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The Role of the Mediterranean Diet in the Prevention and Management of Coronary Heart Disease

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Abstract. Cardiovascular disease (CVD) is the leading cause of death in China and globally, and coronary heart disease, as a typical type, is closely related to dietary structure. Currently, the Mediterranean diet (MD) has attracted much attention for its potential in cardiovascular protection. Observational studies have shown that it is beneficial for CVD risk factors, but there is still a lack of rigorous experimental verification, and the long-term intervention effect and mechanism of action are not yet clear. This article analyzes the core components and characteristics of the MD, explores its biological mechanisms for intervening in coronary heart disease, reviews clinical research evidence and meta-analysis conclusions, and clarifies its significant potential in preventing and intervening in coronary heart disease. Research provides a basis for dietary management of coronary heart disease and helps develop personalized dietary intervention strategies. However, its promotion is limited by factors such as ingredients and genetics. In the future, further research is needed to optimize the plan, promote the translation of theory into practice, and provide more solid support for the prevention and control of CVDs.

Keywords: Mediterranean Diet, Cardiovascular Disease, Coronary Heart Disease.

1. Introduction

Cardiovascular disease (CVD) is one of the most serious diseases threatening human beings in the world today. Its incidence rate and mortality rate have exceeded that of tumor diseases and become the first. In 2004, global sales of cardiovascular prescription drugs exceeded $75 billion, and it is expected to exceed the $100 billion mark by 2008. A survey and analysis of the causes of death in China shows that in recent years, 40% of countrymen deaths are caused by CVDs, which means that one in every three deaths is caused by CVDs. CVD has become the first cause of death in China's population and the first killer of country men's health [1]. The pathological basis of coronary heart disease is coronary atherosclerosis, which is closely related to diet.

The Mediterranean diet (MD) was first proposed by Angel Keys in the 1860s based on observations of the dietary habits of people in the Mediterranean Basin. It was finally determined at the International MD Conference in 1993. It is a healthy dietary pattern that mainly consists of a large amount of vegetables and fresh fruits, and uses olive oil as the main source of fat. In contrast, the MDary pattern centered around rich plant-based foods (whole grains, vegetables, fruits, beans), high-quality fats (olive oil, fish), and moderate dairy products has attracted much attention. The

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early epidemiological survey showed that the incidence rate of coronary heart disease in Mediterranean coastal countries was 30% -50% lower than that in European and American countries. This significant difference prompted the medical community to have a strong interest in the cardiovascular protective effect of MD. However, existing research is mostly observational analysis and lacks rigorous experimental validation, although it has been confirmed that adhering to the MDary pattern is beneficial for CVD risk factors. However, due to the low quality of some research evidence, there is still uncertainty about the impact of the MD on the occurrence and risk factors of CVD, and the long-term intervention effect and mechanism of action are not yet clear.

This study will systematically assess the impact of MD on the incidence rate, risk factors and biomarkers of coronary heart disease. Intended to fill the existing research gap, provide a basis for dietary management of coronary heart disease, assist in the development of personalized dietary intervention strategies, and improve CVD prevention guidelines.

2. Core components and characteristics of Mediterranean cuisine

2.1. High plant-based foods

Daily intake of whole grains (such as brown rice, oats, etc.), vegetables, fruits, nuts, and legumes can provide the body with rich dietary fiber, antioxidants (such as vitamin C, E), and plant polyphenols. Among them, foods rich in dietary fiber such as corn, buckwheat, and millet can promote gastrointestinal peristalsis and regulate the gastrointestinal tract. Adequate vitamin supplementation can enhance the human immune system, and long-term consumption can reduce the risk of CVD. In addition, cholesterol is an important trigger for arteriosclerosis, and lowering cholesterol levels can help reduce the risk of CVD. Dietary fiber can bind with cholesterol, reducing its absorption by the intestine and thus lowering cholesterol levels in the blood [2,3].

