



# **NOVEL FOOD: A STRATEGY TO REDUCE CARDIOVASCULAR DISEASE**

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## **ABSTRACT**

Cardiovascular diseases (CVDs) such as coronary artery disease, arrhythmias, angina pectoris and hypertension have become a major health problem throughout the world. The major modifiable risk factors of developing CVDs are unhealthy diet, physical inactivity, smoking, hyperlipidaemia, obesity and high intake of alcohol. The role of diet in the etiology of most CVDs is extremely important. The industrial revolution in the last few decades has introduced radical changes in methods of food production, processing, storage and distribution. Economic developments together with recent technological innovations and modern marketing techniques have further modified dietary preferences. Current scientific evidences increasingly support the notion that novel foods have many potential health benefits. Novel foods are traditional foods with newly defined significances on humans. This article focuses on role of novel foods in cardiovascular disease prevention and health promotion.

**Key words:** Cardiovascular, Food

## **INTRODUCTION**

### **Cardiovascular diseases**

It has been predicted that CVDs will be the most widespread cause of death in India by 2015. Millions of people in the world have coronary artery disease (CAD). It is the number one killer of both men and women<sup>1</sup>. CAD is caused by thickening and hardening of inner walls of coronary arteries (arteriosclerosis). The arteries harden and become narrow due to buildup of plaques on the inner walls, which decreases oxygen supply to the heart muscle<sup>2</sup>. Major risk factors for developing coronary atherosclerosis are sedentary life style, hypertension, obesity, high blood total cholesterol, elevated low density lipoprotein (LDL) cholesterol, low levels of high density lipoprotein (HDL) cholesterol and diabetes mellitus<sup>3</sup>. Research has consistently shown that adequate HDL

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cholesterol (“good cholesterol”) level have a beneficial effect on heart. HDL cholesterol has been shown to reverse some of the harmful effects of LDL cholesterol (“Bad cholesterol”). Triglyceride is another type of lipid circulating in the blood. Triglyceride can deposit themselves along the walls of arteries and veins, forming a thick plaque, which is referred to as atherosclerosis<sup>4</sup>. Epidemiological transition, with increasing life expectancy and demographic shifts in population increase the degree of exposure to CVD risk factors. The shift towards high saturated fat diet, refined food, smoking, meat and dairy products (nutrition transition) are associated with an increased risk of CVDs<sup>5</sup>. To achieve the goal of preventing CVD, it is important to avoid the occurrence of these major risk factors. People with elevated cholesterol levels are much more likely to have atherosclerosis than people with low cholesterol levels. Eating a healthy balanced diet is beneficial to prevent various health complications including CVD<sup>6</sup>. There is now overwhelming evidence that novel food has the potential to play a role in prevention of cardiovascular disease and health promotion. Some examples of novel foods are discussed in this article.

### Dietary fiber

The life sciences research office of the Federation of American Societies for Experimental Biology defined fiber as the endogenous components of plant material in the diet that are resistant to digestion by enzymes produced by humans<sup>7</sup>. There are two main types of fibers.

**Table 1. Important food sources and amount of dietary fiber**

Food source	Amount	Soluble fiber (g)	Total fiber (g)
<b>Cooked legumes</b>			
Kidney beans	½ cup	2	6.7
Pinto beans	½ cup	2	6.7
<b>Cooked vegetables</b>			
Brussels sprouts	½ cup	2	3.8
Broccoli	½ cup	1.1	2.6
Spinach	½ cup	0.5	2.1
Zucchini	½ cup	0.2	1.6

Cont...

