

Analysis of Nutritional Composition of Mediterranean Diet and Application of This Model

Jingchun Li*

Department of Biotechnology and Food Science, Tianjin University of Commerce, Tianjin, 300134, China

*Corresponding author: wuyiwei@ldy.edu.rs

Abstract. As a globally recognized healthy diet, the Mediterranean Diet (MD) integrates local characteristics of the natural environment and resources, unique food culture, and upholds the concept of healthy eating. The health benefits of the MD, which include a balanced intake of fruits, vegetables, whole grains, olive oil, and lean proteins, are constantly being studied and applied across diverse populations. Numerous studies have confirmed the diet's ability to reduce the risk of cancer, combat inflammation, and lower the incidence of chronic diseases such as cardiovascular disease, type 2 diabetes, and obesity. This article mainly describes the nutritional structure of the MD and the specific mechanisms through which it helps prevent these four major diseases. In the future, as research deepens and more studies are conducted, the MD will likely play an even more significant role in addressing global health issues. Future studies could focus on promoting the quantification and broader implementation of the MD to further enhance its positive impact on human health.

Keywords: The mediterranean diet; nutrient composition; anticancer effect; anti-diabetic effect; prevention of cardiovascular disease (CVD).

1. Introduction

The Mediterranean diet (MD) refers to a traditional dietary pattern of the countries of Southern Europe that now lie along the Mediterranean Sea. The core dietary concepts of the MD are balance, nature and seasonality. It encourages the use of local, fresh ingredients and uses simple cooking methods to preserve the original taste and nutritional content of food. The main feature of the MD is its fresh and rich ingredients, mainly vegetable, fruit, whole grains, legumes and nuts and other plant foods. The diet pattern is very balanced, using good fat sources, moderate intake of good protein and low consumption of processed foods to maintain a healthy diet. The MD also has a unique food culture and is accustomed to sharing meals with friends and family as a way to promote emotional connection (Figure 1).

The significance of studying the nutritional composition analysis of the MD and the current application of this model is reflected in different levels. In terms of health, the MD can reduce the risk of cancer, prevent cardiovascular disease (CVD), improve the gut and immune system, and prevent diabetes.

Such benefits promote human health. It also has profound significance in terms of culture and value inheritance. MD provides a healthy and nutritionally balanced diet pattern for nutrition research, which helps us to explore the relationship between diet and health. And through research which can deeply understand the relationship between food components and human health, and promote the development of scientific diet. Further research on the composition, mechanism and effect of MD in different populations can provide important basis for formulating scientific dietary guidelines and public health policies.

This article mainly studies the dietary composition of the MD and the relevant application status. Describe the specific definition of the MD in terms of its dietary structure. Macronutrients and micronutrients are studied in the diet structure. Macronutrients are mainly carbohydrates, proteins and fats. Micronutrients are some of the main vitamins and minerals that provide health to the human body. Four health benefits brought by the MD will be introduced in the current status of application,

namely, reducing the risk of cancer, preventing CVD, improving the intestinal and immune system, and preventing diabetes. In addition, the MD also has a positive impact on some chronic diseases. Through continuous research, it is found that the MD is not only a traditional diet way, but also a diet pattern that promotes human health and is worthy of continuous research, which has far-reaching significance for the sustainable development of human health.

Mediterranean diet pyramid: a lifestyle for today
guidelines for adult population

