different from that of those who do not practice physical activity, the important thing is that the balance between the amount of energy necessary to maintain a good body weight and the loss of energy related to physical effort is respected. With these premises, the Mediterranean Diet is also suitable for athletes because it provides the right proportion of nutrients and a large amount of protective substances that counteract the production of free radicals (increased during exercise).

The nutritional needs of the athlete and Mediterranean Diet

The Mediterranean Diet is suitable for those who practice sports, providing the right proportion of nutrients and a large amount of protective substances, such as vitamins and antioxidants, contrasting the production of free radicals which increase during physical exercise. Athletes have different nutritional needs compared to the general population. The dietary pattern is significantly related to the performance, efficiency, fatigue resistance as well as the ability to increase workloads. Each nutritional plan must be customized and adapted to the characteristics of the athlete in relation to weight, height, body composition and what the performance goal is. In fact, eating well, is the first step in optimizing sports performance.

Generally, in athletes a low-calorie diet is related to a sense of exhaustion, fatigue, overtraining symptoms and weight loss, especially muscle mass (5). It is estimated that practicing a moderate activity of about 90 minutes a week, on average requires from 1800 to 2400 Kcal per day. Obviously, these requirements increase considerably in elite athletes, who are involved in intense workouts for about 3-6 hours daily, 5-6 days a week. In particular, Reinert *et al.* (6) found that the Tour de France cyclists' calories requirement can reach about 12000 kcal per day, corresponding to about 150-200 kcal / kg of body weight.

Macronutrients provide energy to our body. They are divided into: *carbohydrates, proteins* and *fats*. The general nutritional guidelines recommend a macronutrient breakdown that includes 40-45% carbohydrates, 10-15% protein and 20-25% fat. In athletes these parameters can undergo important changes with an increase in carbohydrates and proteins in relation to the type and level of physical activity. The Mediterranean Diet provides these nutritional principles because whole grains, vegetables, fruit and legumes bring a high percentage of carbohydrates as well as fibers, vitamins and antioxidants. Eggs, fish, white meats and yogurt are sources of proteins, while olive oil, a typical food of the Mediterranean diet, is one of the best sources of unsaturated fatty acids (7).

Carbohydrates come from the plant world, with the exception of lactose which derives from milk, and they have the main function of producing energy (about 4 kcal/g). Thanks to their fast absorption, carbohydrates are able to meet energy demands, so that in sportsmen their use should represent 55-65% of the total daily energy intake (8), ranging from about 5-7g / kg of body weight (9-11).

Proteins represent the most important nutrients in the diet of athletes because they mainly support the structure of the muscle (actin and myosin) and of the bones. Moreover, other functions of the proteins are: (i) formation and regeneration of new tissues; (ii) synthesis of amino acids; (iii) energy production; (iv) acid-base balance of the body; (v) regulation of enzymes; (vi) endocrine and immune function; (vii) transport of substrates; (ix) control of gene expression. If taken immediately after an intense activity, they intervene in the repair processes in case of damage. Generally, proteins should account for about 10-30% of the calories consumed. Anyway, in a sportsman they can undergo significant variations. In 2018, *Cintineo et al*. showed that consuming proteins before and after the physical activity induces a significant rise in muscle protein synthesis, with an improvement of the athletic performance. This evidence led many manufacturers to launch countless protein products on the market, such as food supplements or protein powders for sportsmen (12).

Among all the macronutrients, lipids, also called fatty acids, produce the best quantity of energy (about 9 kcal / g). They are present both in foods of plant origin – the so-called 'unsaturated' fatty acids considered protective for health – and in foods of animal origin – the so-called 'saturated' fatty acids considered harmful for health.

Taking into consideration their high energetic power, the lipids intake should not exceed values between 25 and 35% of the daily caloric requirement. In sportsmen, the intake of fats has always created discrepancies and ambiguities. In fact, although they are considered the main causes of cardiovascular diseases, namely heart disease, their caloric power makes them suitable for many sport disciplines always in the right quantities, in many diet sports (13).

