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Review Article

# Nutraceutical: A Promising Era for Cardiovascular Disease Prevention and Treatment

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## Abstract

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide, with nearly 18–20 million deaths annually. Conventional pharmacological and surgical therapies have improved survival but are often associated with side effects, high costs, and limited long-term efficacy. Nutraceuticals—bioactive compounds derived from dietary sources such as omega-3 fatty acids, phytosterols, polyphenols, vitamins, probiotics, and herbal bioactives—have emerged as promising adjuncts for the prevention and management of CVD. These agents exert cardioprotective effects through diverse mechanisms, including lipid-lowering, antioxidant, anti-inflammatory, anti-thrombotic, and endothelial-protective pathways. Clinical trials such as GISSI-Prevenzione, REDUCE-IT, PREDIMED, and Q-SYMBIO provide strong evidence supporting the efficacy of specific nutraceuticals, particularly omega-3 fatty acids, plant sterols, Coenzyme Q10, and polyphenols, in reducing cardiovascular risk and improving outcomes in patients with heart disease. Furthermore, plant-based diets rich in fruits, vegetables, legumes, and whole grains—naturally enriched with nutraceuticals—demonstrate significant protective benefits against CVD progression. However, challenges remain regarding variability in supplement quality, bioavailability, and the need for standardized dosing. Future directions include integration of nutraceuticals into precision nutrition, exploration of gut microbiota interactions, and development of novel delivery systems to enhance clinical effectiveness. Overall, nutraceuticals represent a cost-effective, multi-targeted, and accessible strategy that complements conventional therapies, offering a promising era in the prevention and treatment of cardiovascular disease.

**Keywords:** Nutraceuticals; Cardiovascular disease; Omega-3 fatty acids; Polyphenols; Probiotics; Functional foods; Antioxidants; Precision nutrition.

## INTRODUCTION:

In recent years, cardiovascular diseases (CVDs) have affected millions of people globally and have emerged as one of the primary causes of illness and death in both developed and developing nations. CVDs broadly include disorders of the heart and blood vessels, such as stroke (cerebrovascular disease), heart attacks (coronary heart disease), high blood pressure (hypertension), rheumatic heart disease, heart failure, peripheral artery disease, and congenital heart defects[1].Age-related arterial dysfunction is a major physiological factor contributing to the onset of cardiovascular and cerebrovascular events in older adults[2]. Among the various types of arterial dysfunction, stiffening of the large elastic arteries - such as the aorta and carotid arteries — during midlife is especially predictive of cardiovascular and cerebrovascular incidents, as well as an increased risk of Alzheimer's disease and other dementias later in life. This arterial stiffening leads to significant consequences, including the development of high blood pressure (hypertension) and elevated pulsatile stress (increased blood flow pulsatility) on vital organs like the heart, brain, and kidneys[3-4]. Functional foods - foods that contain biologically active compounds offering health benefits beyond basic nutrition - have emerged as promising lifestyle interventions to lower cardiovascular risk. Similarly, nutraceuticals, which include bioactive nutrients and supplements, may positively influence cardiovascular risk factors[5]. This review examines the evidence supporting the use of key functional foods and nutraceuticals in preventing cardiovascular disease (CVD) and promoting heart health[6]. Prevention recommendations advocate diets high in fruits, vegetables, legumes, whole grains, and lean protein sources accompanied with a reduction or avoidance of processed foods, trans fats, and drinks with added sugar. The Dietary Approaches to Stop Hypertension (DASH), the Mediterranean, and plant-based diets have all been shown to be cardio protective to varied degrees and are recommended by professional healthcare societies; however, longer-term research is needed for other new diets like intermittent fasting and the ketogenic diet. Dietary influences on cardiovascular health and the gut microbiota have created a new avenue for precision medicine to enhance cardio metabolic risk factors[7].

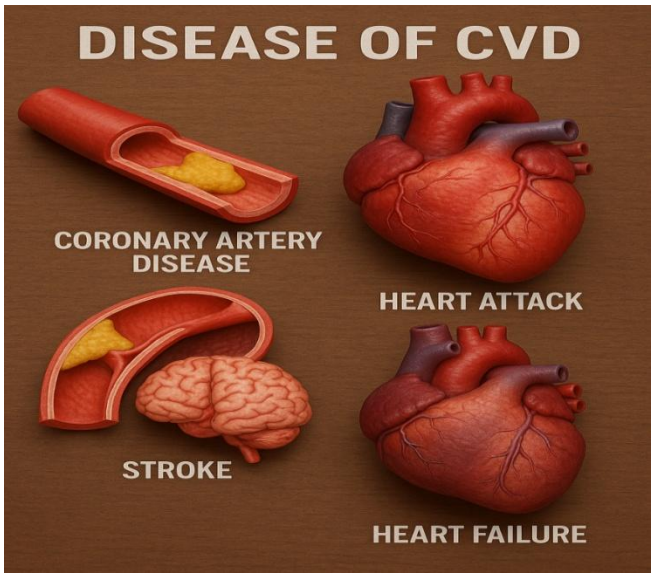


**Figure 1: Disease of CVD**

**Epidemiology of Cardiovascular Disease (CVD):**

**Global Burden:**

CVD remains the **leading cause of mortality worldwide**, responsible for about **17.9–20 million deaths annually**, representing roughly **one-third of all global deaths**.

