



Functional Foods: Potential Activity For Controlling Heart Disease

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Article History	Abstract
Received: 30/09/2023 Revised: 15/10/2023 Accepted: 30/10/2023	In modern communities, functional foods are very much acceptable to health-conscious people. Functional foods are considered healthy foods. Chronic diseases like Heart-related issues develop due to the intake of excessive quantities of fat, refined sugar, salt, and cholesterol-rich foods. However functional foods are involved to facilitate heart distress. Intake of active food ingredients like micronutrients (vitamins and minerals), dietary fibre, antioxidants, and probiotic foods improve cardiovascular disorder therefore upgrading physical and mental well-being. Authors have demonstrated that aged people suffer chronic distress in general therefore it can be prevented by functional foods. functional foods are more relevant than synthetic drugs or pharmaceuticals. So, heart-related issues are torn down by the consumption of functional foods in adequate quantity. Functional foods which have good quantity of bioactive compounds, nutraceutical attributes these are fruits and vegetables, green tea, turmeric, onion, spirulina, soyabean, oats and barley, probiotics and prebiotics, extra virgin olive oil and so on, have capability to mitigate intricate difficulties of cardiovascular disease. Precisely, the motive of this review is the advantageous effect of functional foods in preventing the manifestations of heart disorders around the globe. This review article highlights functional foods' potential activity to control heart disorders.
CC License CC-BY-NC-SA 4.0	Keywords: functional foods, antioxidants, dietary fibre, heart disease, micronutrients, pharmaceuticals, probiotic foods

Causes of cardiovascular obstacles (Mashau & Ramashia, 2021)

1.3 Dietary modifications for cardiovascular disorders

1.3.1 Fruits and vegetables

These are prime sources to ameliorate heart related complications (Yamada *et al.*, 2011; Jacques *et al.*, 2013). Fruits and vegetables are prime source of polyphenolic constituents like phenolic acid and flavonoids. Polyphenols are very much able to prevent these complications. Flavonoids have antioxidant and anti-inflammatory attributes to upgrade the vascular mechanism (Duffy *et al.*, 2001). Fruits and vegetable fallen down susceptibility of LDL to oxidative damage. Apart from that, it carries efficient quantity of dietary fibre which improve biological functions, these reduce the cluster of inflammatory mediator C reactive protein, concentration of LDL and decrease oxidative damage (Aguirre & May, 2008).

1.3.2 Plant sterols and stanols

Plant sterols like campesterol, β sitosterol and stanols such as sitostanol, campesterol are organic constituents of membranous cell wall that are involved to fall down the cholesterol (Mannarino *et al.*, 2014). According to survey, 2gm/day plant sterols are conversely corresponding to total cholesterol and LDL- cholesterol (Klingberg *et al.*, 2008), furthermore, these obstruct the development of micelle and stop the reabsorption capacity of bile acids which hinder cholesterol absorption (Gylling *et al.*, 2014). In accordance with Ras *et al.*, 2014, after consumption of phytosterols, it has resulted that, 6 to 12% LDL-c is decreased in an quantity of less than 3gm/day. Precisely, phytosterol decreases total cholesterol, LDL-c, triglyceride accompanied with 8 isoprostans in hypercholesteraemic people (Mannarino *et al.*, 2009).

1.3.3 Green tea

Green tea is the native of *Camellia sinensis*. It's bioactive component is catechin, especially, epigallocatechin-3-gallate (EGCG) has advantageous functions upon human health (Gaur & Agnihotri, 2014). Green tea is the eminent obstructor of HMG Co-A reductase that restrict the growth and development of micelle so that decrease cholesterol quantity. EGCG increase the appearance of LDL Receptor (LDL-R) in liver cells besides upgraded the biliary secretion than turn down cholesterol (Koo & Noh, 2007). Furthermore, thioflavin containing green tea decreases total cholesterol, LDL-c in hypercholesteremia affected patients (Kim *et al.*, 2011).

