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Research Article

Lactonova Plant sterol gummies: Help to support healthy Cholesterol

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Phytosterols are natural compounds found in plants that can help you safely lower your cholesterol levels to avoid health risks such as heart attack and stroke. They may also help prevent obesity, diabetes and cancer. To meet dietary goals and keep high cholesterol in check, eat foods with added plant sterols or use supplements. Phytosterols, help you manage blood cholesterol levels, reducing your risk of cardiovascular disease, heart attack or stroke. Cholesterol is a waxy substance made by your liver that circulates in your blood. Your body needs cholesterol to build cells, protect nerves and make vitamins and hormones. But too much of a certain type of cholesterol (LDL or "bad" cholesterol) can cause heart problems if it builds up in your arteries and blocks them. Phytosterols may also help prevent obesity, diabetes and cancer. Early studies suggest diets rich in phytosterols could reduce cancer risk by up to 20%. The present Article reviews the role of lactonova Plant Sterol Gummies that help to support healthy cholesterol.

Keywords: Phytosterols, lactonova, Gummies, Cholesterol, heart attack or stroke.

1. Introduction

Heart disease results from the narrowing of the arteries that supply the heart with blood through a process known as atherosclerosis. Fatty deposits (or plaque) gradually build up on the inside of the artery walls, narrowing the space in which blood can flow to heart. Atherosclerosis can start when we are young, so by the time we reach middle age, it can be quite advanced.

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Plaque build-up can be considered as stable or unstable. If there is too much build-up of stable plaque, it narrows the arteries, causing pain and discomfort due to not enough blood reaching the heart – this is called angina and it needs to be treated. Unstable plaque is inflamed and has a thin cap which is prone to developing a crack, allowing the blood to come in contact with the fatty contents of the plaque. The blood will clot to try to seal the gap but in doing so, the blood clot blocks the artery. This prevents the flow of blood to the heart, cuts off its oxygen supply and damages or kills the heart cells. This is a heart attack.

2. Risk factors for heart disease

There are many factors that can increase our risk of heart disease. Although some of these cannot be changed, the good news is that there are plenty of risk factors within your control. For example, by being physically active, ensuring to have good social

support and not smoking, our risk of heart disease is reduced.

Table 1: Risk factors for heart disease

Risk factors that can't be changed	Risk factors within your control
Age	Smoking status
Gender	Diet
Ethnicity	Cholesterol levels
Family history of heart disease	Blood pressure
	Body weight
	Diabetes management
	Physical activity levels
	Depression and social isolation

Some risk factors are connected. For example, cholesterol levels and blood pressure can be affected by diet, as can our body weight and management of diabetes. Therefore, one of the best things we can do to reduce our risk of heart disease is to have a healthy diet and maintain a healthy weight.

Dietary fats and cholesterol levels

Cholesterol is a fat crucial to many metabolic functions and is an essential part of all the body's cell membranes. It is made by the body from the food we eat and is produced in the liver.

Blood lipids (fats) that contain cholesterol include low-density lipoprotein (LDL) and high-density lipoprotein (HDL). LDL ('bad') cholesterol can lead to plaque forming in the arteries while HDL ('good') cholesterol helps to remove cholesterol from the body and makes it harder for plaque to form in the arteries.

Saturated fats

Saturated fats (also known as 'bad fats') tend to increase LDL ('bad') cholesterol in the blood. Common sources of saturated fats include – animal products (butter, coconut oil, meat fat including lard and dripping, beef, lamb, chicken skin and palm oil), and processed foods like pastries and biscuits.

Full fat or reduced fat dairy?

Although full fat dairy foods (such as milk, cheese and yoghurt) contain saturated fat, it appears this type of fat has a neutral relationship with heart health.

The Heart Foundation recommends unflavoured milk, yoghurt and cheese can be consumed by the general population but for people who need to lower their LDL cholesterol, reduced fat versions should be consumed instead.

Eggs

It was once thought cholesterol naturally found in eggs was bad for heart health. However, research suggests eggs have a neutral relationship with heart health – they neither increase nor decrease the risk of heart disease for the general population.