Finally, although in much lower concentrations than macronutrients, the needs of micronutrients is essential for the body, because they cannot be synthesized endogenously and must be introduced with food. Vitamins and minerals are part of this group of substances, which play a role of considerable importance within the world of fitness (14). Vitamins have very different chemical structures and, to date, 13 vitamins have been recognized, each with its own role, but overall fundamental in cellular bioregulation. They are divided into two main groups: fat-soluble (A, D, E, K) and water-soluble (C and group B vitamins). In general, fat-soluble vitamins are mostly contained in meat and oils, while water-soluble vitamins are found mainly in fruit and vegetables, all foods that are part of the Mediterranean Diet. The intake of vitamin D, mainly recovered in oily fish and eggs, is undoubtedly one of the most important for athletes because it regulates the metabolism of calcium and phosphorus and therefore preserves the structure of the bones. Vitamin D also plays a very important role in the constitution of skeletal muscles, thus significantly affecting athletic performance and preventing injuries, inflammation as well as other various stresses affecting the musculoskeletal system. On the other hand, vitamin D deficiency causes asthenia, a greater risk of infections, irritability, loss of appetite and, particularly in athletes, bone fractures. (15, 16).

Minerals such as phosphorus, calcium, magnesium and zinc, act as cofactors in the complex enzymatic activities of the organism. Furthermore, they contribute to the formation of hormones (for example iodine

for thyroid hormones), enzymes and vitamins (for example cobalt for vitamin B12). They also guarantee the maintenance of water balance, regulate neuromuscular functions, are essential for muscles contraction and to regulate the blood pressure and coagulation. Calcium, for example, is very important for athletes for its ability to regulate the growth and to repair the bone tissue, being also involved in the processes of muscle contraction, coagulation and nerve transmission. While iron increases aerobic performances, being the main constituent of the oxygen carriers hemoglobin and myoglobin (17).

Dietary strategies in athletes

Nowadays, some very specific dietary strategies are recommended, capable of optimizing performance and avoiding any type of problem that may arise in the athlete during a very intense training session. The significant loss of electrolytes, hypoglycemia and glycogen depletion are just some of the problems that can occur and which, inevitably, affect the strength, concentration and ability of the athlete. To cope with these unpleasant events, it is necessary to employ excellent eating strategies before, during and after the athletic performance.

Before training, carbohydrates and liquids play a crucial role in the world of fitness. Carbohydrates, in particular, increasing muscle glycogen stores, must be consumed before performance as they represent a source of energy to be used promptly. Depletion of glycogen during the physical activity would inevitably compromise its effectiveness, causing exhaustion and perception of fatigue, so experts recommend adequate intakes of carbohydrates (on average 1 g/kg of body weight) before the performance. Liquids are also indispensable before performances, since important volumes of water and electrolytes are lost through breathing and sweat. Poor hydration in the hours preceding training would compromise its effectiveness since sweating, dissipating the heat that is created due to muscle contraction, could lead to hypovolemia (reduction in blood volume) and therefore to an increased consumption of glycogen. Thus, during training it is advisable to drink the right amounts of water in order to cope with excessive losses of electrolytes, such as sodium and potassium, which could cause very painful muscle cramps.

After completing a grueling training session, the muscles and body must be supplied with the nutrients necessary for full recovery. Although carbohydrates and liquids are also important dietary components, proteins represent the ideal energy substrate to consume at this stage. In fact, they contribute to a better muscle recovery, a better muscle protein synthesis, thus encouraging the increase in muscle mass (18).

If the Mediterranean Diet is an excellent food model of reference for those who practice sports in good health, it is even more so in those who have a pathology, obviously with appropriate modulations and precautions. An incorrect power supply and the progressive reduction in physical activity, largely due to technological progress, are the basis of the irrepressible increase in chronic degenerative diseases, not only in industrialized countries, but also in emerging ones.

Exercise can cause fatigue and muscle damage which, if not treated correctly, could lead to inflammatory processes. For this reason, nutritionists recommend for athletes certain foods with anti-inflammatory and antibiotic properties that play a fundamental role in the prevention and treatment of this phenomenon (19-25) also within the dietary plans of athletes. Antioxidants and phytochemical compounds help to protect against oxidative stress that may derive form a very hard and intense workout, allowing a much more efficient muscle recovery. A large intake of fruits and vegetables, such as apples, apricots, cherries, kiwis, carrots, spinach, broccoli and potatoes, key foods of the Mediterranean Diet, is particularly recommended for athletes. In fact, an intense and long-lasting work out can cause alterations in immune defenses, as it contributes to the production of stress hormones, such as cortisol and adrenaline, modifying in turn the pro-anti-inflammatory balance. A higher consumption of carbohydrates, in addition to all the benefits listed above, promotes a better post-work out muscle recovery, lowering the levels of stress hormones, and therefore moderating the damage to the immune system.

