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Chapter 1

Natural Cholesterol Busters

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Abstract

Hypercholesterolemia, a risk factor for cardiovascular and cerebrovascular diseases, is a silent health problem. It occurs due to buildup of large amount of cholesterol in blood vessels resulting in narrowed blood vessels or blockage of the flow of blood and causes cellular dysfunction. The predisposing factors for hypercholesterolemia are carbohydrates-enriched diet, unhealthy fats, and red meat. Moreover, family history, obesity, hypokinetic lifestyle, aging, and oxidative stress are associated with hypercholesterolemia. Therapeutic interventions of hypercholesterolemia involve cessation of bad habits, regular exercise, consumption of cholesterol buster diets, and cholesterol-lowering drugs. However, cholesterol-lowering drugs have low efficacy, and some patients cannot tolerate the adverse effects of hypocholesterolemic drugs. In light of this, there has been great interest to address natural cholesterol busters as first choice as cholesterol-lowering option. Healthy diet, regular exercise and natural cholesterol-lowering agents are documented to decrease blood cholesterol level. Natural cholesterol busters include dietary fibers, plant sterols, healthy fats, smart proteins, antinutrients, antioxidants, and L-arginine. These busters not only decrease cholesterol oxidation and absorption but also increase cholesterol catabolism and elimination. Most of these busters are found in cereals, oatmeal, fruits, vegetables, legumes, and fermented foods. The natural cholesterol busters are recommended strategies for treatment of hypercholesterolemia alone or in combination with cholesterol-lowering drugs.

Keywords: hypercholesterolemia, health diet, antioxidants, antinutrients, cardiovascular diseases, L-arginine

1. Introduction

Cholesterol is an important component in cell membrane that maintains the structure and function of the cells. Moreover, cholesterol is a precursor of sex hormones, corticosteroid, and vitamin D. This vitamin is involved in bone formation, modulates immune system, and regulates gene expression [1]. Cholesterol can be catabolized into bile acids that play an important role in digestion and absorption of fat diets and fat-soluble vitamins. The cells get its cholesterol through two pathways, endogenous source by means of biosynthesis in liver (80 %) and exogenous source from the diet (20%) [2]. Cholesterol is transported throughout the bloodstream by joining to specific proteins and lipids forming lipoproteins. There are four main types of lipoprotein acting as cholesterol carriers in circulation: chylomicrons, very low-density lipoproteins (VLDL), low-density lipoprotein (LDL) "bad cholesterol", and high-density lipoprotein (HDL) "good cholesterol" [1].

HDL elicits cardioprotective function by reverse cholesterol transport to the liver to be catabolized, moreover, HDL has antioxidant and anti-inflammatory effects as well as involved in nitric oxide (NO) homeostasis [3]. Under hypercholesterolemic conditions, HDL can be turned into a foe for vascular endothelium through production of free radicals that induced vascular cells and erythrocytes damage [3]. Moreover, cholesterol enrichment decreases membrane fluidity, disrupts cell signaling, induces toxic oxysterols, modulates gene expression, and induces apoptosis [4]. This results in disruption of redox balance and NO homeostasis, particularly in vascular cells and erythrocytes. Cholesterol-enriched erythrocyte membrane causes a reduction in the deformability of cells and impairment of the hemorheological behavior that can initiate cardiovascular disease [5]. Oxidative stress is one of the proposed mechanisms responsible for the changes in erythrocytes under hypercholesterolemic conditions; hence, erythrocytes lose their antioxidant power and become oxidized erythrocytes, which triggers foam cell formation by a mechanism similar to oxidized lipoproteins [5]. Therefore, oxidized erythrocytes are addressed as a new culprit in vascular diseases. **Figure 1** displays the double face of cholesterol.