Trans fats

Like saturated fats, trans fats tend to increase LDL (bad) cholesterol in the blood but they also tend to reduce HDL (good) cholesterol levels. So, they are more damaging to our health and can increase our risk of cardiovascular diseases (such as heart disease and stroke).

Trans fatty acids form when monounsaturated or polyunsaturated vegetable oils are 'hydrogenated' and hardened to form margarines, oils for deep frying and shortening for baked products.

These harder vegetable fats and shortenings are used by the food industry in processed foods (such as cakes and biscuits and deep-fried takeaway meals).

Some trans fatty acids also occur naturally in some meats, butter and dairy products.

Monounsaturated and polyunsaturated fats

Reduce your risk of heart disease, by replacing energy intake from saturated and trans ('bad fats') in your diet with unsaturated ('good fats').

Substitute butter, coconut and palm oil, lard, dripping and copha) with oils made from seeds or plants (such as olive, avocado, sunflower, canola, safflower, peanut, soybean andsesame).

Other sources of unsaturated fats include unsalted nuts, seeds (including chia, tahini and linseed) and avocado.

Blood pressure and salt (sodium)

A diet high in salt is linked to hypertension (high blood pressure), which can increase your risk of heart disease and stroke. Most of us consume more than ten times the amount of salt we need to meet our sodium requirements (salt contains sodium and chloride).

Most of the sodium in our diet is not from added salt at the table, but from packaged and processed foods. Even sweet foods and those that don't taste 'salty' can have much more sodium than you'd expect!

A simple way to cut down on the amount of sodium in your diet is to reduce the amount of processed foods, limit fast food and use herbs and spices for flavour.

We can Reduce our heart disease risk with healthy eating. Eating a variety of foods is beneficial to our health and can help reduce our risk of disease (including heart disease).

Try to eat a wide variety of foods from each of the five food groups, in the amounts recommended. Not only does this help you maintain a healthy and interesting diet, but it provides essential nutrients to the body.

The American Heart Foundation recommends:

- Plenty of vegetables, fruits and wholegrains.
- A variety of healthy protein sources (especially fish and seafood), legumes (such as beans and lentils), nuts and seeds. Smaller amounts of eggs and lean poultry can also be included in a heart healthy diet. If choosing red meat, make sure it is lean and limit to 1-3 times a week.
- Unflavoured milk, yoghurt and cheese. Those with high blood cholesterol should choose reduced fat varieties.
- Healthy fat choices – nuts, seeds, avocados, olives and their oils for cooking
- Herbs and spices to flavour foods, instead of adding salt.

Also, be mindful on how much you are eating and whether you are filling up on unhealthy foods. Portion sizes have increased over time and many of us are eating more than we need which can lead to obesity and increase our risk of cardiovascular disease.

Ideally, a healthy plate would include servings of – ¼ protein, ¼ carbohydrates and ½ vegetables.

Fig. 1. Model healthy plate

Remember, serving sizes can vary depending on your age, gender and specific nutrition needs.

3. Foods important for heart health

Although there is no one 'magic' food to lower our risk of developing heart disease, there is some evidence that some foods are important for heart health. These include:

- Oily fish – such as mackerel, sardines, tuna and salmon which contain omega-3 fatty acids. This type of fat has been shown to decrease triglycerides (a type of fat) and increase HDL-cholesterol levels, improve blood vessel elasticity and thin the blood, making it less likely to clot and block blood flow.
- Some vegetables oils – such as corn, soy and safflower (which contain omega-6 fatty acids), and those containing omega-3 fatty acids (such as canola and olive oil). All of these can help to lower LDL cholesterol when used instead of saturated fats such as butter.
- Fruit and vegetables – fibre, potassium and other micronutrients (such as antioxidants) in fruit and vegetables offer protection against heart disease. Are also an important source of folate – which helps lower the blood levels of the amino acid homocysteine, which appears to be linked to an increased risk of heart disease.

