



ATHEROSCLEROSIS

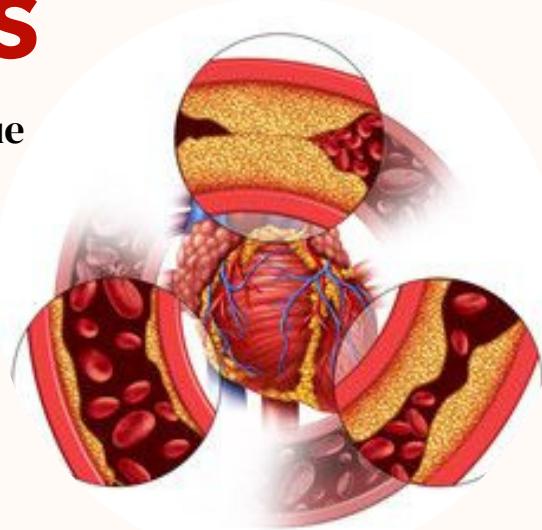
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ATHEROSCLEROSIS

Is a condition characterized by the build-up of plaque in the arteries, which can eventually lead to blockages and reduced blood flow.

Due to endothelium dysfunction which maintain the vascular homeostasis.

Disease occur response to genetic factor or risk factor which lead to it.



RISK FACTOR

1-High cholesterol levels: Elevated levels of LDL (low-density lipoprotein) cholesterol, often referred to as "bad" cholesterol, can contribute to the formation of plaque in the arteries.

2. High blood pressure: Hypertension increases the strain on the arterial walls, making them more susceptible to damage and plaque formation.

3. Smoking: Tobacco smoke contains chemicals that can damage the endothelial cells lining the arteries, promoting the development of plaque.

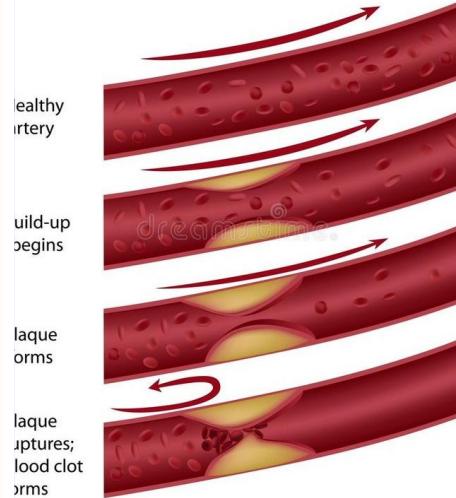
4. Diabetes: Individuals with diabetes often have higher levels of blood glucose, which can contribute to the development of atherosclerosis.

5. Obesity: Being overweight or obese increases the risk of developing several risk factors associated with atherosclerosis, such as high blood pressure, high cholesterol levels, and insulin resistance. [1]

MECHANISM

The mechanism of atherosclerosis involves a multi-step process. It typically begins with injury or damage to the inner lining of the artery, or by high level of free radical which convert LDL to oxidized LDL that accumulate in macrophage found in endothelium of vessel.

In response to this injury, the body initiates an inflammatory response, attracting immune cells to the site. These immune cells, mainly macrophages, engulf LDL cholesterol particles and form foam cells within the arterial wall. Over time, these foam cells accumulate, leading to the formation of fatty streaks and ultimately plaque. [2]



Long term consequence is left untreated:

1-Coronary artery disease (CAD):