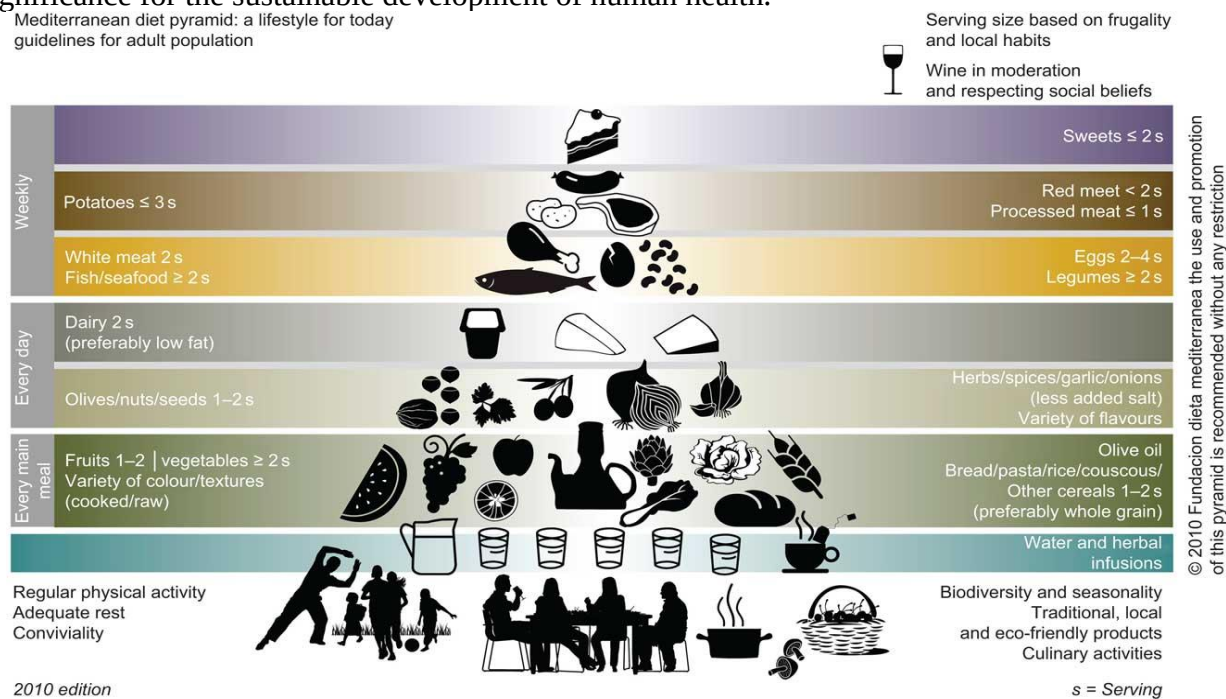


Fig. 1 Mediterranean diet pyramid. Source: Fundacion Dieta Mediterrànea [1].

2. Nutrient Composition

2.1. Macronutrient

2.1.1 Carbohydrate

The carbohydrate composition of the MD is mainly composed of whole grains, legumes, vegetables and fruits, of which the whole grains are mainly oats, brown rice and whole wheat bread [2]. These foods not only provide a certain amount of carbon water, so that our body can operate normally, but also they are rich in a certain amount of dietary fiber, can promote the digestion of the gastrointestinal tract, in addition to providing some essential vitamins and minerals in the body to enhance the body's immunity, maintain the normal physiological function of the body.

Whole grains and legumes are the main sources of carbohydrates, which are rich in complex carbohydrates that help keep blood sugar stable; Vegetables and fruits also contain carbohydrates, but not in large quantities. Its main characteristics are high in water, dietary fiber and vitamins, which help to increase satiety, promote digestion and provide nutrients the body needs.

In the MD, there is no fixed intake of carbohydrates. Need to be based on their own amount of activity and acceptance, both to meet the body's energy needs at the same time, but also to avoid excessive intake and cause the body to produce some load.

In general, carbohydrates are an indispensable factor in the MD culture, which is the main source of energy for the human body. Reasonable intake of carbohydrates and maintenance of a reasonable diet structure are conducive to maintaining stable blood sugar levels, protecting muscles and promoting digestion.

2.1.2 Protein

Protein is an important ingredient in the MD. The protein composition of the MD mainly includes fish, poultry meat, beans and nuts, dairy products and so on [2]. These foods perform a number of

important physiological functions for the human body, in addition to providing energy, promoting metabolism and transporting nutrients.

