

NATURAL PREPARATIONS SUPPORTING THE TREATMENT OF CORONARY HEART DISEASE: A NARRATIVE REVIEW

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ABSTRACT

Coronary heart disease (CHD) is currently the most common cause of death in the world. Diet plays a significant role in the treatment of CHD. The purpose of this review is to present the current knowledge on natural products, including soybeans, garlic, black coffee, tea, and monounsaturated fatty acids, as well as components of the Mediterranean diet and Portfolio diet in supporting the treatment of CHD. A literature search was carried out in a scientific search engine database. Combinations of the following terms were used: “coronary heart disease”, “ischemic heart disease”, and “natural preparation of CHD”. Scientific publications were systematically examined to identify both direct and indirect evidence that met the aims of this review. Only articles that considered human subjects were included. After the selection process, a total of 28 articles were included in the review. The main findings were as follows: garlic ameliorates the function of the endothelium, blood pressure parameters, and lipid profiles. Coffee improves glucose metabolism and shows antioxidant and anti-inflammatory properties. Tea ameliorates the lipid profile. Monounsaturated fatty acids show antioxidant properties. The Mediterranean diet has antihypertensive and antioxidant properties and reduces inflammation. The Portfolio diet shows lipid-lowering and antioxidant properties. Diet in CHD is an extremely important factor supporting treatment and can significantly modify the parameters of cardiovascular risk. However, there is still a need for more research on the properties of natural products and their health effects.

KEYWORDS: coronary heart disease, prevention, natural preparations, diet

BACKGROUND

Ischemic heart disease (IHD) is a disease entity comprising eight subtypes according to the ICD-10 classification (International Statistical Classification of Diseases and Related Health Problems 10th Revision) defined as all states of myocardial ischemia regardless of the pathomechanism [1]. Coronary artery disease (CAD), which is one of the eight subtypes of IHD, is an abnormal process of plaque formation in the epicardial arteries that can constrict and close the vessels. CAD is divided into the following types: stable coronary syn-

dromes (chronic coronary disease), stable angina pectoris, microvascular angina, angina associated with the muscle bridges over the coronary arteries, vasospastic angina (synonym: Prinzmetal angina), and acute coronary syndromes (ACS). On the basis of the baseline electrocardiogram (ECG), ACS is further divided into ST-elevated myocardial infarction (STEMI) and non-ST-elevated myocardial infarction (NSTEMI). Based on the clinical picture, ECG and biochemical indicators of myocardial damage in ACS include unstable angina, NSTEMI, STEMI, unspecified myocardial infarction, and sudden cardiac death [2].

The most common pain symptoms related to cardiac ischemia are located in the chest in the area of the sternum, but can cover the entire area from the upper abdomen to the mandible, the space between the shoulder blades, and both upper limbs, including the wrists and fingers. They are usually depicted as a feeling of pressure, squeezing, weight, choking, burning, or tightening. Dyspnea or discomfort in the chest is common along with fatigue, pre-syncope, burning, anxiety, or the feeling of impending death [2].

Patients with stable CAD are those in whom symptoms are absent or controlled by medication or revascularization. Especially in this group of patients, treatment of comorbidities, including type 2 diabetes and hypertension, should be optimized to minimize cardiovascular risk. Beta blockers are drugs that significantly slow down the heartrate. It has been shown that the use of this group of drugs significantly prolongs the life of patients [3, 4]. Cholesterol-lowering drugs, including statins, along with antiplatelet drugs have been used for many years to reduce the incidence and severity of IHD [3].

Coronary heart disease (CHD) is currently the most common cause of death in the world. After the age of 75, the frequency of CHD diagnosis is comparable in both sexes. Epidemiological studies clearly indicate that the elimination of risk factors, such as alcohol abuse, smoking, unhealthy and irregular eating habits, stress, and lack of physical activity, significantly ameliorates the prevalence of CHD [1].

Diet plays an extremely important role in the treatment of IHD. Another important element is proper weight control, avoiding overweight and obesity. In order to properly control blood pressure, it is recommended that consumption of table salt is limited to 5 g per day (one teaspoon). A minimum amount of alcohol should be consumed. The traditional Mediterranean diet is considered to be the most effective diet for

patients with IHD. With the application of this diet, a patient’s lipid profile can be significantly improved [4, 5]. Natural preparations are secondary metabolites synthesized and used by organisms for defensive and adaptive purposes. [6, 7]. In common understanding, natural preparations are also various types of dietary supplements, the raw materials for which are obtained from the natural environment. Natural preparations are used as healing substances and are an important source of new therapeutic agents [6, 7].