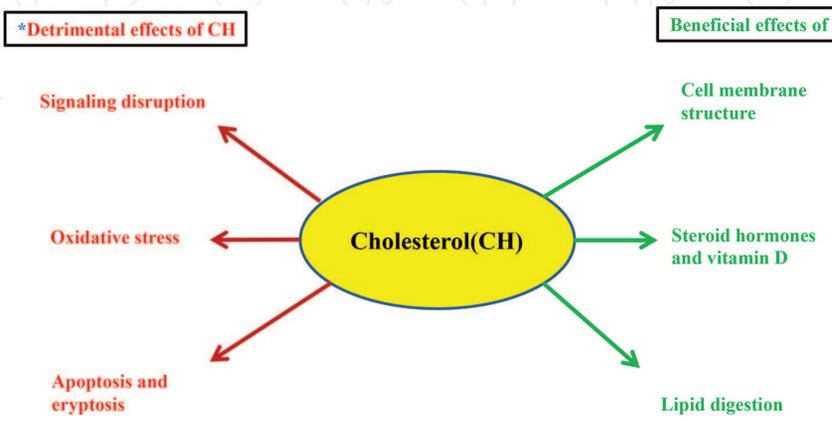

Figure 1. Beneficial and detrimental effects of cholesterol. Asterisk indicates hypercholesterolemic conditions.

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Cholesterol-lowering drug therapies particularly with cholesterol biosynthesis inhibitors are associated with adverse effects such as myopathies, neuropathies, liver dysfunction, weakness, and depression [6]. However, intake of natural cholesterol busters reduces blood cholesterol level with minimal side effects [7–9]. Natural cholesterol busters include healthy diet—drinking excess cold water and avoidance of stress with regular exercise. Moreover, many nutraceuticals have cholesterol-lowering action; they include dietary fibers, plant sterols, healthy fats, smart proteins, antinutrients, antioxidants, and L-arginine [10]. These busters act by modulation biochemical pathways such as appetite suppression, inhibition of digestion, and absorption of dietary fats. In addition, they not only increase the metabolic rate and lipolysis but also decrease lipogenesis and inhibit adipocyte differentiation. **Figure 2** shows the possible mechanisms by which natural cholesterol-lowering agents decrease plasma cholesterol levels.

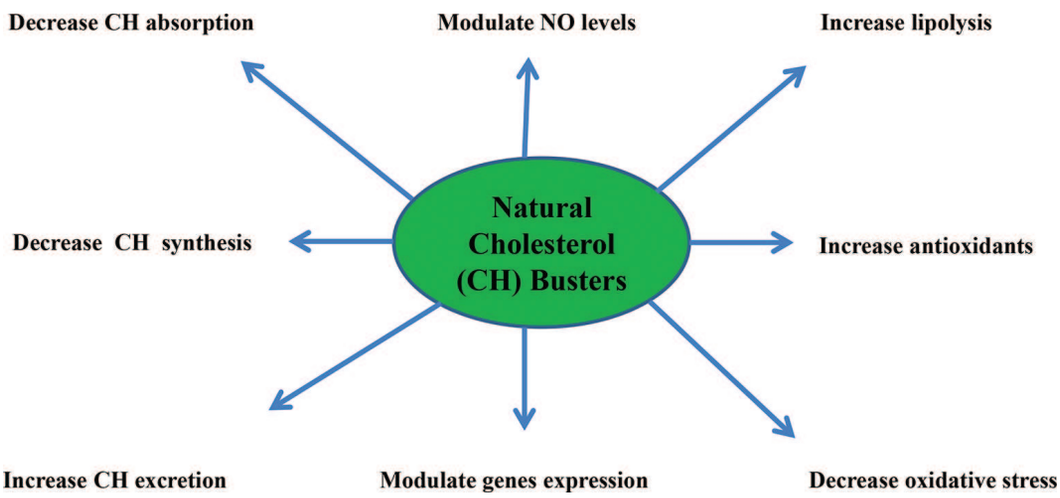

Figure 2. Beneficial effects of natural cholesterol busters.

On this basis, the selection of natural cholesterol-lowering agents with dual action such as lipid lowering and antioxidant activities with minimal side effects is very essential. Natural cholesterol busters can reduce blood cholesterol levels and risk of vascular diseases without adverse effects. This chapter highlights natural cholesterol busters as first line of cholesterol-lowering strategy.