1.3.4 Turmeric

Curcumin is the prime bioactive constituent of turmeric which is the polyphenolic compound. Authors have reported that, in Indian cuisines, turmeric is prolonged used, it is the nutraceutical and functional food compounds which improve bundle of ailments (Zlotogorski *et al.*, 2013). Curcumin has hypolipidemic and hypercholesteraemic attributes through stop NPC1L1 (Niemann-Pick C1-Like 1) polytopic transmembrane protein transporter preformation (Kumar *et al.*, 2011) and through upregulation of LDL-R development by downregulation of PCSK-9 (Proprotein convertase subtilisin/kexin type 9) (Tai *et al.*, 2014). After intake of curcumin for 8 weeks resulting dwindle the parameter TC (Total Cholesterol), LDL (Low-density lipoprotein) cholesterol (LDL-C) and TG (Triglyceride) (Panahi *et al.*, 2016).

1.3.5 Berberine

It is an alkaloid which is included in berries family like Barberry and tree turmeric (Gupta *et al.*, 2014). Berberine is considered as nutraceutical for improving dyslipidaemia (Derosa *et al.*, 2012). It is functioned as strong organic constraint for PCSK-9 that upgrade LDL-R gene in liver which increase the formation of LDL-R therefore diminish excessive cholesterol parameter (Li *et al.*, 2015). A metanalysis has discovered that, 500 to 1000 mg/day if any person intake berberine therefore, decrease TC, LDL-c, TG simultaneously extended HDL-c level (Dong *et al.*, 2013). For improving dyslipidaemia, berberine can be utilised along with red yeast rice and policosanols (Pisciotta *et al.*, 2012).

1.3.6 Garlic

It is another important Cuisinart element which is used as nutraceutical and functional food and this antioxidant rich spice is very much common because sulphur enrich constituent like allicin or S- acetylcysteine are present in this (Gupta *et al.*, 2015). Furthermore, S- acetylcysteine have promising lipid cutter functions and has anti-atherosclerotic property (), besides stop HMG-CoA reductase function (Jung *et al.*, 2014). Apart from that, garlic lesions the function of ACAT (acyl-coenzyme A) and lipase so that blood cholesterol in excess amount is decreased which is very much helpful for hypercholesteremia (Khatua *et al.*, 2013). Additionally, aged black

garlic after consumption of 12 weeks have shown that upgrade the HDL-c level, however there is no alteration of TC and LDL-c quantity in cardiovascular patients (**Jung et al., 2014**).

1.3.7 Fish oil

Oil containing fishes are prime source of DHA and EPA which promote tremendous advantageous effect upon human health (**Shahidi & Ambigaipalan, 2018**). These beneath TG level through enhancement of enzyme lipoprotein lipase (LPL) and oxidation of fatty acids therefore down regulates the mechanism of VLDL receptor and fallen down TC especially LDL-c (**Wang et al., 2017**).

1.3.8 Soyabean

After intake of soy protein and peptide that monitor lipid profile because of bioactive peptides like hydrolysate and isoflavones-euol present in this (**Cicero et al., 2017**). Noteworthy, bioactive component of soyabean has ability to secrete bile acid in faecal matter, stop the development of cholesterol and obstruct the downregulation of SREBPs (Sterol regulatory element binding proteins) protein performance (**Rebholz et al., 2013**). Due to presence of bioactive components like genistein and daidzein, it helps to lesion blood cholesterol level (**Tokede et al., 2015**). A meta-analysis has carried out an outlook that, 3-6 gm/ day soy protein has good hypercholesteraemic functions through decrease the extent of TC, LDL-c, TG besides upgrade HDL-c.

1.3.9 Spirulina

It is the microalga that carries extensive nutrient composition like macromolecule protein and macromolecule vitamin (**Mazokopakis et al., 2014**). The lipid obstructing spirulina can impede along with reabsorption of bile acids therefore upgrade the concentration of adequate cholesterol turnover in liver besides increase the functions of enzyme hepatic lipase so lesions the parameter of cholesterol (**Deng & Chow, 2010**). Noteworthy, spirulina is enriched by C-phycoyanin that is functioned as lipid lowering agent. Precisely, it helps to decrease TC, TG and LDL-c without any alteration of HDL-c (**Serban et al., 2016**).