Food source	Amount	Soluble fiber (g)	Total fiber (g)
<b>Fruits</b>			
Apple	1 medium	1.2	3.6
Orange	1 medium	1.8	2.9
Grape fruit	½ medium	1.1	1.8
Grapes	1 cup	0.3	1.1
Prunes	6 medium	3	8
<b>Grains</b>			
Oatmeal (dry)	1/3 cup	1.3	2.8
Oat bran (dry)	1/3 cup	2	4.4
Corn flakes	1 ounce	0.1	0.3
Cooked brown rice	½ cup	0.4	5.3
Whole wheat bread	1 slice	0.4	2.1
White bread	1 slice	0.2	0.4

Fibers with a high water holding capacity, such as pectin, gums and psyllium, have been referred to as soluble fiber. Pectin is mainly found in apple, vegetables, legumes and oat products. Fibers such as cellulose and lignin (insoluble in water) are mainly found in grain products. Fiber enhances satiety, promotes digestion and prevents gastrointestinal disorders. Fiber also has beneficial effects on some risk factors for coronary heart disease (CHD) such as high lipid levels, sugar and obesity<sup>8</sup>. It has been reported that viscous polysaccharides act in the gastrointestinal tract and reduced blood cholesterol by decreasing absorption of cholesterol and fatty acids<sup>9</sup>. The guidelines of American Heart Association (AHA) recommend a total dietary fiber intake of 25-30 g/d from foods, not supplements, is beneficial in CVD. Certain fruits and vegetables are better sources of both soluble and insoluble fibers (Table 1). An increase consumption of dietary fiber is useful in a ratio of about 1 part soluble to 3 parts insoluble fibers<sup>10</sup>.

### Phytochemicals

Phytochemicals are plant components that are present in food in very little quantity. There are plenty of phytochemicals and more than 1000 different phytochemicals

have been identified as component of foods<sup>11</sup>. Most commonly studied phytochemicals for prevention and control of CAD are listed in Table 2.

**Table 2. Phytochemicals and their important food sources**

<b>Phytochemicals</b>	<b>Food sources</b>
Flavonoids and isoflavonoids	Green leafy vegetables, soybean and parsley
Phytosterols	Pumpkin seeds and nuts
Carotenoids	Carrots, tomatoes and spinach
Saponin	Legumes
Polyphenol	Cranberries, raspberries, blackberries, rosemary and orange
Catechins	Green and black tea
Allicin	Garlic
Limonene	Citrus fruits

### **Flavonoids**

Flavonoids occur in most plant species. Dried green tea leaves contain approximately 30% flavonoids by weight. Flavonoids have been shown in a number of studies to be potent antioxidants, capable of scavenging free radicals. A number of flavonoids, including quercetin, morin, gossypetin, chrysin, myricetin, rutin and catechin, have been shown in various studies to inhibit the oxidation of LDL cholesterol. Oxidized LDL cholesterol is the main culprit for development of atherosclerotic lesions<sup>12, 13</sup>.

### **Phytosterols**

Phytosterols are particular type of fat in plants. These are mainly sitosterols, campesterols and stigmasterols. Phytosterols are poorly absorbed by humans; yet, they compete with dietary cholesterol to be absorbed by the intestine, therefore reducing dietary cholesterol uptake and lowering blood cholesterol levels. Special phytosterol enriched foods such as margarines have been developed for dietary cholesterol lowering intervention<sup>14</sup>.

### **Carotenoids**

Carotenoids are a group of phytochemicals that are responsible for different colors

of the foods. They are recognized as playing an important role in prevention of human diseases and maintaining good health. In addition to being potent antioxidants some carotenoids also contribute to dietary vitamin A<sup>15</sup>. The most well known carotenoids are beta-carotene, alpha-carotene, lutein, lycopene and zeaxanthin. Carotenoids exert high antioxidant activity. Preliminary and experimental studies suggest that a higher dietary intake of carotenoids offer protection against atherosclerosis by preventing oxidative damage to serum cholesterol. In Europe, researchers have found a statistically significant association between high dietary lycopene and a 48% lower risk of heart disease<sup>16</sup>.

### **Tocotrienols**

Tocotrienols are members of the vitamin E family. Like vitamin E, tocotrienols are potent antioxidant against lipid peroxidation (the damaging of fats by oxidation). Tocotrienols may offer protection against atherosclerosis by preventing oxidative damage to LDL cholesterol<sup>17</sup>.

