



Cardioprotective Action of Amomum Subulatum

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ABSTRACT

Large cardamom (*Amomum subulatum* Roxb.), a perennial herbaceous plant, is one of the major spices grown in India. *Amomum* is the second largest genus in the family Zingiberaceae. Various studies proved that it have various cardio protective actions. Cardiovascular diseases are a group of disease which affects the function of heart and blood vessels. CVD have major effect on the majority of the population of the country. The need of reducing the risk of CVD is a major need of the decade. There are various herbs and nutraceuticals which have effect as cardio protectives. Cardamom is a important spice which have major cardio protective action. Studies says cardamom can reduce various CVD like hypertension angina atherosclerosis etc. Anti-oxidant property of cardamom produces the cardio protective action.

KEY WORDS: Amomum subulatum, hypertension, nutraceuticals

INTRODUCTION

CVD is not a single disease, but a cluster of diseases and injuries that affect the cardiovascular system (the heart and blood vessels). These are most commonly diseases of the heart and of the blood vessels of the heart and brain. In general, they affect people in later life (with incidence rising sharply after the 30-44 age range). Cardiovascular diseases (CVD) which mainly include coronary heart disease (CHD), stroke, rheumatic heart disease (RHD) and cardiomyopathy represent the leading cause of death worldwide.

Various heart diseases are as follows.

Coronary heart disease (CHD): also called coronary artery disease (CAD) and Atherosclerotic heart disease, is the result of the accumulation of atheromatous plaques within the walls of the arteries that supply blood to the myocardium (the muscle of the heart). While the symptoms and signs of coronary heart disease are noted in the advanced state of Disease, most individuals with coronary heart disease show no evidence of disease. Disease progresses before the first onset of symptoms, often a “sudden” heart Attack, finally arise. After decades of progression, some of these athermanous plaques may rupture and (along with the activation of the blood clotting system) start limiting blood Flow to the heart muscle. The disease is the most common cause of sudden death. ^[1]

Angina: The pain associated with very advanced CHD is known as angina, and usually presents as a Sensation of pressure in the chest, arm pain, jaw pain, and other forms of discomfort. The word discomfort is preferred over the word pain for describing the sensation of angina, because it varies considerably among individuals in character and intensity and most People do not perceive angina as painful, unless it is severe. Angina is essentially a cramp in the heart muscle.

Stroke: A stroke is an acute neurological injury whereby the blood supply to a part of the brain is interrupted, either by arterial blockage or rupture (haemorrhage). The part of the brain Perfused by a blocked or burst artery can no longer receive oxygen carried by the blood; Brain cells are therefore damaged or die (become necrotic), impairing the function of that Part of the brain. Stroke can cause permanent neurological damage or death if not promptly diagnosed and treated. Strokes can be classified into two major categories: ischemic and haemorrhagic.

Rheumatic heart disease: Rheumatic heart disease is a condition in which the heart valves are damaged by rheumatic Fever caused by streptococcal infection. Rheumatic fever is an inflammatory disease that Can affect many of the body’s connective tissues — especially those of the heart, joints, Brain, or skin. Anyone can get acute rheumatic fever, but it usually occurs in children five to 15 years old. ^[2]

Congenital heart disease: congenital heart disease is a broad term that can describe several different Abnormalities affecting the heart, all of which are abnormalities of the heart’s structure and Function caused by abnormal or disordered heart development before birth.

Peripheral arterial disease: In peripheral arterial disease, the arteries that supply the blood to the legs become narrowed or completely blocked off. The narrowing of the artery usually occurs in the upper part of the leg. The disease is caused by a gradual build-up of fatty material within the walls of the artery (atherosclerosis).

Other cardiovascular diseases These could include tumours of the heart, vascular tumours of the brain, disorders of the heart muscle (cardiomyopathy), heart valve diseases and disorders of the lining of the heart.