1.3.10 Onion

Onion has lipid decreasing capacity due to presence of flavonoids like quercetin (**Lee et al., 2011**). Authors have revealed that, this bioactive constituent is able to improve faecal bile acid secretion and cholesterol absorption besides upregulate LDL-R protein upgradation therefore fallen excess blood lipid profiles (**Lu et al., 2015**). Meta analysis has proved after intake of onion juice for 8 weeks so that lesions TG, TC, LDL-c parameter.

1.3.11 Prebiotic and Probiotic

Authors have reported that, prebiotic defined as fermented plant constituent and probiotic are regarded as fermented dairy compounds. Moreover, probiotics are defined as live microorganism which improves the function of gut microbiome. Prebiotics are defined as nutraceuticals, functional food. Prebiotics help in growth and development of probiotics on the other hand, probiotics helps to sustain the prebiotics. In general, prebiotic is the food of probiotic, both are very much important to improve cardiovascular complications (**Thushara et al., 2016**). Moreover, probiotics like *Lactobacillus*, *Bifidobacterium* are associated to improve any kind of cardiovascular manifestation through upregulation of bile salt hydrolase (BSH) that escalates the development of deconjugated bile acids besides fallen down the reabsorption of bile acids in intestine especially in ileum (**Jones et al., 2012**). Probiotic improve the concentration of short hain fatty acids (SCFAs) therefore upgrade the metabolism of lipid through alteration of cholesterol and hormones (**Ryan et al., 2015**). Probiotic like *Lactobacillus reuteri* and prebiotic like FOS, GOS, TOS and others included are very much beneficial to ameliorate the excessive TC, TG, LDL-c level simultaneously upgrade HDL-c level quantity (**Rerksuppaphol & Rerksuppaphol, 2015**).

1.3.12 Oat and barley

These are very much proficient to upgrade the complication of cardiovascular as they are the prime source of soluble dietary fibre named β -glucan (**Mannarino et al., 2014**) and phenolic alkaloid like avenanthramide. They have lipid decreasing efficiency by functioning as bile acid sequestrants simultaneously decreasing the development of fatty acids through upregulation of LDL-R and decreasing TC, TG, LDL-c. They decrease the emission of insulin hormone so that, obstruct glucose absorption and reduces cholesterol development in hepatic cells (**Whitehead et al., 2014**).

The interconnection among another functional food constituents like royal jelly, prune juice, red yeast rice, tocopherol, ω -3 fatty acid and vitamin E carrying nuts and oilseeds (**Ros et al., 2014**), lycopene holding

tomatoes (Engelhard *et al.*, 2006), fibre filled legumes, fibre and phytonutrients containing whole grain (Erkkilä & Lichtenstein, 2006), flavonoid rich dark chocolate (Grassi *et al.*, 2005), polyphenolic compounds and oleic acid composing extra virgin olive oil (Engelhard *et al.*, 2006), cyanidin, Flavonol, myricetin and quercetin restraining red wines (Pérez-Jiménez & Saura-Calixto, 2008), vitamin C containing citrus fruits (Aguirre & May, 2008) and other bundle of bioactive and phytochemical enrich functional foods performance to improve cardiovascular manifestations are remarkable.

1.4 Conclusion

Based on current review of literature, authors have speculated that, functional foods, nutraceuticals are very much applicable to ameliorate cardiovascular complications because they carry enormous quantity of bioactive components therefore, people are very much aware to consume these especially. Fruits and vegetables, plant sterols and stanols, green tea, garlic, soyabean, fish oil, spirulina, onion, whole grain, oats and barley, extra virgin olive oil, prebiotic and probiotic, citrus fruits and many more which are very omnipotent to upgrade manifestations of cardiac ailments. These functional foods have lipid diminishing function without alteration of good cholesterol level.

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