### **Polymeal diet**

A team of Dutch scientists suggested daily diet regimen (Polymeal) that reduced risk for CVD by 76%. Polymeal diet includes daily intake of almonds, dark chocolate, garlic, wine, fish, fruits and vegetables (Table 3). All novel foods listed in Table 3 contain important, phytochemicals such as flavonoids, phytosterols, carotenoids, saponin, polyphenol, catechin, allicin, limonene and vitamins. It has been reported by many studies that all individual ingredients of polymeal diet have beneficial effects on heart<sup>18</sup>.

**Table 3. Effect of polymeal components on reducing risk of cardiovascular disease**

<b>Ingredient</b>	<b>Amount</b>	<b>Reduction in risk of CVD (%)</b>
Almond	68 g/day	10.5 to 13.5
Dark chocolate	100 g/day	14 to 27
Garlic	2.7g/day	21 to 27
Red wine	150 mL/day	23 to 41
Fish	114 g four times/week	8 to 19
Fruits and vegetables	400 g/day	14 to 27

## **Vitamins**

Vitamins are micronutrients and are very essential for normal functioning of the body. Prospective studies have demonstrated reduced risk of CVD in subjects with a greater intake of vitamins E and C, because these antioxidant vitamins inhibit oxidation of LDL cholesterol<sup>19</sup>. Percutaneous coronary intervention trials have suggested that vitamin B<sub>12</sub> (25 micrograms/ day), B<sub>6</sub> and folic acid reduced the elevated level of homocysteine amino acid. Increased homocysteine levels are associated with an increased risk of CHD<sup>20</sup>.

## **Omega-3 polyunsaturated fatty acids**

Several clinical intervention trials have assessed the effects of fish and fish oil supplements on CHD, mainly after myocardial infarction<sup>21</sup>. Certain cold-water oily fish such as mackerel, herring, tuna, salmon, sardines and trout are rich sources of omega-3 polyunsaturated fatty acids. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are derived from fish and fish oil. The plant source of omega-3 fatty acid is linolenic acid (linseed oil, rape seed oil, walnuts and spinach). The omega-6 fatty acids are mainly derived from linoleic acid (corn, soybean, safflower and sunflower oil)). Humans have no enzymes to convert omega-6 fatty acids to omega-3 fatty acids<sup>22</sup>. It has been reported that omega-3 fatty acids have beneficial effects on cardiovascular diseases such as coronary heart disease, arrhythmias, angina pectoris and hypertension<sup>23</sup>.

The possible mechanism of action of omega-3 fatty acids include:

- Antiarrhythmic
- Antithrombotic
- Antiatherosclerotic
- Anti-inflammatory
- Improves endothelial function
- Lowers blood pressure
- Lowers triglyceride concentrations

The nutrition scientists of US panel have recommended intake of 0.65 g/day of omega-3 fatty acids for prevention of CVDs. Polyunsaturated fatty acids along with monounsaturated fatty acids in diet (ratio 1 : 3) are useful for prevention of CVDs. Monounsaturated fatty acids are mainly present in olive and rape seed (canola) oils. An

increased intake of monounsaturated fatty acids (upto 15-20% of total energy intake) results in a decrease of total and LDL cholesterol levels without affecting HDL levels. Polyunsaturated fat (moderate intake upto 7-8% of total energy) tends to lower LDL and HDL levels<sup>24</sup>.

## **CONCLUSIONS**

- (i) The WHO recommends the changes in attitudes, behavior and social values for primordial prevention of CVDs.
- (ii) Control of smoking is essential.
- (iii) Reduce intake of salt, alcohol, calorie intake (1600 calories / day) are useful in prevention of cardiovascular diseases.
- (iv) Greater intake of dietary fiber and fruits are beneficial to heart.
- (v) Increase of physical exercise and greater intake of green vegetables are helpful in prevention of CVDs.
- (vi) Decrease intake of saturated fats, meat and dairy products are beneficial to heart.
- (vii) An increase intake of monounsaturated fatty acids (upto 15-20% of total energy intake) and polyunsaturated fatty acids (moderate intake upto 7-8% of total energy) are associated with reduced risk of CVDs.
- (viii) Regular exercise can reduce truncal obesity and insulin resistance.
- (ix) Established principles, practices of health and general education on novel foods are important parameters for health program.

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