RISK FACTORS FOR CARDIOVASCULAR DISEASE

The most important behavioural risk factors of heart disease and stroke are unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol. The effects of behavioural risk factors may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, and overweight and obesity. These “intermediate risks factors” can be measured in primary care facilities and indicate an increased risk of heart attack, stroke, heart failure and other complications.^[3]

SYMPTOMS OF CARDIOVASCULAR DISEASES

Often, there are no symptoms of the underlying disease of the blood vessels. A heart attack or stroke may be the first sign of underlying disease.

Symptoms of a heart attack include:

- pain or discomfort in the centre of the chest; and/or
- Pain or discomfort in the arms, the left shoulder, elbows, jaw, or back.

In addition, the person may experience difficulty in breathing or shortness of breath; nausea or vomiting; light-headedness or faintness; a cold sweat; and turning pale. Women are more likely than men to have shortness of breath, nausea, vomiting, and back or jaw pain.

The most common symptom of a stroke is sudden weakness of the face, arm, or leg, most often on one side of the body. Other symptoms include sudden onset of:

- Numbness of the face, arm, or leg, especially on one side of the body.
- Confusion, difficulty speaking or understanding speech.
- Difficulty seeing with one or both eyes.
- Difficulty walking, dizziness and/or loss of balance or coordination.
- severe headache with no known cause; and/or
- fainting or unconsciousness^[4]

MANAGEMENT

The key to cardiovascular disease reduction lies in the inclusion of cardiovascular disease management interventions in universal health coverage packages, although in a high number of countries health systems require significant investment and reorientation to effectively manage CVDs.

Evidence from 18 countries has shown that hypertension programmes can be implemented efficiently and cost-effectively at the primary care level which will ultimately result in reduced coronary heart disease and stroke. Patients with cardiovascular disease should have access to appropriate technology and medication. Basic medicines that should be available include:

- Aspirin.
- Beta-blockers.
- angiotensin-converting enzyme inhibitors and
- Statins.

Sometimes, surgical operations are required to treat CVDs. They include:

- Coronary artery bypass.
- Balloon angioplasty (where a small balloon-like device is threaded through an artery to open the blockage).
- Valve repair and replacement.
- heart transplantation; and

- Artificial heart operations.

Medical devices are required to treat some CVDs. Such devices include pacemakers, prosthetic valves, and patches for closing holes in the heart.^[5]

CARDAMOM

Cardamom also spelled cardamom, spice consisting of whole or ground dried fruits, or seeds, of *Elettaria cardamomum*, a herbaceous perennial plant of the ginger family (Zingiberaceae). The seeds have a warm, slightly pungent, and highly aromatic flavour somewhat reminiscent of camphor. They are a popular seasoning in South Asian dishes, particularly curries, and in Scandinavian pastries.^[6]



Fig no 1: cardamom

DESCRIPTION

Leafy shoots of the cardamom plant arise 1.5 to 6 metres (5 to 20 feet) from the branching rootstock. Flowering shoots, approximately 1 metre (3 feet) long, may be upright or sprawling; each bears numerous [flowers](#) about 5 cm (2 inches) in diameter with greenish petals and a purple-veined white lip. The whole [fruit](#), 0.8 to 1.5 cm, is a green three-sided oval capsule containing 15 to 20 dark, reddish brown to brownish black, hard, angular [seeds](#). The [essential oil](#) occurs in large [parenchyma cells](#) underlying the epidermis of the seed coat. The essential oil content varies from 2 to 10 percent; its principal components are cineole and α -terpinyl acetate.^[7]

CULTIVATION AND PROCESSING

Cardamom fruits may be collected from wild plants, native to the moist forests of southern India, but most cardamom is [cultivated](#) in [India](#), [Sri Lanka](#), and [Guatemala](#). The fruits are picked or clipped from the stems just before maturity, cleansed, and dried in the sun or in a heated curing chamber. Cardamom may be bleached to a creamy white colour in the fumes of burning [sulphur](#). After curing and drying, the small stems of the capsules are removed by winnowing. Decorticated cardamom consists of husked dried seeds.^[8]