2. Natural cholesterol busters

The first choice to decrease the blood cholesterol levels is lifestyle change including healthy diet—drinking excess of water, avoidance of stress and regular exercise. Moreover, there are a group of nutraceuticals that can be considered as cholesterol busters. Some of these nutraceuticals are plant sterols, healthy fats, dietary fibers, antinutrients, antioxidants, and L-arginine.

2.1. Healthy lifestyle as natural cholesterol busters

2.1.1. Health diet and exercise

Diet and lifestyle are major causes of dyslipidemia, diabetes, and cardiovascular diseases. Particularly, protein-enriched diet produces satiating effect and helps stave off hunger [10]. Consumption of plant-based foods lowers the rate of many chronic diseases; this is attributable to diets which contain smart proteins, trace elements, foliate, antioxidants, and antinutrients [10]. Additionally, low carbohydrate consumption modulates hormones release, increases lipolysis, and enhances fatty acids oxidation [10]. On the other hand, aerobic exercise decreases lipogenesis and activates lipoprotein lipase that increases lipolysis, resulted in enhancement of fat clearance and burning [11].

In these situations, depot fats and free fatty acids were utilized as fuel sources for muscle work [12]. Therefore, health diet with regular exercise (3h/week) at least for 5 days per week decreases subcutaneous fats, visceral fats as well as improve blood lipid levels [12]. Generally, the reduction of body fats is associated with a decrease of total cholesterol, triacylglycerol, LDL, while HDL levels were increased [10]. Furthermore, health diet and lifestyle modifications improve the availability of nitric oxide [10]. Therefore, healthy diets enriched with plant protein, low in carbohydrate and fat, devoid of trans fats (margarine, snack food, packaged baked food, and fried fast food), with regular exercise could be considered the best choice to treat hypercholesterolemia. Besides the aforementioned effects, caloric restrictions with exercise preserve antioxidant capacity as well as reduce reactive oxygen species formation and reduce apoptosis.

2.1.2. Cessation of bad habits

Cigarette smoking and alcohol drinking are most common bad habits worldwide. Combined use of both smoking and alcohol is more damaging to health than use of either alone. The most serious medical consequences of smoking and alcohol are vascular diseases and cancer [13]. This attribute of cigarette smoking enhances catecholamine release and inhibits lipoprotein lipase activity; this results in an increase in levels of chylomicrons, VLDL, and LDL with a decrease in HDL levels [14]. These resulted in alteration of lipid profile associated with decline of antioxidant power with an increase of lipid peroxidation, thrombosis, and vascular dysfunction [13]. Smoking cessation averts these deleterious effects on lipid abnormality, particularly HDL levels [14].

The liver plays a central role in the regulation of cholesterol homeostasis. Alcohol drinking causes fatty liver, besides this alcohol is metabolized into acetaldehyde and reactive oxygen radicals [15]. Acetaldehyde and reactive oxygen radicals can interact with proteins, lipids, and other biomolecules in the cell, resulting in adduct formation which is harmful to the liver. Moreover, acetaldehyde-protein adducts upregulate lipogenetic genes in the liver [15]. Several studies confirmed that chronic alcoholism induced abnormality in lipid metabolism with elevation of triacylglycerol and cholesterol-enriched lipoproteins in the blood [16].

2.2. Nutraceutical as natural cholesterol busters

2.2.1. Healthy fats

Dietary fatty acids are considered one of the main important dietary supplements that strongly determine the development of cardiovascular diseases. The dietary fatty acids include saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids (PUFAs) [17]. Saturated fatty acid–rich diets are implicated in the promotion of cardiovascular diseases, while monounsaturated fatty acids and PUFAs have cardioprotective effects [17]. In particular, PUFAs are essential dietary elements for human body because human body lacks desaturating enzymes that are required for PUFAs' biosynthesis [18].