Mediterranean Diet, physical activity and diseases

The Mediterranean Diet has become synonymous of a balanced diet and is often considered an example of a lifestyle useful to stay healthy and to fight the so-called diseases of well-being, such as cancer, diabetes and cardiovascular diseases. The antioxidant effect of a high vitamin intake, together with the containment of glycemic and blood cholesterol levels, helps to prevent the onset of chronic neurodegenerative diseases, such amyotrophic lateral sclerosis (ALS), the Parkinson's and the Alzheimer's diseases (26, 27).

Among the possible factors that can influence both onset and progression of these diseases, dietary style could play an important role. Thus, the Mediterranean Diet, characterized by the intake of large quantities of fruit, vegetables, cereals, nuts, olive oil, and moderate quantities of wine fish, white meats and eggs, may play a protective role for the brain (28-30).

Various studies have shown that the Mediterranean Diet is able to reduce the risk of cancer, thanks to the high content of unsaturated fats, fibers, vitamins and trace elements with anti-free radical action (31).

Regarding the diabetes, it is now well documented that nutritional therapy represents a fundamental step in the management of the diabetic patient, in association with drug treatment and physical activity. Adherence to the Mediterranean food model has been shown to improve the glycemic and lipid profile in diabetic patients, reducing the incidence of diabetes by 52% compared to other low-fat diets. (32, 33). Regular exercise is an integral part in the treatment of diabetes and other chronic degenerative diseases (obesity, metabolic syndrome, osteoporosis, cardiovascular disease) thanks to the numerous benefits it brings (e.g. reduction of blood sugar; improvement of insulin sensitivity; reduction of triglyceride levels (LDL) and increases of HDL levels; reduction of visceral adipose tissue; regulation of weight loss; reduction of blood pressure, etc.) (34).

Benefits deriving from the association of Mediterranean Diet and physical activity are well-known in persons suffering from celiac disease. Obviously, a celiac need to choose gluten-free grains, such as rice, buckwheat, millet, amaranth, quinoa, and corn. Quinoa in particular is an excellent source of energy, while bananas, mushrooms, beans, tomatoes, beets and potatoes are recommended for their richness in potassium, a very important mineral salt for maintaining bones and muscles before and after training. In addition to potassium, a celiac must also replenish other minerals such as magnesium and calcium to a greater extent than non-celiac athletes. In fact, the intestinal villi in celiacs are subjected to a continuous state of inflammation so they find it difficult to absorb the minerals lost during the physical activity (35).

Conclusion

In recent times, especially among young people, many initiatives have been undertaken to monitor knowledge on recent Public Health topics. For example, interesting questionnaires have been distributed aimed at detecting knowledge on Mediterranean diet (36-38), obesity (39), vaccinations (40, 41), antibiotic resistance (42). Knowledge is not always at a high level and this means that we still have a lot of work to do to understand how the spread of these phenomena can affect human health and how important it is to undertake initiatives that will serve to improve Public Health.

An appropriate sports diet must take into consideration of the practiced sport, in fact there is no better diet model than others, but it is certainly true that a healthy and balanced diet is often enough to keep oneself in ideal physical conditions. It is not necessary a maniacal search for an improvement due to specific percentage variations of certain nutrients, but to keep the caloric intake at the level necessary for the sporting intensity carried out and not to unbalance the supply of macronutrients.

To promote a healthy lifestyle such as the one carried out by the Mediterranean Diet, it is necessary to make athletes and producers of dedicated foods understand how important it is to make the right choices. What a sportsman eats influences weight, body composition, energy availability, recovery capacity, sports performance itself. The right choice of foods must guarantee an adequate energy and nutritional intake, an indispensable condition for maintaining and improving psychophysical well-being and guaranteeing

excellent performances, at this point a correct information provided by experts through all possible channels is extremely important (43-45).

The Mediterranean diet model was forged by poverty, hardship and favorable climatic conditions rather than scientific intuition. However, to date, the results recorded by the studies conducted through in-depth and methodologically correct nutritional investigations, have confirmed the modernity of the hypotheses suggested by the experiment performed at that time in the Mediterranean area (46, 47).

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