Purpose of the analysis

The aim of the study is to present findings on the use of natural preparations and ingredients in the treatment of IHD.

MATERIALS AND METHODS

A literature search was carried out in a scientific search engine database (PubMed). The following terms were used in combination: “coronary heart diseases” and “soy bean” or “green tea” or “coffee” or “Mediterranean diet” or “Portfolio diet” or “garlic” or “monounsaturated fatty acids” or “natural products”.

Articles published in English since 2015 were included. Papers from earlier years were included if they contained key information unavailable elsewhere. Articles that presented both human and animal studies were included. Observational and intervention studies were included. Case reports were excluded.

In total, 10,027 titles were found in the PubMed database. After reading the headings, 9,803 abstracts were excluded. The remaining 224 articles were analyzed and 173 were excluded, leaving 51 articles (Fig. 1). All articles are public information available through the PubMed search engine.

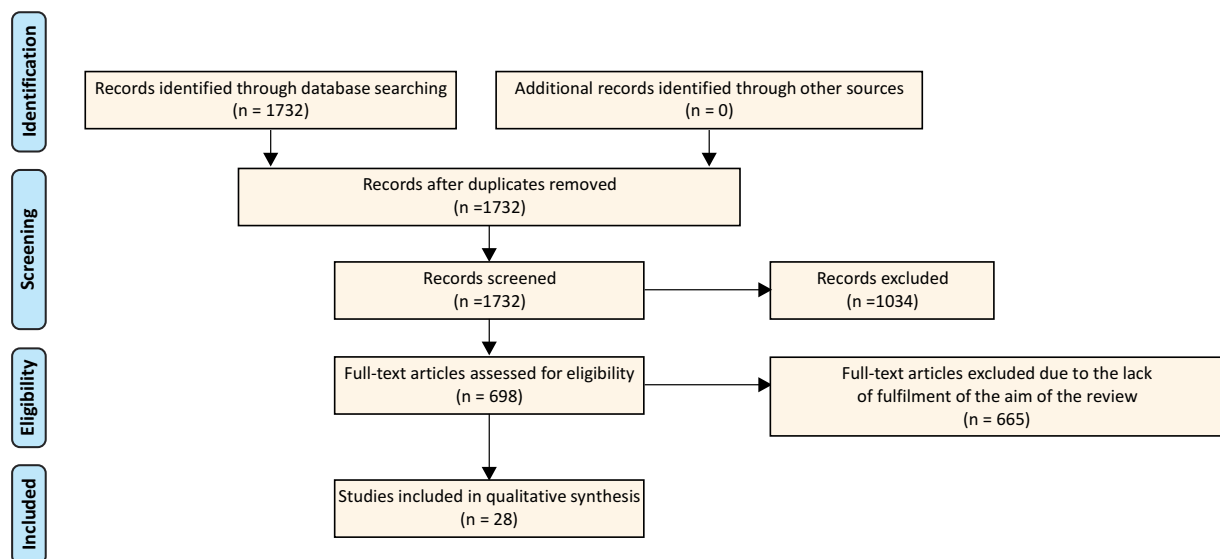


Figure 1. Flow chart of study selection

Natural preparations

Soy

Soybean (*Glycine max*) has been cultivated for almost 5,000 years on the Asian continent, first in China and then in Japan. It was introduced to Europe in the 18th century and to the United States of America (USA) in the 19th century. Currently, the USA is the leading producer of soybeans and supplies 30% of the world's production. Over the past decades, the popularity of soy products in North America has increased, especially after the US Food and Drug Administration (FDA) made a health claim that foods that contain soy protein minimize the risk of CHD. Soybean is a plant rich in high-quality proteins and low in saturated fatty acids. Epidemiological studies clearly show the preventative effects of soy consumption in chronic diseases such as obesity, cardiovascular diseases, insulin resistance, certain types of cancer, type 2 diabetes, and autoimmune disorders [8]. Proteins and related phytochemicals and isoflavones are responsible for the beneficial effects of soy on health. Over the past decade, studies have shown the health benefits of soy consumption. Many soy peptides that lower blood triglycerides and cholesterol and block lipid synthesis and storage have been identified. Soybean is a source of peptides that show a wide range of biological activities, such as antihypertensive, anti-cancer, antioxidant, anti-inflammatory, immunostimulatory, and neuromodulatory properties. These properties were proven in a study by Chatterjee et al. [8]. In a meta-analysis by Lou D. et al., it was found that the consumption of soy isoflavone was inversely proportional to the occurrence of stroke and CAD [9]. A study by Sathyapalan et al. showed that in postmenopausal women, the risk of cardiovascular diseases was reduced after using soy and soy isoflavones. Thanks to the use of these preparations, the risk of death due to cardiovascular diseases was reduced by as much as 42% and the probability of myocardial infarction was reduced by 37%. It was also shown that the risk of developing IHD was reduced by 27% in 10 years [10]. Studies are still needed to investigate the effects of soy in patients with IHD.