PUFAs are classified according to the position of first double bond from the methyl end (omega carbon) into omega-3 (ω3) PUFAs and omega-6 (ω6) PUFAs. Dietary intake of ω3-PUFAs with reduction in ω6-PUFAs consumption is beneficial for cardiac health [19], while higher consumption of ω6-PUFAs with lower ω3-PUFAs dietary contents is a risk for many diseases, particularly cardiovascular diseases. Inside the human body α-linolenic acid can be converted to eicosapentaenoic acid and docosahexaenoic acid by desaturase and elongase enzymes in a series of biochemical reactions [20]. The process of endogenous desaturation and elongation of α-linolenic acid into eicosapentaenoic acid and docosahexaenoic acid is usually inefficient. Therefore, intake of α-linolenic acid is essential for production of eicosapentaenoic and docosahexaenoic acids [21–24].

Omega-3 fatty acids are the precursors of biologically active mediators with health benefits with regard to their anti-inflammatory, antithrombotic, hypolipidemic, and cardioprotective effects [20]. However, ω6-PUFA produces pro-inflammatory, pro-thrombotic, and pro-atherogenic mediators [21–24]. Therefore, balanced ratio between ω3-PUFAs/ω6-PUFAs dietary intake is recommended for the decrease of cardiovascular risk. The reversal of this ratio has been considered responsible for the high prevalence of cardiovascular disease [21–24].

The ω3-PUFAs are involved in the formation of phospholipids that are involved in reverse cholesterol transport to the liver for catabolism [24]. Additionally, intake of ω3-PUFAs can reduce triacylglycerol levels through inhibition of hepatic lipogenesis and very low-density lipoproteins production by the liver and output into circulation. The ω3-PUFAs have been shown to increase plasma LDL with large particle size, which is much less atherogenic than LDL that cannot infiltrate blood vessels of vascular endothelium to start development of atherosclerosis [24]. Moreover, ω3-PUFAs downregulate sterol regulatory element-binding protein, resulting in suppression of gene expression of 3-hydroxy-3-methyl-glutaryl CoA reductase, a rate-limiting enzyme in cholesterol synthesis [25]. ω3-PUFAs also activate liver X receptors that upregulate expression of 7-α-hydroxylase, the main enzyme in conversion of cholesterol into bile acids [26].

Diet enriched with ω3-PUFAs is abundant in plant and marine sources, such as flaxseed, canola, salmon, mackerel, herring, and tuna. The fish oil is composed of higher percent of ω3-PUFAs; therefore, they are the best source of biologically active ω3-PUFAs mediators. The ω3-PUFAs have susceptibility to oxidative damage; therefore, antioxidants supplementation is

recommended during ω3-PUFAs consumption. The ω3-PUFAs are promising therapeutic options for the prevention and treatment of hypercholesterolemia. The risk of antioxidants deficiency and mercury contamination during intake of fish oils must be considered.

2.2.2. Phytosterols

Phytosterols are plant source sterols; they are similar to animal sterol in the presence of steroid nucleus, whereas they differ in their side chain. Phytosterols have been incorporated in many dietary regimens to reduce plasma cholesterol levels and provide a cardioprotective action [27–28]. Phytosterols are classified according to their saturation into sterols and stanols; saturation of sterols produces stanols. The main physterols are sitosterol and campesterol, with their respective stanols, sitostanol and campestanol [27–28]. Phytosterols are relatively less absorbed than cholesterol, particularly stanols. Addition of phytosterols to the diet of hypercholesterolemic patients can effectively reduce blood cholesterol levels [29–30]. Phytostanols are preferred than sterols because the effect of sterols diminishes over time, while stanols' effect persists for a long time. Maximal reduction in cholesterol was reported with daily intake of 2.0 g of plant stanols. The effect of phytosterols is food dependent because the maximal bile secretion is with or directly after meals where stanols can target micelle formation to reduce the absorption of cholesterol and lipids [31–35]. Phytostanols esters showed greater effectiveness if taken on daily basis in sufficient amounts (0.8–2.0 g) with meals [31–35]. The beneficial effect of stanols over LDL reduction appears after 1–2 weeks of (2.0 g) daily consumption. Most importantly, this reduction in LDL persists as long as stanols being consumed [31–35].