- Wholegrains – a diet high in fibre from wholegrain cereals is linked to reduced LDL cholesterol and lowered heart disease risk. Foods with high levels of soluble fibre (for example, oats, legumes and barley) are great for lowering total cholesterol levels.
- Unrefined carbohydrate sources with a low glycaemic load – such as wholegrain breads and cereals, legumes, certain types of rice and pasta, and most fruits and vegetables also help to lower blood triglycerides and glucose (sugar) levels, help manage diabetes and reduce heart disease risk.
- Legumes, nuts and seeds – are good sources of plant proteins, fibre, healthy fats and micronutrients to help lower your cardiovascular risk.
- Tea – some research suggests antioxidants in tea can help prevent the build-up of fatty deposits in the arteries. They may also act as an anti-blood clotting agent and improve blood vessel dilation to allow increased blood flow.
- Foods containing vitamin E – some studies indicate that vitamin E acts as an antioxidant, helping to protect against LDL cholesterol.
- Sources of vitamin E include – avocados, dark green vegetables, vegetable oils and wholegrain products. Eat foods containing vitamin E rather than supplements, which have not been shown to have the same protective effects.
- Garlic – a compound in fresh garlic (called allicin) has been found to lower total and LDL cholesterol in the blood, thereby reducing the risk of heart disease.
- Foods enriched with plant sterols – a daily intake of 2–3g of phytosterols/stanols lowers LDL cholesterol levels by approximately 10% in healthy people, those with high cholesterol or diabetes. This equates to 2-3 serves of phytosterol-enriched foods like margarine spreads, yoghurts, milk and breakfast cereals.

How to reduce our risk of heart disease with healthy eating. Try these steps to reduce your risk of developing heart disease:

- Limit fried fast food and processed foods.
- Replace energy from saturated fats (such as butter, coconut oil and cream) with healthy unsaturated fats from seeds and plants (such as extra virgin olive oil, avocado, sunflower, canola, safflower, peanut, soybean and sesame) and foods such as nuts, seeds, avocado, olives and soy.
- Increase the amount and variety of plant foods – eat more vegetables, fruits and wholegrain cereals.
- Reduce intake of refined sources of carbohydrates with higher glycaemic indices (including foods with added sugars).
- Limit unprocessed red meats (such as beef, veal, mutton, lamb, pork, kangaroo, rabbit, and other game meats) to a maximum of 350g (cooked weight) per week and avoid processed meat (such as sausages, ham, salami and prosciutto).
- Trim all visible fat from meat and remove skin from poultry.
- Eat legumes regularly – like baked beans (reduced salt), soybeans, lentils and tofu.
- Snack on a handful of raw, unsalted nuts on most days of the week (especially walnuts and almonds).
- Eat oily fish at least once per week.
- Reduce your salt intake – avoid packaged and processed foods, limit fast foods and salty foods. Replace salt at the table and in cooking, with herbs and spices for flavour.
- Check the sodium content of foods and choose the lowest sodium products.
- If you have elevated cholesterol levels, switch to low-fat or non-fat dairy products and have no more than 7 eggs per week.
- If you drink alcohol, have no more than two standard drinks on any one day. A high alcohol intake increases blood pressure and can increase triglycerides in the blood.

4. Pathophysiology of heart failure

The main pathophysiology of heart failure is a reduction in the efficiency of the heart muscle, through damage or overloading. As such, it can be caused by a wide number of conditions, including myocardial infarction (in which the heart muscle is starved of oxygen and dies), hypertension (which increases the force of contraction needed to pump blood) and amyloidosis (in which misfolded proteins are deposited in the heart muscle, causing it to stiffen).

Over time these increases in workload will produce changes to the heart itself.

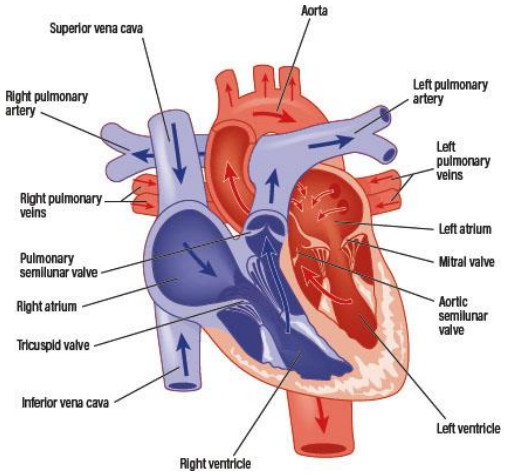

Fig. 2. Human Heart

The heart of a person with heart failure may have a reduced force of contraction due to overloading of the ventricle. In a healthy heart, increased filling of the ventricle results in increased contraction force (by the Frank–Starling law of the heart) and thus a rise in cardiac output. In heart failure, this mechanism fails, as the ventricle is loaded with blood to the point where heart muscle contraction becomes less efficient. This is due to reduced ability to cross-link actin and myosin filaments in over-stretched heart muscle.[1]