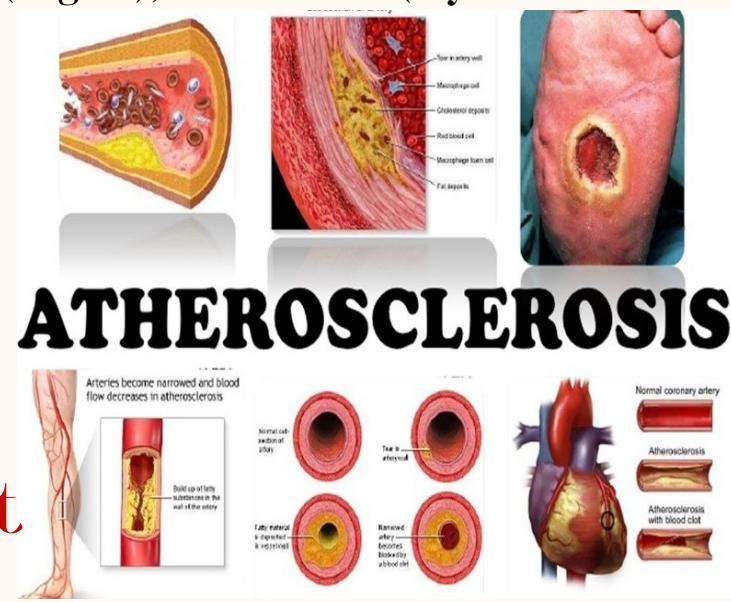
Atherosclerosis in the coronary arteries can reduce blood flow to the heart muscle, leading to CAD. This can cause chest pain (angina), heart attack (myocardial infarction), or even heart failure.

2 Peripheral artery disease (PAD):

Atherosclerosis can occur in the arteries supplying blood to other parts of the body, such as the legs or arms. PAD can lead to pain, decreased mobility, and an increased risk of non-healing wounds or infections.

Plants used in treatment of atherosclerosis

Several plants are known for their therapeutic benefits in the treatment of atherosclerosis. Here are some examples:



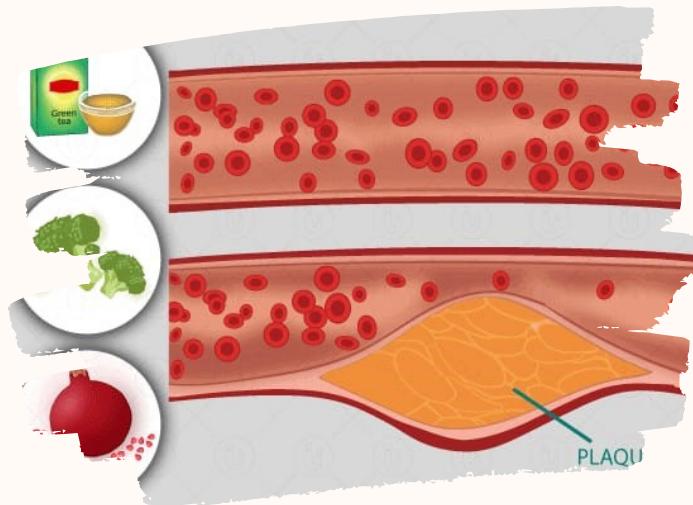
1. Garlic: As previously mentioned, garlic contains allicin and other active compounds that help to reduce inflammation and oxidative stress that contribute to the progression of atherosclerosis. [3]

2. Turmeric: The active ingredient in turmeric, curcumin, has been shown to have anti-inflammatory effects and may help prevent the buildup of arterial plaque.

3. Hawthorn: Hawthorn contains flavonoids and other antioxidants that help to improve circulation and reduce blood pressure, both of which are important for reducing the risk of atherosclerosis. [4]

4. Ginger: Ginger has anti-inflammatory properties and has been shown to help lower cholesterol levels, which can help to prevent the development of atherosclerosis. [5]

5. Ginkgo Biloba: Ginkgo Biloba has been shown to improve blood flow and reduce the risk of blood clots, which can help to reduce the risk of atherosclerosis. [6]



6. Green tea: contain Antioxidant properties: contains polyphenols, particularly catechins, which have potent antioxidant effects. These compounds may help reduce oxidative stress and inflammation, both of which play a role in the development and progression of atherosclerosis.

Lipid profile improvement: Several studies suggest that green tea may have a positive impact on lipid metabolism. It may help lower total cholesterol levels, reduce LDL (bad) cholesterol oxidation, and increase HDL (good) cholesterol levels, which are all beneficial for heart health.

Blood pressure regulation: Regular consumption of green tea has been associated with modest reductions in blood pressure. High blood pressure is a significant risk factor for the development of atherosclerosis, so managing blood pressure levels can help prevent or slow down the progression of the condition.