Several mechanisms including interference with intestinal cholesterol solubility, inhibition of digestive enzymes, and decreasing cellular uptake of cholesterol have been proposed to explain the cholesterol-lowering effects of phytosterols [31–35]. Therefore, phytosterols reduce the absorption of both dietary and biliary cholesterol from the intestinal tract. Moreover, phytosterols induce the expression of ATP-binding cassette transporters, thus increasing the efflux of cholesterol from the intestinal cells [31–35]. In addition, phytosterols suppress the activity of acyl-cholesterol acyl transferase required for sterols absorption, consequently reducing intestinal cholesterol uptake. Phytosterols are partially inhibiting dietary and biliary cholesterol absorption by 30–50% through inhibition of cholesterol emulsification through disruption of the lipid micelles, reducing its solubility and availability for intestinal absorption [31–35]. Phytosterols are present naturally in many plants, such as corn, soybeans, and sunflower seeds. The risk of beta-sitosterolemia must be considered during intake of phytosterols as cholesterol-lowering therapy.

2.2.3. Dietary fibers

Dietary fibers including cellulose and its derivatives as well as lignin are considered as non-digestible parts of food. Diet rich in fiber has been reported to have an inverse relationship to cardiovascular risk. Therefore, fiber-enriched diets are recommended by many leading organizations to improve human health [36–37]. The chemical composition of dietary fibers is carbohydrate in nature; they are present in edible plants. Dietary fibers resist alimentary digestive enzymes, are non-absorbable and susceptible for partial fermentation by normal

flora gastrointestinal tract [36–37]. Generally, dietary fibers are classified according to their solubility into soluble and insoluble fibers. Inulin, oligofructosides, pectin, mucilage, psyllium, gum, polysaccharides, and β-glucans are examples for soluble fibers, whereas lignin, cellulose, hemicellulose, and resistant starch are examples for insoluble fibers [38–41]. Chitosan can reduce the risk of cardiovascular diseases because it can lower triacylglycerol and cholesterol levels by increasing bile acid excretion [42].

Dietary fibers have hypolipidemic effect over both triacylglycerol and cholesterol-enriched lipoproteins [41]. The biochemical mechanisms underlying the hypolipidemic effect of dietary fibers may be due to different hypotheses. Dietary fibers form complexes with dietary fats, cholesterol, and bile acids. Therefore, fat digestion by pancreatic lipases is inhibited, while hepatic bile synthesis and cholesterol excretion are enhanced [41, 43]. In addition, dietary fibers can entrap water and water-soluble foodstuff, such as glucose, resulting in reduction in glucose absorption. Therefore, post-prandial plasma insulin declines with suppression of its stimulating action for 3-hydroxy-3-methylglutaryl-CoA reductase in cholesterol synthesis. This resulted in decrease of cholesterol biosynthesis with decrease in blood cholesterol levels [41, 43]. Fermentation of fibers by intestinal flora produces short chain fatty acids such as propionic and butyric acids. These acids can suppress hepatic cholesterol synthesis via competitive inhibition of 3-hydroxy-3-methyl-glutaryl CoA reductase and downregulate most of lipogenic enzymes [41, 43–45].

Dietary fibers promote growth of intestinal microflora such as *Lactobacillus acidophilus* [37]. Therefore, dietary fibers that selectively stimulate the growth and activity of beneficial microflora are known as "prebiotics"; "probiotics" in the gastrointestinal tract improve the intestinal microbial balance, thus improving human health. When probiotics and prebiotics are used in combination, they are known as "synbiotics" [46]. The use of synbiotics is to improve gut health and exert other health-promoting effects, such as modulation of the immune system, antihypertensive effects, prevention of cancer, antioxidant effects, reduction of dermatitis symptoms, facilitation of mineral absorption, and improvement of candidiasis [46]. Additionally, synbiotics has cholesterol-lowering properties through deconjugation of bile acids by bile-salt hydrolase, thus leading to coprecipitation of cholesterol with deconjugated bile [46]. Other explanations for cholesterol-lowering effects of probiotics include utilization of cholesterol in the cell membranes during growth of probiotics, conversion of cholesterol into coprostanol and production of short-chain fatty acids upon prebiotics fermentation by probiotics [46].