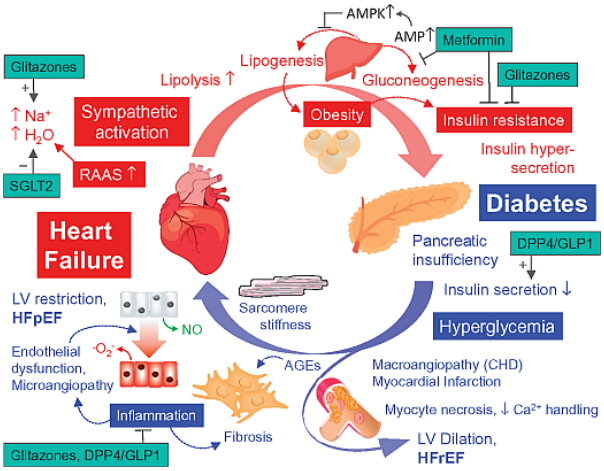

Fig. 3. Human Heart work chart

A reduced stroke volume may occur as a result of a failure of systole, diastole or both. Increased end systolic volume is usually caused by reduced contractility. Decreased end diastolic volume results from impaired ventricular filling; this occurs when the compliance of the ventricle falls (i.e. when the walls stiffen). As the heart works harder to meet normal metabolic demands, the amount cardiac output can increase in times of increased oxygen demand (e.g., exercise) is reduced. This contributes to the exercise intolerance commonly seen in heart failure. This translates to the loss of one's cardiac reserve, or the ability of the heart to work harder during strenuous physical activity. Since the heart has to work harder to meet the normal metabolic demands, it is incapable of meeting the metabolic demands of the body during exercise.

A common finding in those with heart failure is an increased heart rate, stimulated by increased sympathetic activity[2] in order to maintain an adequate cardiac output. Initially, this helps compensate for heart failure by maintaining blood pressure and perfusion, but places further strain on the myocardium, increasing coronary perfusion requirements, which can lead to worsening of ischemic heart disease. Sympathetic activity may also cause potentially fatal abnormal heart rhythms. An increase in the physical size of the heart's muscular layer may occur. This is caused by the terminally differentiated heart muscle fibers increasing in size in an attempt to improve contractility. This may contribute to the increased stiffness and thus decrease the ability to relax during diastole. Enlargement of the ventricles can also occur and contributes to the enlargement and spherical shape of the failing heart. The increase in ventricular volume also causes a reduction in stroke volume due to mechanical and inefficient contraction of the heart.[3]

The general effect is one of reduced cardiac output and increased strain on the heart. This increases the risk of cardiac arrest (specifically due to abnormal ventricular heart rhythms) and reduces blood supply to the rest of the body. In chronic disease the reduced cardiac output causes a number of changes in the rest of the body, some of which are physiological compensations, some of which are part of the disease process:

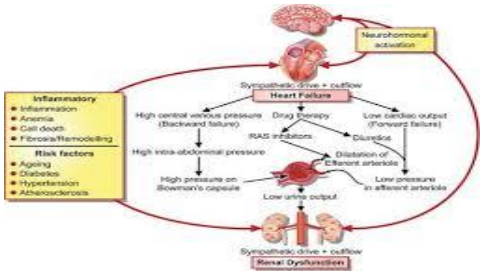

Fig. 4. Human Heart Failure

- Arterial blood pressure falls. This destimulates baroreceptors in the carotid sinus and aortic arch which link to the nucleus tractussolitarii. This center in the brain increases sympathetic activity, releasing catecholamines into the bloodstream. Binding to alpha-1 receptors results in systemic arterial vasoconstriction. This helps restore blood pressure but also increases the total peripheral resistance, increasing the workload of the heart. Binding to beta-1 receptors in the myocardium increases the heart rate and makes contractions more forceful in an attempt to increase cardiac output. This also, however, increases the amount of work the heart has to perform.
- Increased sympathetic stimulation also causes the posterior pituitary to secrete vasopressin (also known as antidiuretic hormone or ADH), which causes fluid retention at the kidneys. This increases the blood volume and blood pressure.
- Heart failure also limits the kidneys' ability to dispose of sodium and water, which further increases edema.[4] Reduced blood flow to the kidneys stimulates the release of renin – an enzyme which catalyses the production of the potent vasopressor angiotensin. Angiotensin and its metabolites cause further vasoconstriction, and stimulate increased secretion of the steroid aldosterone from the adrenal glands. This promotes salt and fluid retention at the kidneys.
- The chronically high levels of circulating neuroendocrine hormones such as catecholamines, renin, angiotensin, and aldosterone affect the myocardium directly, causing structural remodelling of the heart over the long term. Many of these remodelling effects seem to be mediated by transforming growth factor beta (TGF-beta), which is a common downstream target of the signal transduction cascade initiated by catecholamines[5] and angiotensin II,[6] and also by epidermal growth factor (EGF), which is a target of the signaling pathway activated by aldosterone.[7]
- Reduced perfusion of skeletal muscle causes atrophy of the muscle fibers. This can result in weakness, increased fatiguability and decreased peak strength – all contributing to exercise intolerance.[8]

The increased peripheral resistance and greater blood volume place further strain on the heart and accelerates the process of damage to the myocardium. Vasoconstriction and fluid retention produce an increased hydrostatic pressure in the capillaries.

This shifts the balance of forces in favor of interstitial fluid formation as the increased pressure forces additional fluid out of the blood, into the tissue. This results in edema (fluid build-up) in the tissues. In right-sided heart failure, this commonly starts in the ankles where venous pressure is high due to the effects of gravity (although if the patient is bed-ridden, fluid accumulation may begin in the sacral region.) It may also occur in the abdominal cavity, where the fluid buildup is called ascites. In left-sided heart failure edema can occur in the lungs – this is called cardiogenic pulmonary edema. This reduces spare capacity for ventilation, causes stiffening of the lungs and reduces the efficiency of gas exchange by increasing the distance between the air and the blood. The consequences of this are dyspnea (shortness of breath), orthopnea and paroxysmal nocturnal dyspnea.

The symptoms of heart failure are largely determined by which side of the heart fails. The left side pumps blood into the systemic circulation, whilst the right side pumps blood into the pulmonary circulation. Whilst left-sided heart failure will reduce cardiac output to the systemic circulation, the initial symptoms often manifest due to effects on the pulmonary circulation. In systolic dysfunction, the ejection fraction is decreased, leaving an abnormally elevated volume of blood in the left ventricle. In diastolic dysfunction, the end-diastolic ventricular pressure will be high. This increase in volume or pressure backs up to the left atrium and then to the pulmonary veins. Increased volume or pressure in the pulmonary veins impairs the normal drainage of the alveoli and favors the flow of fluid from the capillaries to the lung parenchyma, causing pulmonary edema. This impairs gas exchange. Thus, left-sided heart failure often presents with respiratory symptoms: shortness of breath, orthopnea, and paroxysmal nocturnal dyspnea.

In severe cardiomyopathy, the effects of decreased cardiac output and poor perfusion become more

apparent, and patients will manifest with cold and clammy extremities, cyanosis, claudication, generalized weakness, dizziness, and fainting.