In summary, soybeans lower lipids, reduce triglyceride levels in the blood, and have anti-cancer, anti-inflammatory, antioxidant, immunostimulatory, and neuromodulatory effects.

Garlic

Garlic (*Allium sativum* L.) is a herb used in natural therapies [11]. It is also one of the most popular vegetables around the world and a frequently used spice in the Mediterranean and Asia. It is characterized by

the content of flavonoids and organic sulfur compounds [12]. However, the main active ingredient found in fresh and powdered garlic is alliin, an inactive biological precursor. The conversion of alliin to alliinase is influenced by the enzyme allinase, which is found in fresh garlic and dried garlic powder tablets. From tablets, allinase is released only after dissolving in the gastrointestinal tract. The authors of a randomized trial found that daily consumption of 800 mg of powdered garlic tablets improved the function of the vascular endothelium and lowered C reactive protein (CRP) levels in patients with elevated CRP and IHD after angioplasty [11]. Garlic preparations are also used to lower the concentration of total cholesterol (TC), but the decrease is clearly greater in people with hypercholesterolemia and the greatest benefit is recorded during the first three months of use. The effect of garlic on the high density lipoprotein cholesterol (HDL-cholesterol) fraction is insignificant. However, the consumption of garlic oil resulted in the most noticeable increase in the HDL-cholesterol fraction. The effect of garlic on the low density lipoprotein cholesterol (LDL-cholesterol) fraction is still debatable, and the level of triacylglycerols, in turn, significantly decreased in many studied groups in response to garlic intake. Garlic supplementation also influences the regulation of blood pressure – both systolic and diastolic blood pressure decreased significantly after the use of a garlic supplement [12]. Garlic is considered a safe substance. However, in the event of gastrointestinal problems due to intolerance, use of an odorless preparation is recommended [11]. Side effects of garlic supplementation are limited to bad breath, body odor, unpleasant taste, and allergic reactions (e.g., skin rash) and are very rare [12].

In summary, garlic improves vascular endothelial function and the lipid profile and regulates blood pressure parameters.

Black coffee

Coffee is a complex infusion containing over 1000 compounds, many of which are biologically active, including caffeine, a central nervous system stimulant and a bronchodilator drug; diterpenes, which can increase blood cholesterol levels; chlorogenic acid, which improves glucose metabolism; melanonidins, quinides, lignans, which show antioxidant and anti-inflammatory properties [14]. It is recommended to consume 2–3 cups of black coffee per day. In one meta-analysis analyzing studies on the risk of myocardial infarction, it was shown that consumption of > 4 cups of black coffee per day significantly increases the risk of myocardial infarction. Therefore, in patients with IHD, consumption of black coffee should not exceed 3 cups per day [15]. Coffee consumption – up to 6 cups

per day – has been shown not to be associated with an increased risk of developing high blood pressure. Caffeine is metabolized by cytochrome P450 1A2 (*CYP1A2*). People homozygous for the *CYP1A2*1A* allele metabolize caffeine rapidly while people with the *CYP1A2*1F* allele tend to metabolize caffeine slowly, so the latter group is more likely to develop hypertension and IHD with higher coffee consumption (especially >6 cups a day). An epidemiological study showed that coffee consumption may reduce the likelihood of obesity. Especially among people genetically predisposed to obesity, higher coffee consumption correlates with a lower body mass index [16]. Adverse effects on the lipid profile were observed in the presence of previous dyslipidemias or the consumption of unfiltered coffee, and in people who drink >6 cups of coffee per day. Unfiltered coffee contains the bioactive particle cafestol, which inhibits cholesterol 7- α -hydroxylase, which is involved in the synthesis of bile acids. Thus, this enzyme adversely affects the lipid profile. In contrast, filtered coffee does not have this effect, as the filter paper retains the oil drops containing diterpenes [15].