2.2. Sources of healthy fat

The MD uses olive oil as the main cooking oil, replacing animal fat and providing a healthy source of fat for the human body. The nutritional value of olive oil is usually determined by its chemical composition, with its main component saponifiable matter (triglycerides) accounting for about 99%, of which unsaturated fatty acids account for about 75%, with the highest reaching 88%. Olive oil also contains carotenoids, polyphenols, squalene, various trace elements, and vitamins, with high nutritional value [4]. It is recommended to take fish 2-3 times a week (especially deep-sea fish rich in ω -3 fatty acids, such as salmon and sardine). Omega-3 fatty acids can lower the levels of triglycerides in the blood, reduce platelet aggregation, and have excellent cardiovascular protection.

2.3. Moderate amount of protein

Mainly consisting of beans, fish, and low-fat dairy products, with less intake of red meat. Consuming an appropriate amount of protein can effectively reduce the intake of high sugar foods. Protein binds with monounsaturated fatty acids (MUFAs) and vitamin E, providing essential amino acids while improving endothelial function and reducing oxidative stress. Specifically, soybeans, mung beans, red beans and their products, such as tofu, soybean milk, are rich sources of high-quality vegetable protein, and are rich in dietary fiber, which helps reduce the risk of CVD; Low fat or skim milk products such as milk, yogurt, etc. are good sources of high-quality protein and calcium, which help maintain cardiovascular health [5].

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2.4. Low alcohol intake

The MD is often paired with moderate amounts of red wine (recommended ≤ 1 glass per day for men and ≤ half a glass per day for women). The polyphenolic compounds in red wine, such as flavonoids and non flavonoids, have antioxidant, anti-inflammatory, and platelet aggregation inhibiting effects. At the same time, resveratrol is a natural compound existing in the skin of red grapes. It is believed that it can reduce low-density lipoprotein (LDL) cholesterol and increase the level of high-density lipoprotein (HDL) cholesterol. It can improve vascular function by promoting vascular endothelial cells to produce nitric oxide (NO), thereby reducing the incidence rate of coronary heart disease.

3. Biological Mechanism of MD intervention in coronary heart disease

3.1. Protection of vascular endothelial function

Polyphenols in olive oil can promote the production of nitric oxide (NO), improve the structure and function of endothelial cells, reduce the oxidation of low-density lipoprotein cholesterol (bad cholesterol), enhance vasodilation ability, improve endothelial dependent vasodilation function, and reduce the risk of vascular spasm. Whole grain foods can reduce adverse stimulation to vascular endothelium and protect endothelial function.

3.2. Blood lipid regulation effect

Dyslipidemia (especially the increase of LDL-C) is the "driving force" behind the formation of coronary heart disease, which gradually destroys coronary artery function by promoting the formation of atherosclerotic plaque and vascular inflammation. After the infiltrated LDL-C is oxidized, it stimulates macrophages to phagocytosis, forms foam cells, releases inflammatory factors, further recruits white blood cells, and aggravates inflammation of blood vessel wall. High blood sugar can disrupt the structure of endothelial cells through non enzymatic glycation reactions (glucose binds to proteins to form AGEs), leading to a decrease in their ability to secrete NO (a key substance that maintains vasodilation) and a reduction in vascular elasticity. MUFAs (such as oleic acid) in olive oil can increase high-density lipoprotein cholesterol (HDL-C) and promote cholesterol efflux; ω -3 fatty acids can reduce the level of blood triglycerides and the risk of atherosclerotic plaque formation by inhibiting the synthesis of liver triglycerides.

3.3. Blood pressure and blood glucose regulation

Hypertension significantly increases the risk of coronary heart disease through multiple mechanisms such as mechanical injury, endothelial dysfunction, and plaque instability. Hypertension promotes plaque formation, and after plaques cause coronary artery stenosis, they may make blood pressure more difficult to control by affecting blood flow regulation, forming a vicious cycle. At the same time, hyperglycemia can easily induce oxidative stress, activate inflammatory signaling pathways, promote the inflammatory response of vascular wall, and accelerate the onset of atherosclerosis. The high potassium (from fruits and vegetables) and low sodium (from low salt cooking) characteristics of the MD help reduce peripheral vascular resistance and assist in controlling blood pressure; Dietary fiber in whole grains can delay glucose absorption, improve insulin sensitivity, reduce the incidence of diabetes (risk factor of coronary heart disease), and thus reduce the incidence rate of coronary heart disease.