The resultant low blood oxygen caused by pulmonary edema causes vasoconstriction in the pulmonary circulation, which results in pulmonary hypertension. Since the right ventricle generates far lower pressures than the left ventricle (approximately 20 mmHg versus around 120 mmHg, respectively, in the healthy individual) but nonetheless generates cardiac output exactly equal to the left ventricle, this means that a small increase in pulmonary vascular resistance causes a large increase in amount of work the right ventricle must perform. However, the main mechanism by which left-sided heart failure causes right-sided heart failure is actually not well understood. Some theories invoke mechanisms that are mediated by neurohormonal activation.[9]

5. Systolic dysfunction

Heart failure caused by systolic dysfunction is more readily recognized. It can be simplistically described as a failure of the pump function of the heart. It is characterized by a decreased ejection fraction (less than 45%). The strength of ventricular contraction is attenuated and inadequate for creating an adequate stroke volume, resulting in inadequate cardiac output. In general, this is caused by dysfunction or destruction of cardiac myocytes or their molecular components. In congenital diseases such as Duchenne muscular dystrophy, the molecular structure of individual myocytes is affected. Myocytes and their components can be damaged by inflammation (such as in myocarditis) or by infiltration (such as in amyloidosis). Toxins and pharmacological agents (such as ethanol, cocaine, doxorubicin, and amphetamines) cause intracellular damage and oxidative stress. The most common mechanism of damage is ischemia causing infarction and scar formation. After myocardial infarction, dead myocytes are replaced by scar tissue, deleteriously affecting the function of the myocardium. On echocardiogram, this is manifest by abnormal wall motion (hypokinesia) or absent wall motion (akinesia).

Because the ventricle is inadequately emptied, ventricular end-diastolic pressure and volumes increase. This is transmitted to the atrium. On the left side of the heart, the increased pressure is transmitted to the pulmonary vasculature, and the resultant hydrostatic pressure favors extravasation of fluid into the lung parenchyma, causing pulmonary edema. On the right side of the heart, the increased pressure is transmitted to the systemic venous circulation and systemic capillary beds, favoring extravasation of fluid into the tissues of target organs and extremities, resulting in dependent peripheral edema.

6. Diastolic dysfunction

Heart failure caused by diastolic dysfunction is generally described as the backward failure of the ventricle to adequately relax and typically denotes a stiffer ventricular wall. The "stiffness" and contractility of the ventricular walls in diastole was first described by Pierre-Simon Laplace. This causes inadequate filling of the ventricle and therefore results in an inadequate stroke volume (SV). SV is a mathematical term amenable to manipulation of many variables. The failure of ventricular relaxation also results in elevated end-diastolic pressures, and the end result is identical to the case of systolic dysfunction (pulmonary edema in left heart failure, peripheral edema in right heart failure).

Diastolic dysfunction can be caused by processes similar to those that cause systolic dysfunction, particularly causes that affect cardiac remodeling.

Diastolic dysfunction may not manifest itself except in physiologic extremes if systolic function is preserved. The patient may be completely asymptomatic at rest. However, they are exquisitely sensitive to increases in heart rate, and sudden bouts of tachycardia (which can be caused simply by physiological responses to exertion, fever, or dehydration, or by pathological tachyarrhythmias such as atrial fibrillation with rapid ventricular response) may result in flash pulmonary edema. Adequate rate control (usually with a pharmacological agent that slows down AV conduction such as a calcium channel blocker or a beta-blocker) is, therefore, of key importance to preventing acute decompensation.

Left ventricular diastolic function can be determined through echocardiography by measurement of various parameters such as the E/A ratio (early-to-atrial left ventricular filling ratio), the E (early left ventricular

filling) deceleration time, and the isovolumic relaxation time.

7. Phytosterols

Phytosterols (fi-TAH-ster-ols) are natural products (compounds) found in plants. Eating plant-based foods with phytosterols as part of a healthy diet may help you lower your cholesterol levels. You can find phytosterols in:

- Fruits and vegetables.
- Whole grains.
- Nuts.
- Cheese and milk made (fortified) with phytosterols.

It's also available in dietary supplements. Ask your healthcare provider how adding phytosterols to your diet could improve your heart health.

Other names for phytosterols are:

- Plant stanols.
- Plant sterols.
- Stanol esters.

Phytosterols help you manage blood cholesterol levels, reducing your risk of cardiovascular disease, heart attack or stroke. Cholesterol is a waxy substance made by your liver that circulates in your blood.

Your body needs cholesterol to build cells, protect nerves and make vitamins and hormones. But too much of a certain type of cholesterol (LDL or "bad" cholesterol) can cause heart problems if it builds up in your arteries and blocks them.