Endothelial function improvement: The endothelium is the inner lining of blood vessels. Dysfunction of the endothelium is closely related to atherosclerosis. Some research suggests that green tea may improve endothelial function and promote the dilation of blood vessels, which can enhance blood flow and potentially reduce plaque formation [7].



Pomengrate, broccoli, Turmeric will have discussed in details.

Pomengrate

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(Punica granatum) is a fruit-bearing deciduous shrub including the juice and the seeds. Pomegranate belongs to the family Lythraceae.

Active constituent

1-Punicalagins

2. Ellagic Acid

3. Anthocyanins

4-Flavonoids: Pomegranate contains various flavonoids, such as quercetin, kaempferol, and luteolin

5- Other Fatty Acids: Pomegranate seeds also contain small amounts of other fatty acids, including oleic acid and linoleic acid. These are monounsaturated and polyunsaturated fatty acids [8]



Mechanism of action

1. *Antioxidant Activity*: Pomegranate is known for its high levels of antioxidants, including polyphenols like ellagic acid and punicalagin. These antioxidants can help reduce oxidative stress and inflammation, which are key factors in the development of atherosclerosis.

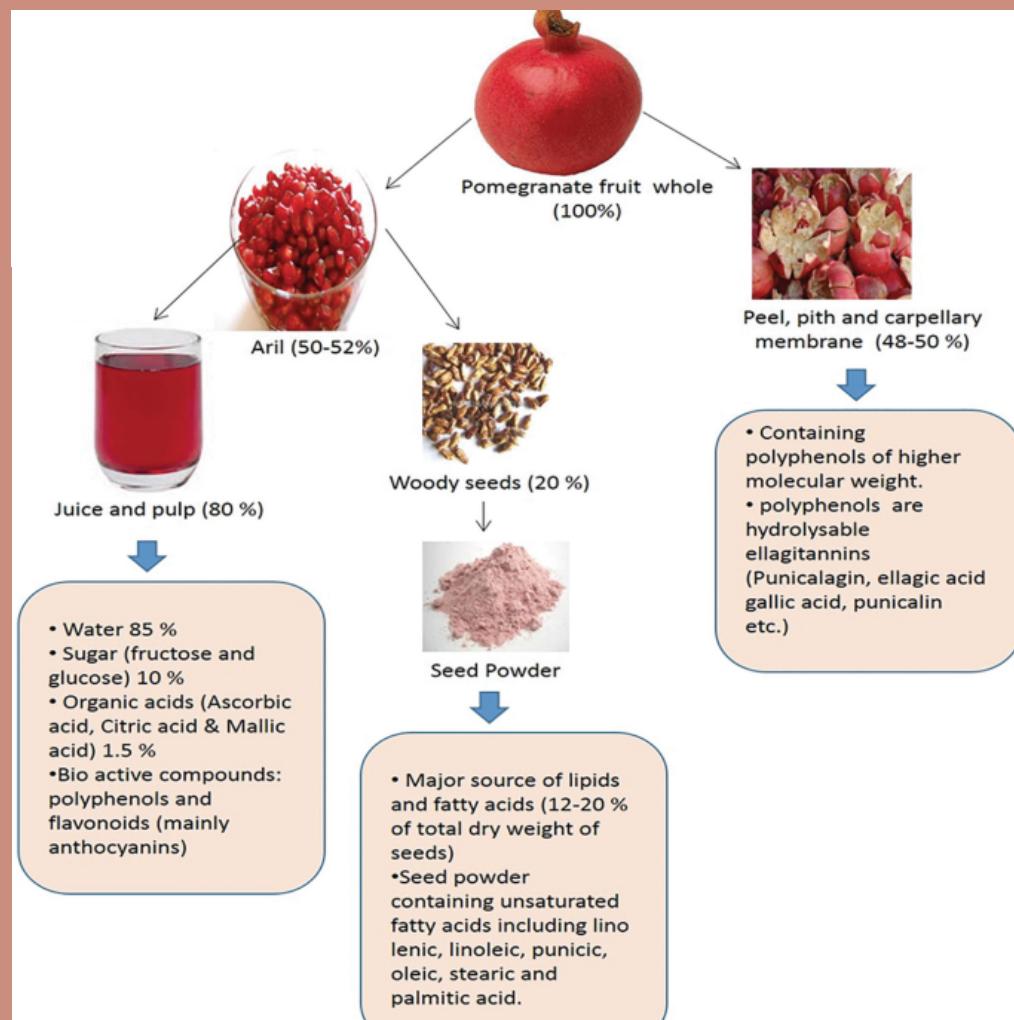
2. *Anti-inflammatory Effects*: Chronic inflammation plays a significant role in the progression of atherosclerosis. Pomegranate has been shown to have anti-inflammatory properties, helping to reduce inflammatory markers and cytokines associated with the condition. This may contribute to the prevention or slowing down of plaque formation in the arteries.