In summary, coffee consumption is associated with a lower risk of developing IHD [17]. Moreover, coffee has antioxidant and anti-inflammatory effects and improves glucose metabolism.

Tea

Black tea is one of the most consumed beverages in the world. Polyphenols, especially tea flavonoids, have an inhibitory effect on the oxidation reactions caused by free radicals and prevent or delay atherosclerosis. Flavonoids also have antithrombotic, anti-inflammatory, and endothelial protective properties. According to recent studies, chronic inflammation and oxidative stress play an important role in the pathogenesis of arterial hypertension [18]. In arterial hypertension, the production of various pro-inflammatory cytokines is increased, including interleukin-1 (IL-1), interleukin-17 (IL-17), interleukin-6 (IL-6), and tumor necrosis factor (TNF- α) [19]. CRP also indicates the presence of increased inflammation. Studies have shown a relationship between elevated CRP levels and blood pressure [20, 21]. Catechins are the most effective polyphenol compounds in green tea and constitute about 78% of the polyphenol fraction. They effectively eliminate free radicals and prevent atherosclerosis and arterial hypertension, thus preventing cardiovascular diseases [22]. Daily consumption of tea may be associated with a reduced risk of developing IHD [23]. A cohort study of healthy people showed that tea consumption slowed decline in HDL-cholesterol levels compared to people who did not drink tea. Mod-

erate consumption of tea during the day – around 2–3 cups – may be beneficial for the development of atherosclerosis and reducing heart failure, arrhythmia, and overall mortality [15]. A study by Li [24] showed that drinking 4 cups of green tea per day for 4 weeks significantly decreased CRP levels in a group of smokers, suggesting anti-inflammatory effects of catechins [25, 26]. The same researchers proved that epigallocatechin gallate (EGCG), which is contained in tea, inhibits CRP synthesis induced by angiotensin II and IL-6, and thus reduces the production of free oxygen radicals [24]. Ponteza et al. [27] demonstrated comparable antihypertensive effects of the pharmacological treatment enalapril and the consumption of green tea (4 g of green tea extract), which resulted in lower blood pressure in rats with essential hypertension. Green tea also has a beneficial effect on the lipid profile. A study by Stepien M et al. [28] showed that supplementation with green tea extract lowered both serum LDL cholesterol and total cholesterol.

In summary, tea has anticoagulant, anti-inflammatory, and antioxidant effects and improves the lipid profile.

Monounsaturated fatty acids and polyunsaturated fatty acids

Monounsaturated fatty acids (MUFA) contribute significantly to the improvement of the blood lipid profile in interventional studies. Omega-3 fatty acids, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), which are all present in fish oil, help prevent CHD. A lower omega-6 to omega-3 ratio is beneficial for avoiding inflammation in chronic diseases. A 4:1 ratio of omega-6 to omega-3 fatty acids in the diet reduces the mortality from IHD by 70%. A study conducted in the Dutch population showed that low levels of EPA and DHA consumption (40–150 mg/dl) are not important to avoid developing IHD [29]. Unlike polyunsaturated fatty acids (PUFA), MUFAs come from various plant and animal sources and have many beneficial health properties. A study by Zong G et al. found a beneficial relationship between MUFA consumption and the risk of CHD. The researchers noted a noticeably low risk of CHD in patients consuming a diet in which trans fats and refined carbohydrates were replaced with MUFAs. The beneficial effects of MUFA in the long-term prevention of CHD can be seen in patients whose primary source of MUFA is plant-derived products such as vegetable oils, nuts, and other related food products [30, 31].

In summary, monounsaturated fatty acids have anti-inflammatory and antioxidant effects and reduce the risk of CHD.