Phytosterols may also help prevent obesity, diabetes and cancer. Early studies suggest diets rich in phytosterols could reduce cancer risk by up to 20%.

Types of cholesterol

- Low-density lipoprotein cholesterol (LDL): LDL or “bad” cholesterol can clog your arteries and is a major cause of heart disease.
- High-density lipoprotein cholesterol (HDL): HDL or “good” cholesterol helps protect arteries and may help prevent heart disease.

The cell structure of phytosterols looks and acts like cholesterol, so it competes with cholesterol for absorption by your digestive system.

When your body digests plant sterols instead of cholesterol, it removes some of the cholesterol as waste. This results in lower cholesterol levels and improved health.

Types of phytosterols

Researchers have identified more than 250 types of phytosterols. Common ones include:

- Beta-sitosterol.
- Beta-sitostanol.
- Campestanol.
- Campesterol.
- Stigmasterol.

Who should use phytosterols?

Most people can benefit from eating more foods that contain phytosterols. You may benefit from a diet especially high in phytosterols or by taking a daily phytosterol supplement if you have:

- Heart disease or family history of heart disease.
- High cholesterol, including familial hypercholesterolemia (FH), that's difficult to manage.
- History of atherosclerosis.

Who should not take phytosterols?

Phytosterols aren't recommended for people with sitosterolemia, a genetic disorder in which cholesterol and plant sterols build up in the body. High plant sterol levels may cause an increased risk of early (premature) atherosclerosis. Talk to your healthcare provider or dietitian to develop an eating plan that’s right for you.

What are the benefits of phytosterols?

Phytosterols are effective in lowering cholesterol if you eat enough of them as part of a heart-healthy diet low in saturated fat and cholesterol. Studies have shown that a daily diet that contains 2 grams of phytosterols correlates with an 8% to 10% lower LDL cholesterol level. Phytosterols can also benefit people taking statins or ezetimibe, a cholesterol-lowering drug.

What are the risks of phytosterols?

Phytosterols are generally safe for most healthy people. They typically don't stay in your body or affect how your body absorbs fat-soluble vitamins A, D, E and K. (Fat-soluble vitamins can dissolve in fat.)

Don't replace any prescription medications with plant sterols. If you use phytosterol supplements, read labels to check for ingredients and side effects. Talk to your healthcare provider if you have any questions or concerns.

Are phytosterol supplements safe for children?

Phytosterol supplements haven't been sufficiently tested in children to determine their safety. Talk to your child's healthcare provider about phytosterols for your child, especially if they're at high risk of heart disease.

What is the recommended daily intake of phytosterols?

According to the U.S. Food and Drug Administration (FDA), phytosterol-containing foods can help reduce your risk of heart disease. Eat foods with at least 0.65 grams per serving of phytosterols twice a day with meals (total daily intake at least 1.3 grams). Eat these foods as part of a diet low in saturated fat and cholesterol.

Adults with high cholesterol may need to consume a higher amount of phytosterols. The National Cholesterol Education Program (NCEP) recommends 2 grams of phytosterols daily to help protect against cardiovascular disease risk.

In the U.S., most people get between 160 and 500 milligrams of phytosterols per day — a fraction of the recommended totals. That means you need to eat foods with added plant sterols (phytosterol-enriched) or take dietary supplements to meet that goal. Your healthcare provider can help determine if a daily phytosterol supplement is right for you.

What foods are high in phytosterols?

Small amounts of phytosterols occur naturally in certain foods. You can find them in:

- Fruits.
- Legumes.
- Nuts.
- Vegetables.
- Vegetable oil.
- Wheat germ.
- Whole grains.

Other foods have added plant sterols, which can help you reach your dietary goals. They include:

- Bread.
- Breakfast and snack bars.
- Cereal.
- Cheese.
- Chocolate.
- Juice.
- Low-fat cheese spread.
- Margarine.
- Milk.
- Salad dressing.
- Yogurt.

Talk to your healthcare provider or a dietitian to help develop a healthy eating plan. Many of these foods are high in sugar or calories, so it's important to plan a diet that helps you meet your needs.