Dietary fibers are present in nuts, beans, lentil, lupin, blueberries, cucumber, green leafy vegetables, green beans, carrot, celery, yoghurt, and fermented foods.

2.2.4. Antioxidants

Antioxidants can minimize cellular damage by inactivating free radicals, which could attack other cellular molecules. Enzymatic antioxidants that could provide a protection against free radicals are superoxide dismutase, catalase, and glutathione peroxidases [47]. Non-enzymatic antioxidants with similar function are present widely in the biological system and able to quench many types of free radicals. They include glutathione, vitamin E, vitamin C, β-carotene,

retinols, selenium, copper, zinc, manganese, and others [47]. Hypercholesterolemia upregulates the activity of free radical–generating enzymes; however, it downregulates the activity of antioxidant enzymes that trigger the production of reactive oxygen metabolites [48]. These reactive metabolites provoke lipoproteins oxidation, protein glycation, and glucose autooxidation. Therefore, hypercholesterolemia has been implicated as pathogenesis of pancreatitis, hepatitis, renal injury, stroke, atherosclerosis, and metabolic syndrome by oxidative damage-dependent mechanism [49].

There are scientific evidences of the protective effects of naturally occurring antioxidants in biological systems. Consequently, the identification of natural antioxidants with cholesterol-lowering effect in diet consumed by human is very important. Antioxidants are attractive alternative therapy to treat hypercholesterolemic patients [50]. The antioxidants with cholesterol-lowering capability include antioxidant vitamins, coenzymeQ-10, resveratrol, grape seed, cherry seed, and spices. Moreover, flavonoids, such as silymarin, rutin, quercetin, naringin, and hesperidin, were used for the same purpose [7–9]. Chrysin is a natural flavonoid that is able to decrease plasma lipid concentration and has an antioxidant property [51]. Moreover, rice bran oil is involved in lipid metabolism and oxidation; therefore, it has significant health benefits by the modulation of lipid profiles and preservation of normal redox balance in hypercholesterolemic conditions [52]. Antioxidants are exerting their beneficial effects as free radical scavengers and as chelators of pro-oxidant metals. Furthermore, administration of antioxidants augments endogenous antioxidant power as well as inhibits free radicals generating enzymes [54]. Antioxidants inhibit the oxidation of lipoproteins, protect the oxidative damage of erythrocytes and preserve the availability of nitric oxide in the body [53]. Consequently, antioxidants prevent hypercholesterolemia-induced vascular cells damage. Vegetables and fruits are good source of antioxidants; they include reddish, lettuce, carrot, tomato, cucumber, red cabbage, and low caloric fruits such as apple, grape fruits and orange.

2.2.5. Antinutrients

Antinutrients are plant secondary metabolites such as saponins, flavonoids, alkaloids, tannins, oxalates, phytates, protease inhibitors, amylase inhibitors, lipase inhibitors, and lectins. They are secreted by the plant as a part of the defense mechanism [54, 55]. Human beings use these agents for many beneficial purposes. Some of the antinutrients are used in modulation of gastrointestinal function. Lectins have high binding capacity to the intestinal brush border membrane. This stimulates the release of anorectic neuropeptides that produce satiety and decrease food intake [55]. However, lectins can cause severe intestinal damage with disrupting digestion provoking food allergies and other immune responses [55]. Saponins are amphipathic antinutrients which can reduce cholesterol absorption by disruption of cholesterol micelle formation and downregulate the activity of lipogenic enzymes [54, 55]. Furthermore, saponins also reduce the uptake of glucose from the gut through intraluminal physicochemical interaction [54, 55].

Tannins are present in most cereals and are able to inhibit the activities of protease, amylase and lipase [54–56]. Chlorogenic acid is a member of antinutrients present in green coffee.

Soybeans, fenugreek, bean, and ginseng are good sources of antinutrients. Antinutrients have immune-potentiating action, anticancer effect, and antioxidant power, which could prevent cardiovascular diseases. However, the risk of hemolysis, pancreatic hypertrophy, minerals deficiency, vitamins deficiency, and other malabsorption syndrome must be considered during intake of antinutrients for treatment of hypercholesterolemia [54–56]. **Table 1** annotated the common dietary sources, the main mechanisms of action, and the probable side effects of natural cholesterol lowering agents.