Over **80% of CVD deaths occur in low- and middle-income countries (LMICs)**, highlighting inequalities in prevention and care.

Women, particularly in low- and middle-income regions, continue to experience a rising burden of CVD, with over **53 million cases in women aged 15–49 by 2019**, and trends continuing upward post-pandemic.

**United States:**

The **COVID-19 pandemic (2020–2022)** led to a significant increase in CVD mortality in the U.S.

Age-adjusted mortality rate for CVD rose to **451.8 per 100,000 in 2021**, declining slightly to **434.6 per 100,000 in 2022**, yet still higher than pre-pandemic levels.

Excess CVD deaths during the pandemic period (2020–2022) were estimated at ~190,000.

Statin and antihypertensive medication use increased slightly during this period, yet mortality from coronary heart disease and stroke also rose.

**Regional Disparities:**

In **China**, CVD mortality—especially ischemic heart disease—has risen faster in rural areas than urban areas. Rural mortality rates doubled over three decades.

In **India**, the prevalence of self-reported CVD in adults ≥45 years is about **5.2%**, with higher rates in men and in urban populations. Risk factors such as hypertension (~47%), diabetes (~12%), obesity, and smoking are prevalent.

**Risk Factors:**

Major modifiable risk factors include **hypertension, high LDL/non-HDL cholesterol, diabetes, smoking, physical inactivity, poor diet, and air pollution.**

The Global Burden of Disease (GBD) 2020–2022 estimates ~64% of CVD burden and ~69% of CVD deaths are attributable to these modifiable risk factors[8-14].

## NUTRACEUTICAL:

The term *nutraceuticals* is derived from the word *nutrition*. It was coined in 1989 by Stephen De Felice, the founder and chairman of the Foundation for Innovation in Medicine in Cranford, New Jersey, by blending the words *nutrition* and *pharmaceutical*. According to De Felice, a nutraceutical is a food or dietary component that offers therapeutic or health-enhancing effects which treat and prevent the disease[15]. The terms "nutrition" and "pharmaceutical" are combined to form the phrase "nutraceuticals," which describes foods or food extracts that have health and/or medical advantages, such as illness prevention and therapy[16]. The anti-inflammatory and antioxidant qualities of nutraceuticals contribute significantly to their positive effects, indicating that they may be used as a treatment to lessen arterial stiffness in the elderly[17]. It has been demonstrated that a variety of nutraceuticals have important roles in immune function and vulnerability to specific disease states. A number of oxidative stress-related ailments, such as allergies, Alzheimer's disease, cardiovascular disorders, cancer, and eye disorders, Parkinson's diseases, and obesity, can also be treated using nutraceuticals[18]. A wide word used to refer to any product made from food sources that offers additional health advantages beyond the fundamental nutritional worth of foods is "nutritraceuticals".The source usually determines how nutraceuticals and related items are defined. The pharmacological circumstances, chemical composition, and natural sources of these items may all be used to define their classification. The four main categories into which nutraceuticals fall are dietary supplements, functional foods, medicinal food, and pharmaceuticals[19].

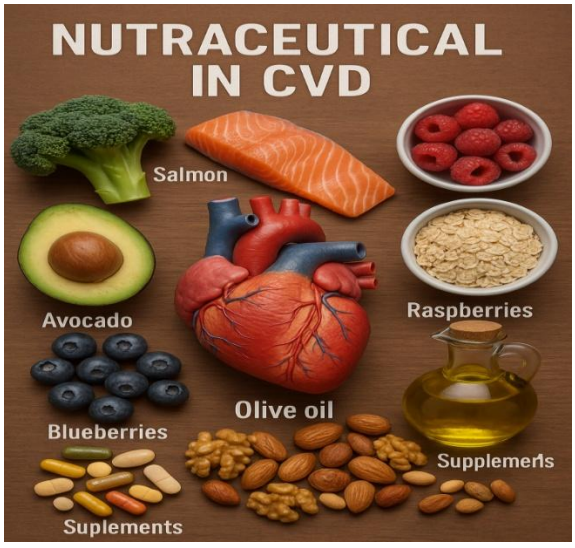


**Figure 2: Nutraceuticals in CVD**

The following factors may contribute to the propensity for nutraceuticals[20-24]:

- The rising expenses of healthcare are causing concern for a growing number of people.
- People who are unhappy with the way pharmaceutical medicines have improved their health are turning to nutraceuticals to help them stay healthy and prevent chronic illnesses.
- Medical professionals understand that the highly processed food we consume, which is grown with chemical pesticides, fertilizers, herbicides, and sometimes genetically modified seeds, is deficient in nutrients for good health.
- A population inclined more toward illness prevention than therapy.
- People suffering from chronic illnesses who have not sought relief from them through allopathic remedies.
- Individuals looking for more affordable medical treatments who are limited by their financial means.