3. *Lipid-Lowering Effects*: Pomegranate has been found to have lipid-lowering effects, particularly in reducing LDL cholesterol oxidation. Oxidized LDL cholesterol is more likely to contribute to the development of atherosclerosis. By reducing oxidation, pomegranate may help inhibit the formation of plaque in the arteries.

4. *Endothelial Protection*: Endothelial dysfunction is an early event in atherosclerosis.

Pomegranate has demonstrated potential in improving endothelial function, enhancing nitric oxide bioavailability, and reducing endothelial inflammation.

These effects may contribute to the maintenance of proper arterial function and reduce the risk of plaque formation. [9]



Side effect and contraindication

1-Allergic Reactions: Some individuals may be allergic to pomegranate. Allergic reactions can range from mild symptoms like itching and hives to more severe reactions like difficulty breathing or anaphylaxis. If you have known allergies to pomegranate or any related fruits, it is best to avoid it.

2. Interaction with Medications: Pomegranate juice or supplements may interact with certain medications, particularly those processed by enzymes in the liver called cytochrome P450. Pomegranate contains compounds that can inhibit these enzymes, leading to increased drug levels in the body. This can potentially affect the therapeutic efficacy or increase the risk of side effects of medications such as statins, blood thinners, and certain blood pressure medications.

It is recommended to consult with a healthcare professional if you are taking any medications before adding pomegranate supplements to your routine.

3. Blood Pressure Effects: Pomegranate juice may have a slight blood pressure-lowering effect. While this can be beneficial for many people, individuals who already have low blood pressure or are on antihypertensive medications should exercise caution and monitor their blood pressure levels closely when consuming pomegranate in large amounts or taking pomegranate supplements.

4. Gastrointestinal Upset: In some cases, consuming excessive amounts of pomegranate juice or seeds may cause gastrointestinal discomfort, such as stomach cramps, diarrhea, or indigestion. It's wise to consume pomegranate in moderation to minimize the risk of such symptoms.

5. Interference with Kidney Function: Pomegranate juice contains high levels of potassium. Individuals with kidney problems or those on potassium-restricted diets should be cautious about consuming large quantities of pomegranate juice, as it may potentially increase potassium levels in the blood.

Other medicinal uses [10]

Skin health

Oral health

Cardiovascular health

Antidiabetic

Anticarcinogenic

Anti-inflammatory activity



Broccoli

Brassica oleracea L. belongs to the Brassicaceae family

Active constituent

1. Vitamin C
2. Fiber
3. Flavonoids: Broccoli contains flavonoids like kaempferol and quercetin,
4. Glucosinolates: Broccoli is well-known for its high glucosinolate content, which are sulfur-containing compounds that can be converted into various potent bioactive compounds like sulforaphane.
5. Carotenoids: Broccoli contains carotenoids such as beta-carotene, lutein, and zeaxanthin,
6. Vitamins and minerals: Broccoli provides essential vitamins such as vitamin K, vitamin A, vitamin E, and B-vitamins, as well as minerals like potassium, calcium, and iron.[11]