Specifically, the first is fish, and the MD often contains a wide variety of fish. It is worth mentioning that deep-sea fish, such as tuna and cod, are rich in omega-3 fatty acids. Because omega-3 fatty acids can lower triglyceride levels, eating this type of fish not only provides high quality protein, but also reduces the risk of CVD [2]. The poultry in the MD mainly includes chicken, duck, Turkey and so on. Unlike other diets, Turkey is a low-fat, high-protein meat that is often used as a substitute for red meat in MD cultures. Among them, Turkey contains vitamin B6 and niacin, which can enhance skin elasticity and improve skin condition. Beans are mainly divided into tofu and some beans and vegetables, nuts are mainly divided into walnuts, hazelnuts, almonds, etc., they are rich in a lot of plant-based protein, easy to be digested by the human body, but also an important part of the MD. Finally, dairy products, mainly cheese and yogurt, boost immunity, promote bone health, are a good source of protein,

There are a variety of proteins in the MD, which can be reasonably combined with appropriate intake to ensure that the body gets enough protein content and maintain a balanced and healthy diet.

2.1.3 Fat

Fat in the MD comes mainly from olive oil, nuts, and some fish. These foods help fat store energy, maintain body temperature, and protect organs. Compared to other diets, the MD is low in fat and mainly composed of unsaturated fatty acids.

First of all, olive oil, as the main source of fat, is rich in monounsaturated fatty acids, which can reduce the risk of CVD. There are many other nutrients in olive oil, which can help us delay aging and promote metabolism. Nuts are also an important source of fat. Nuts are high in value, nutritious and provide our bodies with the energy they need. Secondly, some fish and seafood, the fats in them, especially the omega-3 fatty acids in deep-sea fish, can help the body reduce inflammation and reduce the risk of CVD.[2].

Fat in the MD emphasizes choosing healthy fat sources and consuming them in moderation. In addition to providing the energy and nutrients the body needs, this eating pattern also has certain benefits for the body.

2.2. Micronutrient

2.2.1 Vitamins

The MD is nutritious and rich in many vitamins, mainly including vitamin A, vitamin C, vitamin D and vitamin E. These vitamins play a role in various physiological functions of the body and can also prevent some diseases.

Vitamin A comes mainly from vegetables and fruits in the MD, such as carrots and tomatoes. Vitamin A has some effect on vision and can help and promote bone growth and keep skin healthy. Vitamin C comes mainly from citrus fruits in the MD, such as oranges and lemons, and also from some vegetables. Vitamin C can promote iron absorption, enhance immunity, and promote collagen synthesis. Vitamin D is less abundant than other sources of vitamin D. Although the Mediterranean region has plenty of sunlight and can synthesize vitamin D in the skin, the body still needs some food sources. Vitamin D in the MD comes from some fatty fish, such as salmon and tuna [2]. Some nuts and grains in the MD are sources of vitamin E, a powerful antioxidant that protects lipids from damage, as well as vitamin E, which may also protect against Alzheimer's disease. In addition to these vitamins, there are some B vitamins from the MD, can help the body's energy metabolism, for the nervous system function also plays a role.

The variety of vitamins in the MD provides good nutrition for the human body, but also prevents the risk of some diseases to a certain extent, and has a certain role in maintaining health.

2.2.2 Mineral

The MD is rich in mineral elements. Minerals include calcium, iron, zinc, magnesium, potassium and so on. These minerals play a specific role in the health of the human body, not only providing nutrition, but also improving immune system function and promoting metabolism.

Calcium in the MD comes mainly from beans, vegetables and dairy products. Calcium is good at preventing osteoporosis and promoting bone growth. Iron, found in fish, beans, and some nuts, can help prevent a range of health problems, including anemia, and regulate immune function, but too much iron can strain the heart or damage the liver. Zinc is widely found in the MD and comes from whole grains, meat, legumes and more. Zinc can promote growth and development and maintain immune function. Magnesium, found in green leafy vegetables and some whole grains, helps maintain heart health and energy metabolism. Potassium, which comes mainly from fruits and vegetables, plays an important role in both heart and blood pressure levels. In addition, the MD also contains a number of other minerals to maintain the body's health.