## ROLE OF NUTRACEUTICALS IN CVD:

**Table 1: (Role of Nutraceuticals)**

| Nutraceutical | Source | Role in CVD |
|---|---|---|
| **Omega-3 fatty acids** | Fish oil, flaxseed, chia seeds, walnuts | Reduce triglycerides, lower inflammation, improve endothelial function, reduce arrhythmias |
| **Phytosterols & stanols** | Fortified spreads, nuts, seeds, vegetable oils | Lower LDL-cholesterol by competing with cholesterol absorption |
| **Coenzyme Q10 (CoQ10)** | Organ meats, supplements | Improves endothelial function, reduces oxidative stress, may lower BP |
| **Polyphenols (Flavonoids, Resveratrol)** | Red wine (resveratrol), cocoa, berries, green tea | Antioxidant And Anti-inflammatory, improve vascular health |
| **Garlic (Allicin)** | Garlic bulbs, supplements | Lowers BP, modestly reduces cholesterol & platelet aggregation |
| **Vitamin D** | Sunlight, fatty fish, fortified milk, supplements | Associated with lower BP, reduced inflammation (though evidence is mixed) |
| **Probiotics** | Yogurt, supplements | May improve lipid profiles, lower BP, and reduce inflammation |
| **Curcumin** | Turmeric | Anti-inflammatory, antioxidant, may reduce arterial stiffness |

**Polyunsaturated fatty acids:**

Polyunsaturated fatty acids are vital to bodily functions and are obtained externally through diet; they are also known as essential fatty acids[25]. Polyunsaturated fatty acids can be divided into two categories:

a. Fatty acids with omega-3 (n-3)

b. Fatty acids that are omega-6-(n-6)

The three main omega-3 fatty acids are docosahexanoic acid (DHA), eicosapentanoic acid (EPA), and alpha-linolenic acid (ALA). The precursors of docosahexanoic acid and eicosapentanoic acid are alpha-linolenic acid. The primary sources of eicosapentanoic acid and docosahexanoic acid are fish oils and fatty fish like salmon, herring, trout, blue fin tuna, and mackerel. Flaxseed, canola, soybeans, some nuts (including walnuts), and red or black current seeds are sources of alpha-linolenic acid.The primary components of omega-6-polyunsaturated fatty acids are arachidonic acid, gamma linolenic acid, and linolenic acid. The primary source of linolenic acid is vegetable oils, such as those found in corn, sunflower, safflower, and soy. Meat, poultry, and eggs are examples of animal products that contain arachidonic acid.

According to studies, omega-3 fatty acids have three main effects on cardiovascular diseases: they are hypolipidemic (they help lower the concentration of lipids in the serum), antithrombotic (they reduce arteriosclerosis), and antiarrhythmic (they prevent and increase irregularities in the force or rhythm of the heart)[26].

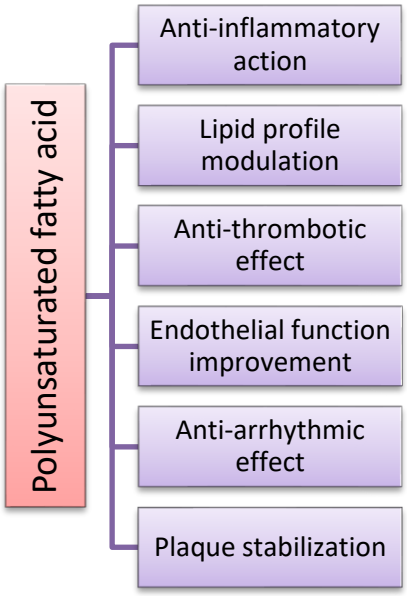


**Figure 3: Activities of PUFAs**

**Probiotics:**

Probiotics have a long history that began more than 2,000 years ago with the first consumption of fermented milk. The work of Metchinkoff (1907) to convert the large intestine's flora into a host-friendly colony of Bacillus bulgaricus increased scientific interest in this field[27].A probiotic is a type of live microbial feed additive that, when given in sufficient quantities, improves the intestinal microbial balance of the host animal[28]. Probiotics come in a variety of forms, including liquid, gel, paste, granules, powder, and more. Certain probiotics are typically used to treat gastrointestinal disorders include severe diarrhoea, lactose intolerance, and gastrointestinal side effects linked to antibiotics[29]. Probiotics are non-toxic, non-pathogenic, resistant to stomach acid, and cling to the tissues of the gut epithelium to produce antibacterial compounds. There is proof that taking probiotics lowers the chance of developing chronic illnesses like cancer, allergies, asthma, and numerous other illnesses as well as urinary tract and ear infections[30].