Mechanism of action

- 1. Anti-inflammatory properties:** Broccoli contains compounds such as sulforaphane and flavonoids that possess anti-inflammatory effects. Chronic inflammation plays a crucial role in the development and progression of atherosclerosis. By reducing inflammation, broccoli may help protect arterial walls from damage and prevent plaque formation.
- 2. Antioxidant activity:** Broccoli is rich in antioxidants like vitamin C, vitamin E, and various phytonutrients. These compounds help neutralize harmful free radicals and reduce oxidative stress. Oxidative stress contributes to the oxidation of LDL cholesterol, a key event in the formation of arterial plaques. Antioxidants in broccoli may inhibit this oxidation process and protect against atherosclerosis.
- 3. Lipid profile regulation:** Certain components found in broccoli, such as fiber and phytosterols, have been associated with improving lipid profiles. Fiber can help decrease total cholesterol levels, particularly LDL cholesterol. Phytosterols, which are structurally similar to cholesterol, can compete with it for absorption in the intestine, leading to lower blood cholesterol levels. By positively influencing lipid levels, broccoli may reduce the risk of atherosclerotic plaque formation.

- 4. Nitric oxide production:** Sulforaphane in broccoli has been shown to increase the production of nitric oxide (NO) in the body. NO helps relax blood vessels and improve endothelial function, promoting healthy blood flow. Dysfunction of the endothelium, the inner lining of blood vessels, is an early event in atherosclerosis. By enhancing NO production, broccoli may support endothelial health and reduce the chances of plaque formation.[12]

Side effect

1. Gastrointestinal discomfort: Some people may experience bloating, gas, or an upset stomach after consuming broccoli, particularly in large amounts. This is because broccoli contains fiber, which can be difficult for some individuals to digest easily. If you notice any discomfort, it may be helpful to moderate your intake or cook broccoli to make it more easily digestible.

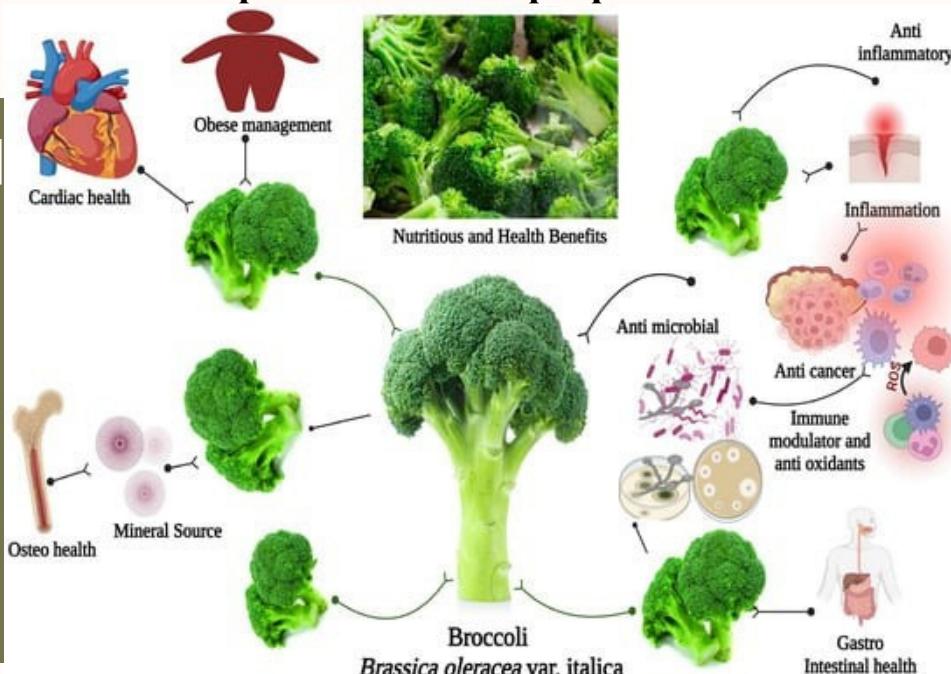
2. Thyroid conditions: Broccoli belongs to a group of vegetables known as cruciferous vegetables. It naturally contains compounds called goitrogens, which can interfere with the absorption of iodine by the thyroid gland. For individuals with pre-existing thyroid conditions or iodine deficiency, excessive consumption of raw or uncooked broccoli may potentially worsen their condition. However, cooking broccoli can help reduce the goitrogenic activity, making it safer to consume.