Cholesterol buster	**Dietary source**	**Main mechanism of action**	**Probable side effects**
Healthy fats	Salmon, flaxseed, and canola oils	Decrease cholesterol synthesis and increase its catabolism	Depletion of antioxidant
Phytosterols	Corn, soybeans, and sunflower seeds	Induce expression of ATP-binding cassette transporters	Beta-Sitosterolemia
Dietary fibers	Legumes, beans, and vegetables	Form complexes with dietary cholesterol and bile acids	Abdominal discomfort
Antinutrients	Beans, fenugreek, and ginseng	Produce satiety and decrease cholesterol micelles formation	Hemolysis and malabsorption syndrome
Antioxidants	Fruits, vegetables, and rice bran oil	Decrease free radicals formation and lipoprotein oxidation	-
L-arginine	Poultry, seafood, and lupine	Antioxidants and restores nitric oxide bioavailability	Hypotension

Table 1. The common dietary sources, the main mechanisms of action, and the probable side effects of natural cholesterol busters.

2.2.6. L-Arginine

Nitric oxide is an important vasodilator and has many biological functions. Several cells including endothelial cells and erythrocytes can produce nitric oxide which uses L-arginine as a substrate and tetrahydrobiopterin and flavoproteins as cofactors [57, 58]. Hypercholesterolemia is associated with the increased oxidative stress that reduces the nitric oxide bioavailability through disruption of L-arginine transport into cells, inactivation of nitric oxide

synthase, and activation of arginase [9, 58, 59]. Furthermore, high blood cholesterol levels increase endogenous L-arginine analogues that are able to inhibit nitric oxide synthesis. In particular, asymmetric dimethylarginine competes with L-arginine at the catalytic site of nitric oxide synthase, and symmetric dimethylarginine blocks the transport of L-arginine into the cells via the transporter for cationic amino acids [9, 58, 59]. In hypercholesterolemia, erythrocytes and endothelial cells float in cholesterol-enriched media. This results in a decrease of nitric oxide production and endothelial dysfunction [9, 58, 59]. On the contrary, L-arginine supplementation restores nitric oxide levels and reduces vascular oxidative damage in hypercholesterolemic conditions [57]. It has been reported that L-arginine–enriched foods lower LDL levels; this indicates positive health benefits associated with L-arginine on cardiovascular system [60]. Moreover, dietary supplementation with L-arginine stimulates nitric oxide biosynthetic pathway. In addition, polyphenolic compound mediates L-arginine transport into cells and enhances nitric oxide production [60, 61]. L-arginine–enriched foods include dairy products, poultry, seafood, wheat germ, lupine, granola, oatmeal, peanuts, nuts, pumpkin seed, and chickpeas. The risk of hypotension must be considered during intake of L-arginine as a cholesterol-lowering agent. **Figure 3** shows role of cholesterol busters in prevention hypercholesterolemia induced endothelial dysfunction.