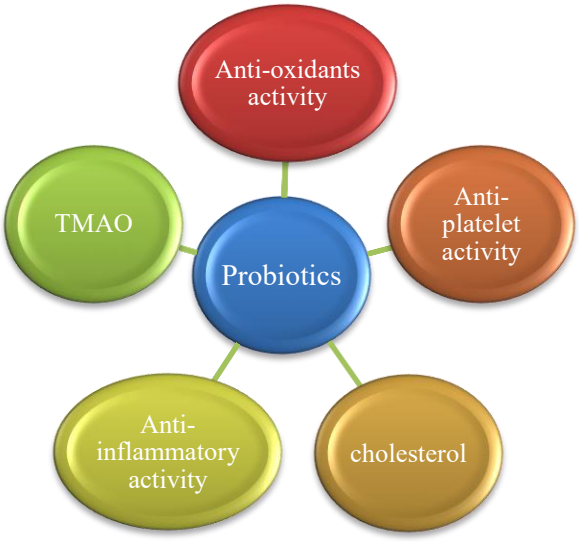


**Figure 4: Activities of Probiotic**

**Curcuma longa:**

The yellow pigment found in turmeric, curcumin, possesses hepatoprotective, anti-inflammatory, anticarcinogenic, and antioxidant properties. The majority of curcumin's liver-protective properties are associated with its antioxidant properties[31].The turmeric (Curcuma longa) rhizome is a readily available source of curcumin (diferuloylmethane), a polyphenolic category of nutraceuticals. Chinese and Indian cultures have long utilized turmeric as a traditional remedy. Because of its possible therapeutic benefits, curcumin has recently drawn the attention of experts. In addition to its well-known anticancer, antioxidant, hypoglycemic, wound-healing, anti-inflammatory, antiviral, and anti-infectious qualities, this extremely pleiotropic chemical is still being studied[32-34]. By binding to target receptors implicated in virus infection mechanisms such as spike glycoprotein-RBD, PD-ACE2, and SARS-CoV-2 protease, curcumin prevents virus entrance and budding, as shown by the molecular docking approach[35].

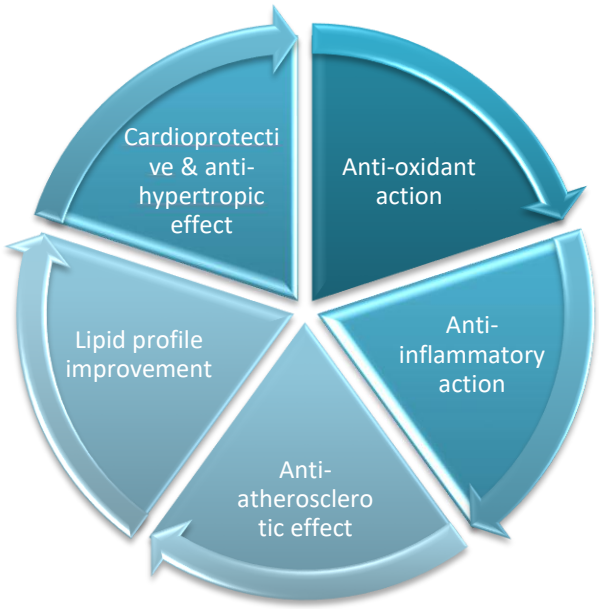


**Figure 5: Activities of Turmeric**

**Vitamins:**

A higher risk of chronic illnesses like cardiovascular disease, osteoporosis, and childhood rickets has all been connected to vitamin D supplementation[36]. In order to maximize therapeutic approaches, it is crucial to comprehend how vitamins and drugs interact. In order to maintain good health and prevent chronic diseases, it is crucial to make sure that one consumes enough of these vitamins through a balanced diet full of fruits, vegetables, whole grains, lean meats, and healthy fats. Vitamins have pharmacological benefits that include supporting immune function, energy metabolism, antioxidant protection, bone health, and vision through a variety of phytoconstituents found in fruits, vegetables, whole grains, meats, and dairy products[37].

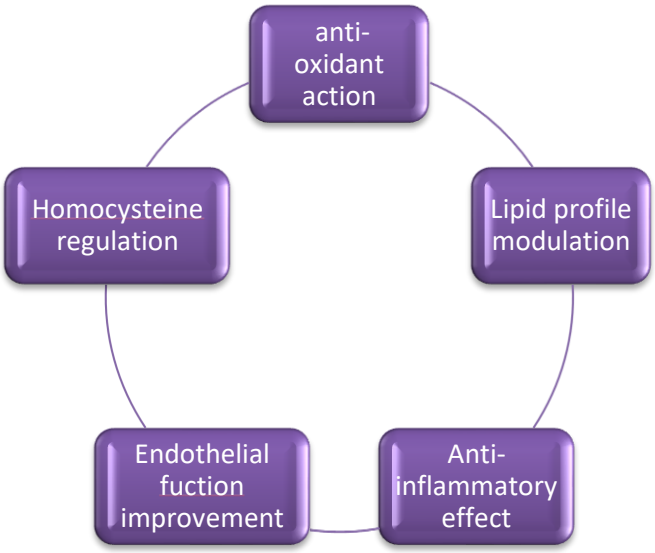


**Figure 6: Activities of Vitamins**

## BENEFITS OF NUTRACEUTICALS:

In recent years, nutraceuticals have gained a lot of popularity. In addition to medications, they are used as additional or alternative treatments to help prevent and treat a variety of illnesses. Nutraceuticals can have a significant impact on the body's numerous biological functions, preventing diseases and enhancing general health and wellness. Numerous nutraceuticals have been demonstrated to play important roles in immune function and vulnerability to specific disease states. Additionally, oxidative stress-related disease-modifying indications for nutraceuticals include cancer, Alzheimer's disease, cardiovascular disorders, allergies, eye disorders, Parkinson's diseases, and obesity[38].

## TYPES OF NUTRACEUTICALS:

- Dietary supplements
- Functional Food

**Dietary supplements:**

Products that contain concentrated bioactive elements from food sources that have been processed into an appropriate dose form are known as dietary supplements. A variety of substances, including vitamins, minerals, essential metabolites, herbs and other botanicals, amino acids, and specific enzymes, may be included in these supplements. Dietary supplements come in a variety of forms, including beverages, candies, energy bars, tablets, capsules, and powders[39].