Fig no 2: cardamom plant

TYPE OF CARDAMOM

Cardamom is mainly two type (green) Small cardamom and (black) large cardamom. Small green cardamom biological source is *Elettaria Cardamomum*, and it is the most Common type of cardamom while black Cardamom is mainly grown in India. The largest Producing cardamom country is Guatemala in India^[9]

CHEMICAL CONSTITUENTS

Chemical Constituent-Table under the study of Gas Chromatography- Mass Spectroscopy (GC-MS) area (%)

1. α -terpinyl Acetate

Its chemical formula is $C_{12}H_{20}O_2$ and other name of α -terpinyl acetate is Terpeneol acetate. IUPAC Name of α -terpinyl acetate Is-2-(4-methylcyclohex-3-en-1-yl) propan-2-yl Acetate. Boiling point is 115.0°C.

2. 1, 8-cineole

Its chemical formula is $C_{10}H_{18}O$ and molecular Weight is 154.25 and other name is Eucalyptol. IUPAC name of 1,8-cineole is 1,3,3-trimethyl-2-oxabicyclo [2.2.2]octane.

3. α -terpineol

Its chemical formula is $C_{10}H_{18}O$. Molecular Weight is 154.25 and other name is-2-(4-methylcyclohex-3-en-1-yl) Propan-2-ol, α -Menth-1 -en-8-ol. IUPAC name--2-(4-methylcyclohex-3-en-1-yl) propan-2-ol.

4. Limonene

Its chemical formula is $C_{10}H_{16}$ and molecular Weight is 136.23 and other name is cinene, Cajaputene etc. IUPAC name is 1-methyl-4-prop-1-en-2-ylcyclohexene with Boiling point 176.00C. It is colour less liquid with pleasant lemon like odour and sweet and citrus in taste.

4. α -pinene

Its chemical formula is $C_{10}H_{16}$ and molecular Weight is 136.23 and other name is Acintene A, α -Pinene etc. Boiling point is 313.20F or 1550C. Its IUPAC name is 2,6,6-trimethylbicyclo [3.1.1] hept-2-ene.

5. β -pinene

Its chemical formula is $C_{10}H_{16}$ and molecular Weight is 136.23 and another name is No pinene, 2(10)-Pinene, etc. It is colourless transparent Liquid characteristic turpentine odour, dry woody or resinous aroma odour and piney and turpentine Like taste and its boiling point is 166.00C.^[10]

PHARMACOLOGICAL ACTIVITY OF CARDAMOM

Cardamom has the many medicinal and pharmacological activity like- antiseptic (pulmonary), antispasmodic (neuromuscular), aphrodisiac, expectorant, anthelmintic, antibacterial (variable), cephalic, cardiogenic, diuretic, emmenagogue, sialagogue and stomachic.

Anti-inflammatory: The small cardamom is used to treat Gums infection and throat infection and Relieve in inflammation of the lungs and Pulmonary tuberculosis and also helpful digestive Disorder. The extract of cardamom in ethanolic aqueous medium produce anti-inflammatory Effect against carrageenan induced paw oedema in rat.

As Antidote: Some research reported that it is also effective against snake and scorpion venom.^[11]

Anti- ulcerogenic: The large cardamom has also use treat gastrointestinal disorder. Because it produces Cooling effect the methanolic extract seed of Cardamom produce the analgesic effect.

Analgesic, Laxative and Anti-Depressant: The Methanolic extract at dose 140 to 280 mg/kg and ethyl extract at dose of 180 and 390 mg/kg of seeds showed analgesic effect. According to researcher, the methanolic Extract of cardamom seed shows a analgesic Activity. Depression is very common in current Days mostly every people suffering from Depression it is a type of mental disorder its affect or low energy low of interest and appetite it's also Impact on our life activities. Cardamom oil is also helpful in the digestive system it also acts as a Laxative and soothes colic. In present days marble Burying test in rats to evaluate antidepressant Activity of cardamom oil is studying^[12]

Anti-Diarrhoeal and Anti Carminative Properties: We well know cardamom is a sweet spice and used as a flavouring agent. The fruit of Cardamom has the carminative properties in GIT Problems by help of extract in hot water. It's also Affected in castor oil and magnesium sulphate Induced diarrhoea.