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3.4. Anti-inflammatory and antioxidant effects

Flavonoids and vitamin E in vegetables and fruits can inhibit the production of oxidized low-density lipoprotein (ox LDL) and alleviate endothelial inflammation; Nuts are rich in polyphenols such as flavonoids, tannins, phenolic acids, etc. Flavonoids have strong antioxidant properties and can eliminate free radicals in the human body, reducing oxidative stress reactions. Tannin (mainly in walnuts and almonds) can reduce the level of inflammatory markers such as C-reactive protein (CRP), inhibit inflammatory reaction and delay the process of atherosclerosis. High fiber foods in the MD (such as legumes and whole grains) can promote the proliferation of probiotics (such as bifidobacteria), reduce the entry of pro-inflammatory substances such as lipopolysaccharides (LPS) into the bloodstream, and lower the burden of chronic inflammation throughout the body. Epidemiological studies have shown a significant negative correlation between vitamin C levels in food and plasma and CVD. Vitamin C is water-soluble and the strongest antioxidant in the aqueous environment of organisms. It can eliminate free radicals, especially hydroxyl radicals, and promote the conversion of vitamin A, vitamin E, reduced glutathione (GSH), and methemoglobin from oxidized to reduced forms [6].

4. Clinical research evidence and meta-analysis conclusions

4.1. Prospective cohort study

ATTICA (2002-2022) conducted a study on adult participants who did not initially have CVD. In all evaluation stages (2002, 2006, 2012 and 2022), the incidence of CVD, type 2 diabetes, hypertension and hypercholesterolemia was evaluated according to WHO-ICD-10 standard, and the compliance of MD was evaluated through Med DietScore. PFP based on MD was calculated in different population groups. The results show that about 30% of CVDs, type 2 diabetes, hypertension and hypercholesterolemia cases can be prevented due to long-term high adherence to the MD [7].

4.2. Randomized Controlled Trials (RCTs)

A more recent RCT study is the CORDIOPREV study (a single center secondary prevention study targeting 1002 Spanish patients aged between 20 and 75 years). The patients were randomly assigned to receive Med Diet or low-fat diet intervention, with a follow-up period of 7 years. After multivariable adjustment for all known susceptibility factors for coronary heart disease, Med Diet reduced the risk by 18% ($P<0.024$). Three RCT studies have concluded a protective effect in secondary prevention, with one study showing a 70% reduction in cardiovascular events (Lyon Heart Study) and another study showing a 30% reduction (CARDIOPREV Study). The third study (PrediMED study) concluded that MACE was reduced by 30% in subjects with higher cardiovascular risk in terms of primary prevention [8].

4.3. Meta analysis support

Taylor et al. included 159 cohort studies from four databases in their analysis in 2023, which evaluated dietary quality and CVD outcomes. Among them, 17 studies evaluated the effect of the MD. Compared with the highest and lowest MD scores, the incidence rate of CVD was reduced by 15%. Karam et al. conducted a network meta-analysis comparing randomized controlled trials (RCTs) to evaluate the impact of seven popular structured diet plans on cardiovascular mortality and individual cardiovascular events (stroke, non fatal myocardial infarction, unplanned cardiovascular

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interventions) in patients at increased risk of CVD. Compared with minimal intervention, MD reduced cardiovascular mortality by 45%, stroke risk by 35%, and non fatal myocardial infarction risk by 52%. The remaining dietary plans showed little or no benefit compared to minimal intervention [9].

5. Practical suggestions and limitations

5.1. Clinical application

Patients with coronary heart disease can combine a MD with medication under the guidance of a nutritionist, with a focus on increasing olive oil intake (25-30g per day), consuming deep-sea fish twice a week, and reducing the intake of refined sugars, high sodium salts, and processed foods. This dietary pattern demonstrates significant value in the prevention and control of chronic diseases. In the management of CVD, high potassium fruits and vegetables can lower blood pressure and regulate unsaturated fatty acids, which can reduce the risk of disease in high-risk populations and provide postoperative patients with low inflammation and healing promoting nutritional support; In the management of diabetes, the low glycemic properties of whole grains and beans, and the improvement of insulin sensitivity of dietary fiber can cooperate with drugs to optimize blood sugar control and delay the progress of complications; In the intervention of cognitive impairment, antioxidants and Omega-3 fatty acids provide protection for nerve cells, which not only helps with primary prevention in high-risk populations, but also delays cognitive decline in patients through nutritional support. In the future, it is necessary to deepen the precision of clinical research, combine food engineering technology to expand application forms, promote the transformation of MD from theoretical evidence to practical clinical collaborative intervention plans, and provide sustainable dietary strategies for chronic disease prevention and health management.