**Figure 7: Dietary Tablets**

**Figure 8: Dietary beverages**

**Functional Food:**

Foods or substances that offer health benefits beyond basic nourishment are referred to as functional foods. This group of foods comprises complete foods as well as fortified, enriched, or enhanced foods that, when routinely ingested as part of a diverse diet, can promote health. Functional food and is available as pasta, cereal, whole grains, yogurt, snacks and more[40].

Functional foods include:

- Traditional Functional Foods: These are natural, nutrient-dense foods that offer health advantages beyond simple nourishment, such lycopene in tomatoes and omega-3 fatty acids in salmon.
- Non-Traditional Functional Foods: Bioactive ingredients are added to artificial foods to improve health and wellbeing. Examples include iron-enriched cereal, wheat with extra folic acid, and fortified nutritional products like juice with added calcium. Recombinant nutraceuticals, or foods that produce energy through biotechnology, such as bread, yogurt, cheese, and vinegar, can also be considered modified functional food.

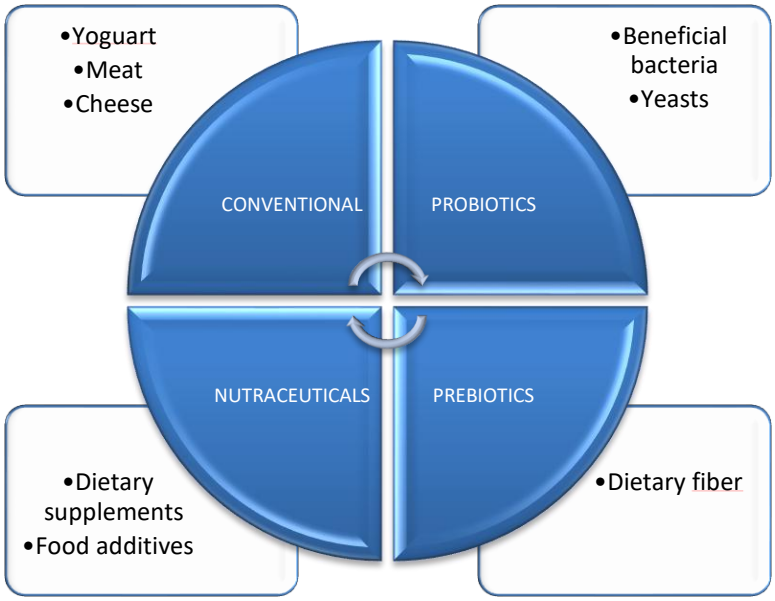


**Figure 9: Functional Food**

**Figure 10: Example of Functional food**

**Herbal-based bioactive agents:**

The term "herbal bioactive ingredients" describes the naturally occurring substances that may have health benefits that are present in herbs and plant-based goods.These ingredients are recognized to have therapeutic qualities and can be very helpful in both preventing and curing a number of illnesses. Over time, therapeutic plants and herbs have attracted a lot of attention because of their wide range of flavors and scents, which make them useful complements to the fields of medicine and cooking[41]. The nutraceutical industry relies heavily on herbal bioactive components, which include compounds such as carotenoids, coumarins, favonoids, lignans, phthalides, plant sterols, polyphenols, saponins, sulphides, and terpenoids.These ingredients have a dual function in raising quality of life since they not only improve our food preparations but also act as powerful agents to promote health and fend off illnesses[42]. These bioactive compounds can be classified into two categories based on their sources: those obtained from herbs and those present in dietary supplements (Table 2).

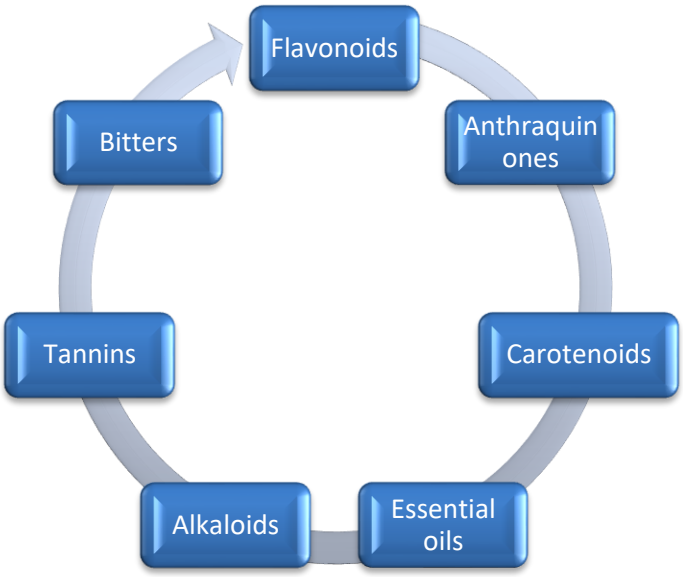


**Figure 11: Herbal-based bioactive ingredients**

**Table 2: (Herbal bioactive ingredients with dietary supplements)**

| Herbal bioactive ingredients | Dietary supplements |
|---|---|
| **Anthraquinones** | Carbohydrates |
| **Bitters** | Prebiotics |
| **Tannins** | Lipids |
| **Alkaloids** | Proteins |
| **Carotenoids** | Vitamins |
| **Essential oil** | Mushroom |
| **Flavonoids** | Probiotics |