The MD provides enough minerals through a variety of foods, so that the body gets enough nutrients, helps prevent some chronic diseases, and gets comprehensive nutrition.

3. Application Status

The MD has a significant impact on the prevention and treatment of related diseases, and the following are specific examples of four diseases that the MD has improved, respectively, reducing the risk of cancer, preventing CVD, improving the intestinal and immune system, and preventing diabetes.

3.1. Cancer

As a healthy eating habit, the MD also has preventive and palliative effects on cancer. The effect of the MD on cancer is to reduce the process of cell oxidation and inflammation and avoid a series of protective effects such as DNA damage, cell reproduction and blood vessel formation [3]. By this mechanism, the MD is an effective and easily implemented way to reduce the incidence of cancer.

In addition to genetic and environmental influences, the cause of cancer is also strongly related to dietary habits. Some unhealthy eating habits and lifestyle can increase the risk of cancer, and dietary changes can reduce the incidence of cancer by 30% to 40% [4]. Optimal dietary patterns require fruits and vegetables rich in vitamins and fiber, small amounts of meat, and moderate amounts of dairy products. The MD effectively reduces the risk of cancer through a number of mechanisms. Fish intake can reduce the growth of tumor cells, fruits and vegetables rich in vitamin fiber and olive oil have antioxidant and anti-inflammatory effects, some dairy products can inhibit tumor development, and some micronutrients in red wine, including polyphenols, have a positive effect on cancer. The MD has a positive impact on cancer through a rich diet and a healthy lifestyle.

3.2. CVD

The MD is the best model for preventing CVD. The benefits of this traditional dietary pattern are that you can eat plenty of whole foods including vegetables and fruits and some olive oil, while reducing some ultra-processed foods and drinking red wine in moderation [5].

The main effects and prevention of CVD are the following foods, the first is fish containing Omega-3 polyunsaturated fatty acids (PUFAs), according to the American College of Cardiology (ACC), eating fish containing Omega-3 PUFAs twice a week can have a positive effect on CVD. The second is olive oil, which contains unsaturated fats, a distinctive feature of the Mediterranean is the presence of unsaturated fats in both protein and fiber sources. The protective mechanism of olive oil for the heart is due to its water solubility and the presence of some phenolic compounds, which are very effective antioxidants and free radical scavengers. Another is the consumption of fruits and vegetables, almost every recommendation to treat CVD encourages eating more fruits and vegetables because they provide a large amount of micronutrients. The antioxidant properties of fruits and

vegetables and the intake of flavonols are also beneficial. Although fruits and vegetables have not been specifically tested, there is a certain synergistic effect in the treatment of CVD. Last but not least, whole grain foods with high fiber. Increasing the consumption of whole grains can reduce the incidence and mortality of CVDs, and the rich dietary fiber in whole grain foods can promote the health of CVDs [6].

3.3. Intestinal Immune System

The relationship between nutrition and the immune system is very complex, and at different stages, some vitamins and minerals play a crucial role. When an essential nutrient is lacking, it can damage health [7]. Diet plays a key role in regulating the gut microbiota, and adoption of the MD is associated with increased biodiversity in the gut biota [8]. In addition to the effect of the MD on the gut microbiota, the main components of the MD also have a positive effect on the gut microbiota.

The first is dietary fiber. The MD is rich in dietary fiber, which can reduce intestinal damage. Next is extra virgin olive oil containing polyphenols, which has a bactericidal effect on *H. pylori* strains and is an effective chemopreventative agent for treating stomach ulcers. The MD is rich in Omega-3 fatty acids, which come from some fresh fruits and oily fish, which can promote the production and action of intestinal alkaline phosphatase, induce changes in intestinal microbiota, and reduce inflammation. In addition, the MD provides the human body with rich minerals and some micronutrients, and these dietary minerals have a potential positive impact on the gut microbiome. The MD relies on a variety of nutrients that all have a positive effect on the proper functioning of the gut microbiome and immune system [9].