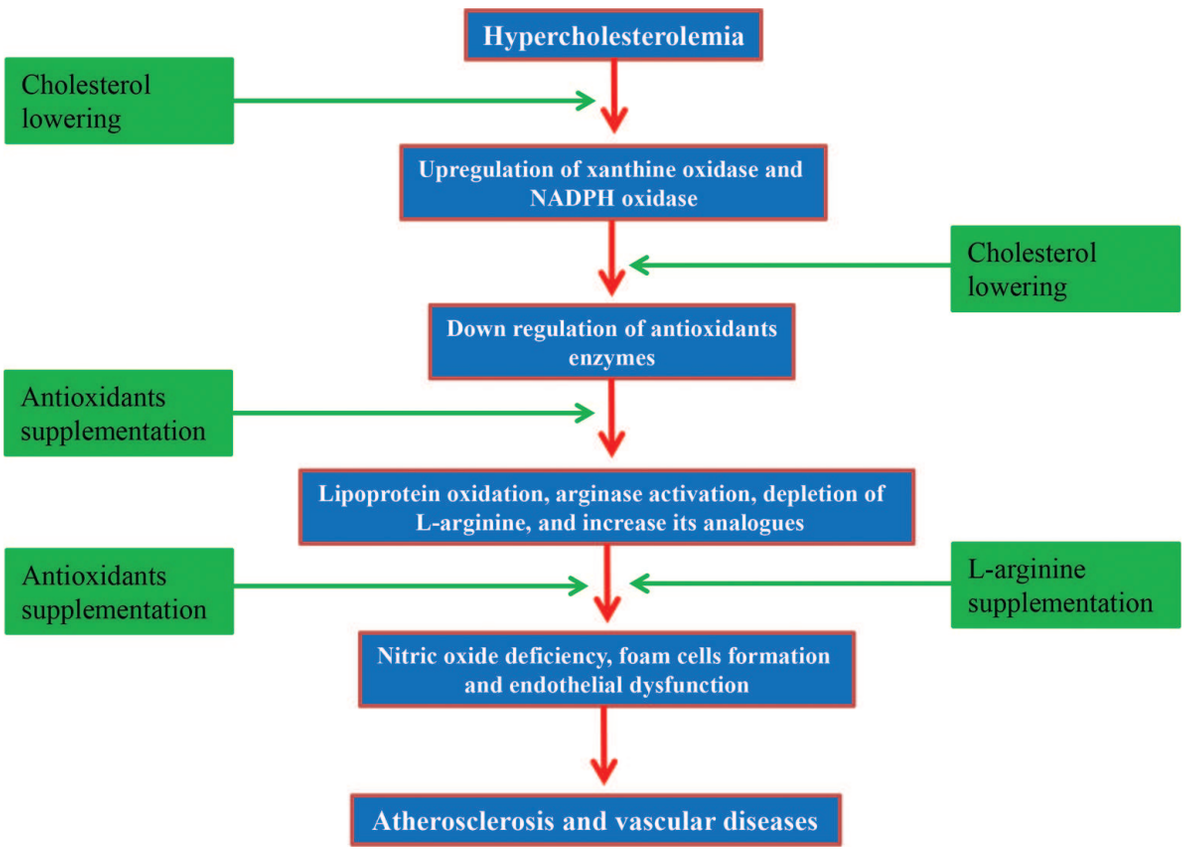

Figure 3. Mechanisms of action of cholesterol busters in prevention hypercholesterolemia induced endothelial dysfunction. Green color indicates the site of action of therapeutic agent.

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3. Suggestion and recommendations

Based on the current data in this chapter, the following recommendations aid in maintaining a healthy life.

- Eat three to five healthy diet daily containing different foods. Healthy diets contain fruits, vegetables, and legumes with less fat and carbohydrate.
- Reduce the intake of salt, flour, and sugar; use more fibers and reduce the amount of food in your plate.
- Consume cold water and sugar-free gum during a feeling of false or emotional hunger.
- Motivate regularly such as walking, riding a bike, and other activities (30–45 min), at least 5 days weekly to burn off the excess calories.
- Prohibit bad habits such smoking and alcohol drinking as conceivable.
- Avoid overcrowding, noise, and contaminant exposure as possible.
- Check your body weight weekly.
- Examine your blood sugar level and plasma lipids profile for every 6 months.

4. Summary

Healthy diet and exercise can successfully manage blood cholesterol levels, besides supplementation of natural cholesterol busters. Natural cholesterol busters not only decrease cholesterol absorption, but also increase cholesterol metabolism and elimination. The intervention of natural cholesterol busters is the safest strategy in the prevention and treatment of hypercholesterolemia. The hypocholesterolemic properties of natural cholesterol busters have been proved; however, further studies are required to address general recommendations considering human variability in response to dietary regimen. The natural cholesterol busters are found in cereals, oatmeal, fruits, vegetables, and legumes. In case of failure of natural cholesterol busters as first choice cholesterol-lowering option, the cholesterol-lowering drugs are recommended with natural cholesterol busters. Take care that high intake of antinutrients may be associated with serious health problems due to the presence of phytate, oxalate, cyanogenic glycoside, and other toxic antinutrients.

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