**Flavonoids:**

Alkaloids are a unique class of substances that play essential roles in the biological processes of many different organisms, including microbes, plants, and mammals.These substances, which are classified as nitrogen-containing heterocyclic chemical molecules, have numerous uses in disciplines like pharmacology, medicine, and ecology[43].The pharmaceutical industry has largely accepted them as powerful therapeutic agents due to their substantial physiological effects at the cellular and molecular levels [44]. Despite their advantages, alkaloids are known to dissolve in organic solvents and can occasionally be exceedingly poisonous, even in very little doses[45].Flavonols, flavones, flavanones, isoflavones, flavon-3-ols (sometimes called catechins), and anthocyanins are some of the subclasses of flavonoids. These substances are widely present in tea, red wine, fruits, vegetables, and a variety of herbs. They add to the colour and flavour of these meals as well as their health-promoting qualities. Numerous types of flavonoids exist, each with unique biological structures and functions. One well-known flavanol with anti-inflammatory and antioxidant qualities is quercetin, which is present in apples, berries, and onions[46].

**Figure 12: Cocoa beans**

**Tannins:**

The main characteristics of tannins, which are complex substances, are their phenolic and polyphenolic structures. These chemical components give them the special capacity to function as astringents in the human body, producing tissue constriction and the constricting of structural proteins in the skin and mucosa.However, their function goes beyond this harsh characteristic. They are essential for the body's proactive defense against many forms of oxidative damage.As strong antioxidants that support the preservation of the body's health, they effectively stop lipid peroxidation, a process that can cause cell damage, and aid in the neutralization of superoxides and other free radicals[47- 48].

**Figure 13: Coffee seeds**

**Prebiotics:**

Prebiotics are indigestible food ingredients that improve health by promoting good bacteria in the gut. These substrates, which were first presented by Glenn Gibson and Marcel Roberfroid in 1995, are beneficial to health because host bacteria selectively use them[49]. Prebiotics are compounds that improve general gut health and immune function in addition to encouraging the growth of good gut bacteria like lactobacilli and bifidobacteria. Inulin, fructosaccharides (FOSs), galactosaccharides (GOSs), resistant starch, and pectin are examples of prebiotic phytoconstituents[50]. Short-chain fatty acids, such as butyrate, propionate, and acetate, are produced when gut microbial fermentation is aided by phytoconstituents. These SCFAs are essential for preserving the integrity of the intestinal barrier, supplying energy, controlling inflammation, and preserving colon health. Numerous pharmacological actions of prebiotics greatly enhance human health.Numerous pharmacological actions of prebiotics greatly enhance human health. By encouraging a balanced microbiota, preventing the growth of harmful bacteria, enhancing digestion, and lowering the incidence of gastrointestinal illnesses, they improve gut health[51].

**Figure 14: Fructosaccharides(FOSs)**

**Figure 15: Coconut oil**

**Fatty Acid:**

Essential lipids known as fatty acids have important pharmacological properties and are involved in many biological processes. The most significant of these are omega-3 and omega-6 fatty acids, which fall under the categories of saturated, monosaturated, and polyunsaturated fatty acids (PUFAs)[52]. In addition to having therapeutic qualities that support health and fend against illness, these fatty acids are necessary for preserving cellular structure and function. The anti-inflammatory properties of omega-3 fatty acids, in particular ALA, EP, and DHA, have been thoroughly investigated. By controlling the synthesis of eicosanoids, which can lower the synthesis of pro-inflammatory mediators and so lessen the symptoms of chronic inflammatory diseases such arthritis and cardiovascular disorders, they control inflammatory processes[53].

**Figure 16: Chicory roots**

## NUTRITIOUS FRUITS THAT GUARD AGAINST CVD:

Fruits and other plant-based foods have so far shown promise in the prevention and of CVDs[54]. Clinical research and observational studies have demonstrated that eating fruit reduces the incidence of CVDs, a finding that is partly due to the presence of bioactive chemicals. Twelve Additionally, Willett claimed that a proper diet that included more plant-based foods was crucial in reducing heart disease and other chronic illnesses. A good diet has been shown to maintain human health[55].Some fruits and their roles given in (table.3) below:

**Table 3: (Role of Nutraceutical Fruits)**

| S.NO. | Fruit | Bioactive Compounds | Role in CVD |
|---|---|---|---|
| 1 | **Berries** (e.g.,blueberries, strawberries, blackberries) | Anthocyanins, flavonoids, polyphenols | Improve endothelial function, reduce blood pressure, lower LDL, and enhance antioxidant status. |
| 2 | **Pomegranate** | Punicalagins, ellagic acid, polyphenols | Reduce arterial stiffness, improve lipid profile, and decrease oxidative stress and inflammation. |
| 3 | **Citrus fruits** (e.g., oranges, lemons, grapefruits) | Vitamin C, hesperidin, naringenin | Lower blood pressure, improves endothelial function, and reduces cholesterol. |
| 4 | **Apples** | Quercetin, fiber (pectin), polyphenols | Reduce LDL cholesterol, improve vascular health, and decrease inflammation. |

| | | | |
|---|---|---|---|
| **5** | **Grapes** (especially red/purple) | Resveratrol, flavonoids, polyphenols | Improve HDL cholesterol, inhibit platelet aggregation, and protect against oxidative stress. |
| **6** | **Avocado** | Monounsaturated fats, phytosterols, fiber | Lower LDL & triglycerides, increase HDL, and reduce inflammation. |
| **7** | **Tomatoes** (botanically a fruit) | Lycopene, beta-carotene, vitamin C | Control Blood pressure, and improve vascular function. |