5.2. Limitations

The traditional MD has some practical limitations. Its implementation often relies on fresh local ingredients, such as locally produced olive oil, fresh fruits and vegetables, and seafood. However, for regions with limited economic conditions or insufficient material supply, it may be difficult to adhere to such a dietary pattern in the long run. Moreover, its protective effect on coronary heart disease is not absolute and may be influenced by other factors, such as an individual's genetic background. Some people are born with different metabolic abilities for certain nutrients, which can also lead to differences in disease risk; There are also exercise habits in lifestyle. If one only focuses on diet but lacks regular exercise, the effect will be greatly reduced. So when referring to this dietary pattern, it is necessary to adjust it according to one's own actual situation.

6. Conclusion

In summary, the MD, as a dietary pattern centered on high plant-based foods, healthy fats, moderate protein intake, and alcohol titers, has shown significant potential in preventing and intervening in coronary heart disease. It reduces the risk of coronary heart disease through multiple biological mechanisms such as protecting endothelial function, regulating blood lipids, regulating blood pressure and blood sugar, and exerting anti-inflammatory and antioxidant effects. Many studies and analyses have confirmed that adhering to the MD can significantly reduce the incidence rate of CVDs. In clinical practice, the MD can be combined with drug therapy to provide dietary management support for patients with coronary heart disease and related chronic diseases, especially

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in regulating fat, controlling pressure, and improving metabolism, which has practical value. However, its promotion is limited by the dependence on fresh local ingredients and the influence of individual genetics, lifestyle, and other factors. The long-term intervention effect and precise mechanism of action still need to be further studied. In the future, further high-quality experimental research is needed to optimize dietary plans based on individual differences, promote the transformation of MD from theoretical evidence to scalable dietary intervention strategies, and provide a more solid scientific basis for the prevention and management of CVDs.

References

[1] Chen, H. (2022). Research status and development trends of cardiovascular diseases. In Proceedings of the China Medical Equipment Conference and 2022 Medical Equipment Exhibition (Vol. 1, pp. 101–102). Xinyu People's Hospital.
[2] Chen, X., & Li, L. (2014). Protective effects of the Mediterranean diet on cardiovascular diseases. Contemporary Nurse (Mid-Month Edition), (08), 1–4.
[3] Yu, J. (2024). Reasonable intake of dietary fiber to maintain intestinal health. Family Medicine & Happy Wellness, (05), 21.
[4] Wang, H. (2019). Preliminary exploration on the health activity of olive oil and its polyphenols. Fujian Tea, 41(04), 11–12.
[5] Diao, W. (2025). Dietary management for elderly patients with cardiovascular disease. China Food, (06), 72–74.
[6] Yavari, A., Javadi, M., Mirmiran, P., & Bahadoran, Z. (2015). Exercise-induced oxidative stress and dietary antioxidants. Asian journal of sports medicine, 6(1), e24898.
[7] Damigou, E., Anastasiou, C., Chrysohoou, C., Barkas, F., Tsioufis, C., Pitsavos, C., Liberopoulos, E., Sfikakis, P. P., & Panagiotakos, D. (2025). Prevented fractions of cardiovascular disease cases, by long-term adherence to the Mediterranean diet; the ATTICA study (2002–2022). Nutrition, Metabolism and Cardiovascular Diseases, 35(5), 103777.
[8] Delarue, J. (2025). Mediterranean diet and cardiovascular diseases: A 2024 update. Cahiers de Nutrition et de Diététique, 60(1), e1–e5.
[9] Mente, A., Dehghan, M., Rangarajan, S., O'Donnell, M., Hu, W., Dagenais, G., ... & Yusuf, S. (2023). Diet, cardiovascular disease, and mortality in 80 countries. European Heart Journal, 44(28), 2560–2579.