3. Blood-thinning medications: Broccoli, like many other green leafy vegetables, contains vitamin K, which plays a role in blood clotting. If you are taking blood-thinning medications such as warfarin (Coumadin), it's important to maintain a consistent intake of vitamin K-rich foods, including broccoli. Speak with your healthcare provider or a registered dietitian to ensure appropriate management of vitamin K intake while on blood-thinning medications.

4. Allergies: While rare, some individuals may have allergies or sensitivities to broccoli. Symptoms of an allergic reaction may include itching, hives, swelling, difficulty breathing, or digestive discomfort. If you suspect an allergy, it's best to avoid broccoli and consult with a healthcare professional for proper evaluation and guidance.[13]

Other medicinal uses [14]

- Anti microbial
- Anti cancer
- Anti-inflammatory
- Gastrointestinal health
- Cardiac health
- Osteo health
- Mineral source



Turmeric كركم

Turmeric is the dried rhizome or underground stem of the perennial herb, *Curcuma longa* L. (family: Zingiberaceae)

Main active constituents : [15]

1-curcuminoids and curcumin These compounds are known to have powerful anti-inflammatory and antioxidant properties

2-volatile oils such as p-cymene, limonene and eugenol ,Cineol , Tumeron , bisdemethoxycurcumin , Demethoxycurcumin , Diaryl heptanoids



Mechanism of action : [16]

Turmeric exerts cardio-protective effects and anti atherosclerosis activity mainly by antioxidant activity, inhibiting platelet aggregation and decreased susceptibility of LDL to lipid peroxidation, in addition to lower plasma cholesterol and triglyceride levels. Turmeric effect on cholesterol levels due to decreased cholesterol uptake in the intestines and increased conversion of cholesterol to bile acids in the liver. Inhibition of platelet aggregation by turmeric constituents is thought to be via potentiation of prostacyclins synthesis and inhibition of thromboxane synthesis.

Side effect and Contraindications [17] [18]

1-Turmeric usually does not cause significant side effects; however, some people can experience stomach upset, nausea, dizziness, or diarrhea , headache, and yellow stool. Rare cases of contact dermatitis and anaphylaxis have also been reported.

2-Avoid use during pregnancy and lactation because of emmenagogue and uterine stimulant effects.

3-Turmeric should not be used in patients with gallstones or bile duct or passage obstruction or any biliary disease.

4-contraindicated if hypersensitive to any of the components of curcumin.

5-a high dose of turmeric can also interact with certain medications. For example, pain relievers as supplements can lessen the positive effects of ibuprofen, aspirin, and indomethacin.

6-Additionally, in the case of blood thinners, it can increase the risk of bleeding in individuals having warfarin.

Individuals taking tacrolimus can also experience high side effects if you consume high turmeric

Other medicinal uses of the plants [19]

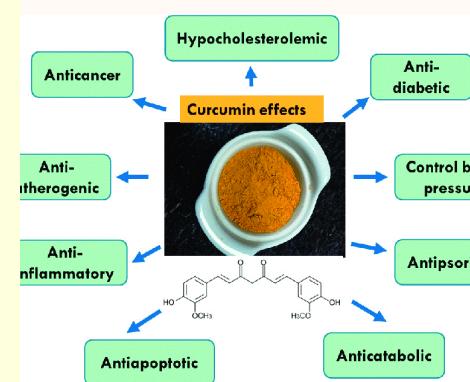
1-for immunity Turmeric is known as an immunity booster herb.

3-for wound healing

4- for digestion

5- Anti diabetes

6- for liver - helps in detoxification and helps maintain liver health.



Pharmaceutical preparations in the market for each plant

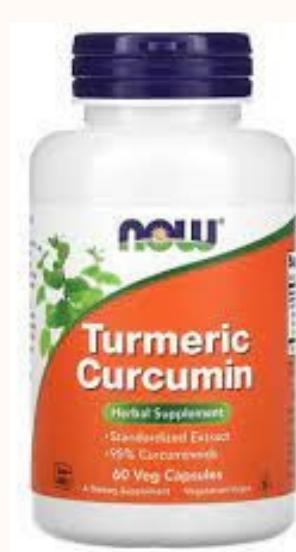
Pomengrate



Broccoli



Turmeric



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