3.4. Antidiabetic

The MD may reduce the risk of diabetes by controlling blood sugar, improving CVD, or controlling weight. First, the MD is full of foods rich in fiber and monounsaturated fat to ease the rise in blood sugar or improve insulin sensitivity to control blood sugar levels, such as vegetables, nuts, olive oil. In addition, some polyphenols may reduce inflammation, improve vascular endothelial function, and reduce cardiovascular risk in people with diabetes. Finally, since obesity is the main cause of diabetes, a reasonable MD can well prevent the occurrence of obesity and reduce the risk of diabetes [10].

4. Conclusion

As a widely known and continuously studied diet, the MD has a positive impact on the development of human health. The nutritional composition of the MD is very balanced and comprehensive, it is characterized by rich plant foods, vegetables, fruits and whole grains as the main dietary sources, followed by healthy fat sources, mainly olive oil and fish rich in Omega-3 PUFA, moderate alcohol consumption and low processing food composition. This healthy diet can help prevent a number of diseases, such as reducing the risk of cancer, preventing CVD, improving the gut and immune system, and preventing diabetes. In this review, we describe the macronutrients and micronutrients of the MD and explain in detail the prevention of the above four diseases. The remaining health effects of the MD, disease prevention and specific mechanisms have not been described. In the future, how to apply and widely implement this healthy eating habit needs to be paid attention to and solved. It is also necessary to continuously explore the molecular mechanism of the protective effect of the MD on health in order to understand and prevent the occurrence of diseases.

References

- [1] Palmi J, Alcubierre N, Gil Moreno de Mora G, Reig F, Planas-Anzano A. 4BR: Educational Training Programme for the Prevention of Sports Injuries in Young Athletes[J]. International Journal of Environmental Research and Public Health, 2021, 18(10): 5487.

- [2] Urquiaga I, Echeverría G, Dussaillant C, Rigotti A. Origen, componentes y posibles mecanismos de acción de la dieta mediterránea[J]. *Rev Med Chil*, 2017, 145(1): 85-95.
- [3] Mentella M C, Scaldaferri F, Ricci C, Gasbarrini A, Miggiano G A D. Cancer and Mediterranean Diet: A Review[J]. *Nutrients*, 2019, 11(9): 2059.
- [4] Vineis P, Wild C P. Global Cancer Patterns: Causes and Prevention[J]. *Lancet*, 2014, 383: 549-557.
- [5] Martínez-González M Á, Hernández Hernández A. Effect of the Mediterranean diet in cardiovascular prevention[J]. *Rev Esp Cardiol (Engl Ed)*, 2024, 77(7): 574-582.
- [6] Martínez-González M A, Gea A, Ruiz-Canela M. The Mediterranean diet and cardiovascular health: A critical review[J]. *Circulation research*, 2019, 124(5): 779-798.
- [7] Widmer R J, Flammer A J, Lerman L O, Lerman A. The Mediterranean diet, its components, and cardiovascular disease[J]. *Am J Med*, 2015, 128(3): 229-238.
- [8] Barrea L, Muscogiuri G, Frias-Toral E, et al. Nutrition and immune system: from the Mediterranean diet to dietary supplementary through the microbiota[J]. *Crit Rev Food Sci Nutr*, 2021, 61(18): 3066-3090.
- [9] Barber T M, Kabisch S, Pfeiffer A F H, Weickert M O. The Effects of the Mediterranean Diet on Health and Gut Microbiota[J]. *Nutrients*, 2023, 15(9): 2150.
- [10] Kiani A K, Medori M C, Bonetti G, et al. Modern vision of the Mediterranean diet[J]. *J Prev Med Hyg*, 2022, 63(2 Suppl 3): E36-E43.