You may need to take phytosterols as dietary supplements in tablets or capsules. Discuss supplements with your provider, especially if you're taking any medications.

Where can I find more information about plant sterol supplements?

The quality of nutritional supplements varies. Read labels carefully and talk to your healthcare provider or a registered dietitian for more information.

There are two main types of cholesterol: high-density lipoprotein (HDL) and low-density lipoprotein (LDL). HDL cholesterol is considered "good" cholesterol because it helps the body get rid of LDL cholesterol, which is known as "bad" cholesterol. High levels of LDL cholesterol can double your risk of having a heart attack.

Adopting healthy lifestyle habits and eating foods that increase HDL cholesterol and lower LDL cholesterol are good for your overall health. But these steps may not be enough for you. If your LDL cholesterol levels remain high after you improve your diet and exercise habits, you still have work to do to reduce your risk of heart disease.

Two possible solutions are statins and plant sterols. Statins are medications prescribed by a doctor, and plant sterols are substances found in certain plant-based foods. Let's look at how these two options compare in lowering cholesterol levels.

How do statins work?

Statins work by lowering levels of LDL cholesterol in your body. They do this by reducing the amount of LDL cholesterol that your liver makes. Statins also help your body reabsorb any cholesterol that's built up in your arteries.

The American Heart Association and the American College of Cardiology guidelines. Trusted Source recommend statins for certain people. These are people who:

- have an LDL level of 190 mg/dL or higher
- already have cardiovascular disease
- have diabetes, are 40–75 years old, and have an LDL level between 70 and 189 mg/dL
- don't have diabetes, are 40–75 years old, and have an increased risk of developing cardiovascular disease in the next 10 years

Examples of statins available today include:

- atorvastatin (Lipitor)
- fluvastatin (Lescol)
- lovastatin (Altoprev)
- pitavastatin (Livalo)
- pravastatin (Pravachol)
- rosuvastatin (Crestor)
- simvastatin (Zocor)

How do plant sterols work?

Plant sterols are compounds that help block your body from absorbing cholesterol. While plant sterols help lower LDL cholesterol, they don't appear to affect your levels of HDL cholesterol or triglycerides. One Canadian study concluded that plant sterols are the most effective natural treatments for high cholesterol.

Plant sterols are found naturally in:

- fruits
- vegetables
- vegetable oils
- wheat bran and wheat germ
- cereals
- legumes
- nuts

All of these foods contain low levels of plant sterols, though. So eating these foods may not make a big impact on your cholesterol level.

An easier way to get enough plant sterols to lower your cholesterol level is through eating fortified foods. Plant sterols are added to certain foods, including some kinds of orange juice, yogurt, and margarine. To reap the cholesterol-lowering benefits, you need to consume at least 2 grams of plant sterols per day. This equals about two 8-ounce glasses of sterol-fortified orange juice per day.

As for how effective plant sterols are, one study examined people with high cholesterol who used margarine that contains plant sterols instead of regular margarine. The study found that these people were able to lower their LDL cholesterol levels by 14 percent in one year.

How do they compare?

Both statins and plant sterols help lower LDL cholesterol levels. Statins are the gold standard for drug treatment, and sterols are thought to be one of the best natural options to combat high cholesterol. Let's see how else they compare.

Plant sterols are not known to interact with other drugs. Statins, however, may interact with some drugs. These include:

- antibiotics such as erythromycin
- antifungal drugs such as ketoconazole
- HIV drugs such as protease inhibitors
- heart disease drugs such as amiodarone, diltiazem, verapamil, and niacin

8. Conclusion

Statins are one of the most commonly prescribed drugs, in part because they're well-tolerated by most people. And besides lowering cholesterol levels, they can help reduce the risk of heart attack or stroke. Plant sterols reduce the risk of heart attack or stroke like statins do. , it is proven that sterols can help reduce LDL cholesterol. Statins can cause side effects for some people. These can include memory loss, muscle pain or damage, weakness, and nausea. Sterols, on the other hand, are not known to cause side effects when used short-term. Information on side effects from long-term use is not available. Plant Sterols are safer for pregnant women. Statins may cause birth defects, but sterols don't pose this risk.

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