Antioxidant: The cardamom seed are the rich source of Antioxidant agent its neutralizing the free radicle Oxidative stress is the main reason of many Degenerative disease such as diabetes cancer. Cardamom is natural source of the antioxidant Agent in current days natural agent are very Popular in use. Some in vitro studies found that Carcinogenic activity.^[13]

Antimicrobial Activity: Cardamom is the most investigational Compound which gives antimicrobial effect. Generally it carries extract of essential oil and Extract of fruit and seeds. According to this study, the cardamom showed capable to cure many Microorganisms which are pathogenic such as *E. coli*, *S. aureus* and *Bacillus cereus*. And other Study was carried out cardamom showed Antibacterial activity against many bacteria Species such as *Aggregatibacter Actinomycetemcomitans*, *Fusobacterium Nucleatum*, *Porphyromonas gingivalis*, in most of the studies was conducted and it show cardamom Extract can be cure as a source of agent which are Capable to treat dental problem like tooth ache and bad smell in mouth.^[14]

CARDIOVASCULAR ACTIVITIES OF CARDOMOM

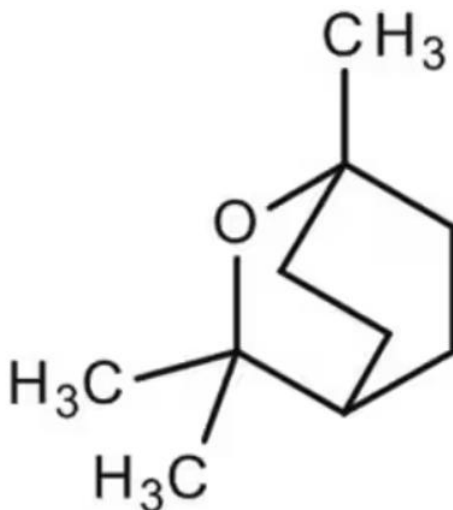
The present study findings demonstrate that cardamom significantly protects the myocardium and exerts cardioprotective effects by free radical scavenging and antioxidant activity. It can improve heart health and reduce the risk of heart disease by controlling one of the major risk factors which is high blood pressure.

Cardamom contains 1,8-cineole which is responsible for the cardioprotective action

1, 8-cineole was revealed to markedly alleviate ISO-induced heart injury, and reduce cardiac hypertrophy, formation of the cytoplasmic vacuole, loss of myofiber, and by inhibiting oxidative stress and ER stress. 1, 8-cineole reduces apoptosis by inhibiting signaling pathways related to oxidative stress and ER stress.^[13]

1,8-Cineole (also known as eucalyptol) is mostly extracted from the essential oils of plants, which showed extensively pharmacological properties including anti-inflammatory and antioxidant mainly via the regulation on NF- κ B and Nrf2, and was used for the treatment of respiratory diseases and cardiovascular.

Eucalyptol (1,8-cineole), a terpenoid oxide isolated from *Eucalyptus* species, is a promising compound for treating such conditions as it has been shown to have anti-inflammatory and antioxidant effects in various diseases, including respiratory disease, pancreatitis, colon damage, and cardiovascular and neurodegenerative diseases. Eucalyptol suppresses lipopolysaccharide (LPS)-induced proinflammatory cytokine production through the action of NF- κ B, TNF- α , IL-1 β , and IL-6 and the extracellular signal-regulated kinase (ERK) pathway, and reduces oxidative stress through the regulation of signaling pathways and radical scavenging. The effects of eucalyptol have been studied in several cell and animal models as well as in patients with chronic diseases. Furthermore, eucalyptol can pass the blood-brain barrier and hence can be used as a carrier to deliver drugs to the brain via a microemulsion system.^[8]