**Figure 17: Nutritious Fruits**

## VARIOUS DISEASE OF CARDIOVASCULAR DISEASE:

A collection of illnesses that impact your heart and blood vessels is known as cardiovascular disease. Your heart and/or blood vessels may be affected in one or more areas by these conditions[56].Some disease of CVD are described in (table: 4) below:

**Table 4: Diseases of CVD with their description and symptoms**

| S.NO. | Disease | Description | Symptoms |
|---|---|---|---|
| **1** | **Coronary Artery Disease (CAD)** | Narrowing or blockage of coronary arteries, usually due to atherosclerosis. | Chest pain (angina), shortness of breath, heart attack. |
| **2** | **Stroke** | Reduced blood supply to the brain (ischemic or hemorrhagic). | Weakness, paralysis, difficulty speaking, vision problems. |
| **3** | **Peripheral Artery Disease (PAD)** | Narrowing of arteries in limbs, usually the legs. | Leg pain when walking (claudication), sores, numbness. |
| **4** | **Congenital Heart Disease** | Structural heart defects present at birth. | Cyanosis (blue skin), poor growth, fatigue. |
| **5** | **Heart Failure (HF)** | Narrowing of arteries in limbs, usually the legs. | Fatigue, fluid retention, shortness of breath, swelling. |
| **6** | **Hypertensive Heart Disease** | Damage to the heart due to high blood pressure over time. | Often asymptomatic initially, may lead to HF or CAD. |
| **7** | **Arrhythmias** | Abnormal heart rhythm (too fast, too slow, or irregular). | Palpitations, dizziness, fainting. |

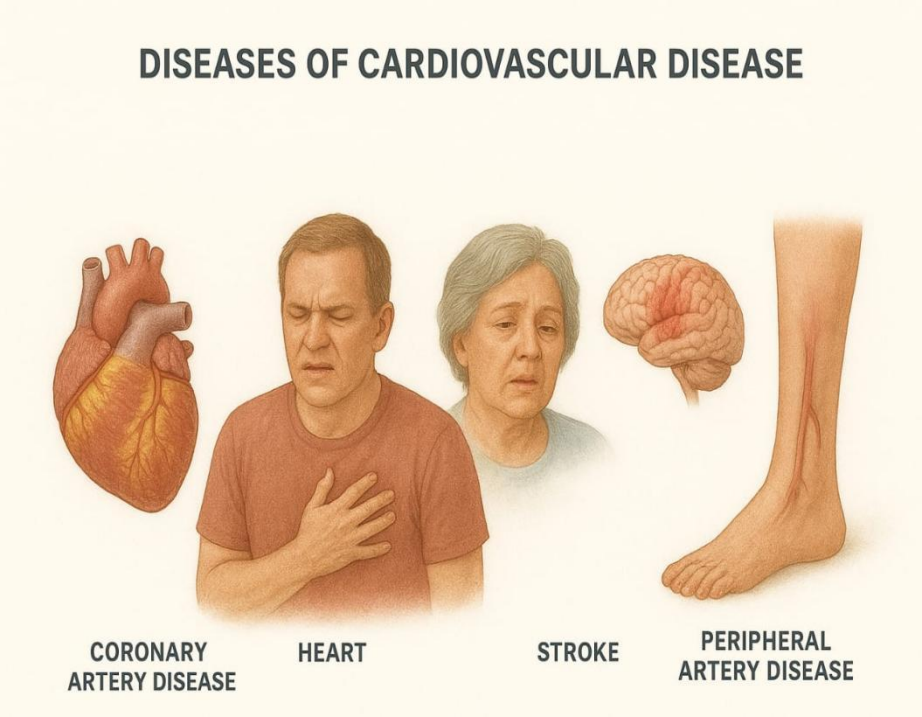


**Figure 18: Various Diseases of CVD**

**Reasons and Risk Factors of CVD:**

Heart failure and myocardial infarction are linked to between one-third and one-fifth of cases of cardiovascular disease (CVD). Smoking, stress, and conditions including diabetes, atherosclerosis, and hypertension are a few risk factors for CVDs. Because current medications for CVDs have adverse effects, using herbal medicines is being studied because they are less expensive and have less side effects. Herbal remedies offer anti-inflammatory, immune-regulating, and antioxidant qualities that help prevent CVDs[57].Some risk factors of CVD are as (table:5).