Components of the Mediterranean diet

The Mediterranean diet is widely recognized as one of the healthiest diets in the world. The definition of the Mediterranean diet was set by Ancel Keys. Studies on health effects of the Mediterranean diet began in the 1960s in Greece and southern Italy. Numerous scientific studies suggest that its use may lower the risk of developing various diseases such as cardiovascular diseases [32]. To date, it has not been established whether the individual components of the Mediterranean diet or the Mediterranean diet as a whole are supportive. The traditional Mediterranean diet is rich in fresh vegetables, olive oil monounsaturated fatty acids, whole grains, nuts, pulses, fish, and seafood with moderate alcohol consumption. The consumption of fish has positive effects on the lipid profile and blood coagulation process, has an antihypertensive effect, and reduces inflammation [33, 34]. Currently, it is recommended to eat fish 1–2 times per week or 40–60 g per day, especially in people at high risk of cardiovascular diseases. Fish should find a permanent place in the diet of this group of people, either as an independent product or as an integral part of the Mediterranean diet. Fish are characterized by a high concentration of omega-3 acids [33]. The consumption of olive oil increases the concentration of HDL-cholesterol. Due to the presence of phenolic compounds, it is an effective antioxidant. Olive oil also reduces systemic inflammation and improves endothelial function. Due to the abundance of vegetables and fruits, the Mediterranean diet has an antihypertensive effect. In addition, vegetables are a rich source of micronutrients and dietary fiber and have antioxidant properties. The American Heart Association (AHA) guidelines indicate that the consumption of whole grains rich in dietary fiber significantly improves the lipid profile and lowers blood pressure, thus reducing morbidity and mortality due to cardiovascular diseases. The AHA recommends that the diet should contain about 25–30 g of dietary fiber daily from various sources [33, 34]. Research shows the beneficial effects of consumption of whole grains on body mass index (BMI) and waist circumference. In addition, studies found significant improvement in CRP levels and lipid profiles in the group of people consuming whole grain carbohydrates for 12 weeks. Subsequently, a randomized clinical trial was conducted in a group of 230 patients. It has been hypothesized that carbohydrate products from whole oat grains result in significant improvement in blood pressure and lipid profiles [33].

In summary, the Mediterranean diet improves the lipid profile, blood coagulation, and vascular endothelial function and also has hypotensive, anti-inflammatory, and antioxidant effects.

Portfolio diet ingredients

The Portfolio diet is a nutritional benchmark created in the early 2000s as a “portfolio” of four food products that have been certified to reduce blood cholesterol levels by the US FDA, Health Canada, and the European Food Safety Authority. The 2000 kcal diet contains 42 g of nuts; 50 g of vegetable protein derived from legumes; 20 g of soluble fiber from oats, barley, psyllium, eggplant, oranges, okra, or apples; and 2 g of plant sterols. A variant of the Portfolio diet was tested in which MUFA monounsaturated fat was replaced with carbohydrates. Each ingredient has been shown to lower LDL cholesterol. Current evidence suggests that the Portfolio diet reduces the estimated 10-year risk of CHD [35].

In summary, the Portfolio diet lowers lipids and has an antioxidant effect.

Table 1. Postulated properties of selected dietary components

Dietary component	Properties	References
Soybeans	lipid-lowering, reduces the level of triglycerides in the blood, anti-cancer, anti-inflammatory, antioxidant, immunostimulating, neuromodulating	[8, 9, 10]
Garlic	improvement of vascular endothelial function, improvement of the lipid profile, regulation of blood pressure parameters	[11, 12]
Coffee	antioxidant, anti-inflammatory, improvement of glucose metabolism	[14, 15, 16, 17]
Tea	anticoagulant, anti-inflammatory, antioxidant, improvement of the lipid profile	[18, 20]
Monounsaturated fatty acids	anti-inflammatory, antioxidant, reduces the risk of CHD	[29, 30]

Table 2. Postulated properties of selected diets

Diet	Properties	References
Mediterranean diet	improvement of the lipid profile, improvement of the blood coagulation process, hypotensive, anti-inflammatory, antioxidant, improvement of vascular endothelial function	[33, 34]
Portfolio diet	lipid-lowering, antioxidant	[35]

CONCLUSIONS

CHD is a medical condition that requires diet therapy. There is ample evidence to suggest positive health effects from the consumption of natural products. Their regular intake is a factor that significantly modifies the parameters of cardiovascular risk. Soy has a lipid-lowering effect. It lowers the

level of triglycerides in the blood and has anti-cancer, anti-inflammatory, antioxidant, and immunostimulating properties. Garlic improves the functions of the vascular endothelium, improves the lipid profile, and improves blood pressure parameters. Coffee improves glucose metabolism and shows antioxidant and anti-inflammatory properties. Tea is characterized by anti-inflammatory and antioxidant properties and improves the lipid profile. Monounsaturated fatty acids have anti-inflammatory and

antioxidant properties and lower the risk of CHD. The Mediterranean diet improves the lipid profile and blood-clotting process; reduces inflammation; has antihypertensive, anti-inflammatory and antioxidant properties; and improves the functions of the vascular endothelium. The Portfolio diet shows lipid-lowering and antioxidant properties. However, there is still a need for more research on the properties of these dietary products and the health effects of their consumption.

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