**Table 5: Risk factor of CVD**

| S.NO. | Reason/Risk Factor | Explanation |
|---|---|---|
| 1 | **Smoking** | Damages blood vessels and increases clot risk. |
| 2 | **Alcohol** | Raises blood pressure and damages the heart muscle. |
| 3 | **High blood pressure (hypertension)** | Puts extra strain on heart and arteries. |
| 4 | **High cholesterol** | Contributes to plaque buildup in arteries. |
| 5 | **Obesity and overweight** | increases strain on the heart and leads to other risk factors. |
| 6 | **Diabetes** | Damages blood vessels and nerves controlling the heart. |
| 7 | **Unhealthy Diet** | High in saturated fats, trans fats, salt, and sugar. |
| 8 | **Family history** | Genetic predisposition to heart disease. |
| 9 | **Age** | Risk increases with age. |
| 10 | **Stress** | Raise your heart rate, increase blood pressure. |

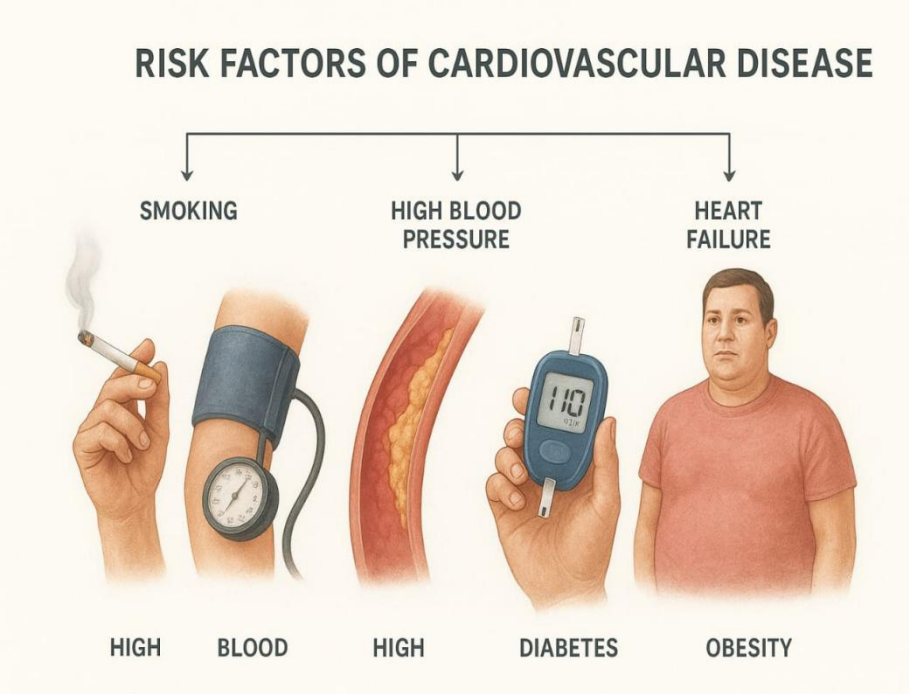


**Figure 19: Risk factors of CVD**

## CLINICAL EVIDENCE:

Nutraceuticals have emerged as promising adjuncts in the prevention and treatment of cardiovascular diseases (CVD) owing to their bioactive properties that target multiple cardiovascular risk factors. Clinical trials provide substantial evidence for their efficacy in improving lipid profiles, endothelial function, oxidative stress, and inflammation, which are key mechanisms in CVD pathogenesis. Omega-3 fatty acids have demonstrated significant benefits, reducing triglyceride levels, cardiovascular mortality, and major adverse cardiovascular events, as evidenced by the GISSI-Prevenzione and REDUCE-IT trials. Plant sterols and stanols lower LDL-cholesterol by approximately 7–10%, thereby contributing to CVD risk reduction. Coenzyme Q10, as shown in the Q-SYMBIO trial, improves symptoms and outcomes in patients with chronic heart failure. Dietary fibre has been associated with reductions in LDL-cholesterol and improved glycaemic control, while polyphenols, highlighted in the PREDIMED study, enhance vascular health and reduce cardiovascular events through antioxidant and anti-inflammatory effects. Additionally, L-carnitine has demonstrated reductions in mortality and arrhythmias in post-myocardial infarction patients, and garlic supplementation has shown modest benefits in lowering blood pressure and cholesterol levels. These findings suggest that nutraceuticals, as part of a comprehensive lifestyle and therapeutic approach, may play a supportive role in the management and prevention of CVD. However, further large-scale, long-term trials are warranted to establish optimal doses and confirm their clinical benefits.

## CONCLUSION:

Nutraceuticals have emerged as valuable adjuncts in the prevention and management of cardiovascular diseases by targeting multiple risk factors through their antioxidant, anti-inflammatory, lipid-lowering, and endothelial-protective properties. Evidence from clinical and epidemiological studies supports the beneficial roles of omega-3 fatty acids, polyphenols, plant sterols, Coenzyme Q10, vitamins, probiotics, and herbal bioactive in reducing cardiovascular morbidity and mortality. Incorporation of nutraceuticals, particularly when combined with balanced dietary patterns such as the Mediterranean or DASH diets, provides a safe, cost-effective, and holistic approach to cardiovascular health. However, challenges remain, including limited bioavailability, variability in product quality, and the lack of universal guidelines for standardized dosing. Future research should focus on large-scale, long-term clinical trials, precision nutrition strategies, and advanced delivery systems to optimize their therapeutic potential. Overall, nutraceuticals represent a promising era in cardiovascular prevention and treatment, complementing conventional therapies while empowering individuals toward healthier lifestyles and improved quality of life.

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