Various studies showed that cardamom not only lowered the mean arterial blood pressure significantly but also decreased the heart rate in rats. The bradycardiac effects of cardamom might be because of muscarinic receptor stimulation. The blockage of cardamom activity [hypotensive and bradycardiac effect] by atropine pre-treatment suggests the involvement of a cholinergic mechanism and muscarinic acetylcholine receptor. M2 subtype activation due to cholinomimetic constituent might cause hypotension and bradycardia as a result of the diminished firing rate at the Sino atrial node (SA node) in the heart. It was also suggested that vascular endothelial muscarinic receptor stimulation leads to the production of NO, which diffuses into smooth muscle cells to relax and cause hypotension. This reveals that cardamom might cause both hypotension and bradycardia

Cardamom was safe and did not cause any mortality or side effect in rats. SHR showed hypertension (an increase in BP) with depressive effects on the HRV. Different doses of cardamom (decoction) exhibits profound antihypertensive effects with a positive impact on HRV in rats, which might be due to activation of muscarinic receptors. Cardamom thus showing great potential for impacting hypertension and HRV.

The present investigation reveals that cardamom exerts cardio protection against ISO-induced MI by ameliorating the hemodynamic and left ventricles impairment, thwarting lipid peroxidation, and harnessing endogenous antioxidant defence system along with histological and ultra-structural

preservation of cardiomyocytes reflected by reduced leakage of myositis injury marker enzymes. ISO-induced MI is an extensively employed in vivo animal model for the experimental evaluation of cardio protective agents as it is clinically pertinent in recapitulating the features of human MI. Administration of subcutaneous injections of ISO causes imbalance between oxygen supply and demand by the cardiomyocytes through increasing the chronotropism and inotropism.^[15]

Cardamom has shown involved in the scavenging of ROS and confer defence against lipid peroxidation in accordance to the previous observations demonstrated anti oxidative mechanism against the free radical induced oxidative damages of body organs. Cardamom treatment also improved the contractile function of the left ventricles as substantiated by improving inotropic ((+) LVdP/dtmax a marker of contraction of heart) and lusitropic ((-) LVdP/dtmax, a marker of relaxation of heart) states of the heart. Furthermore, cardamom also attenuated the increase of LVEDP, an alternative sign of preload that, apparently, represents enhanced contractile function of the left ventricle. Improved hemodynamic and contractile function of left ventricles by cardamom treatment clearly indicates its favourable effect on the hemodynamic and contractile function of the heart in course of the ischemic insult caused by ISO. The study demonstrates that cardamom has potential to protect against MI by restoring endogenous antioxidants, preserving histopathology and ultrastructure of myocardium, and improving cardiac function. The findings of this study are suggestive of cardamom as an adjunct in prophylaxis from MI or as a beneficial mediator in delaying the initiation, progression and development of MI, in patients who are at risk of developing ischemic heart disease. However, for use in humans, further studies are warrant.^[16]

Cardiovascular effects of 1, 8 -cineole, a monoterpenoxide have been evaluated in various experimental studies and demonstrated to possess vascular relaxant, anti-inflammatory and antioxidant properties. The other major components isolated from Greater cardamom are Cardamomum and Alpine tin which have also shown significant anti-inflammatory, vasodilatory and platelet aggregation inhibitory activities in various animal studies. These compounds might be responsible for the observed hypolipidemic and fibrinolysis enhancing activities of Greater cardamom in the present study. Seeds also possess antioxidant activity as studied on hepatic and cardiac antioxidant enzymes, glutathione content and lipid conjugated dines in rats fed high fat diet and in vitro DPPH radical scavenging activity. The antioxidant activity was attributed to their ability to activate antioxidant enzymes that catalyse the reduction of antioxidants. It is therefore; clear that cardamom contains components which enhance TAS. Moreover, in the present study, not only cardamom seeds but the pericarp was also incorporated containing flavonoids and tannins which also possess antioxidant activities.^[17]

The present study therefore, suggests that long term dietary supplementation of Greater cardamom favourably alters lipid profile and significantly enhances fibrinolytic activity and total antioxidant status in patients with IHD. It is safe, well tolerated dietary functional food without any untoward side effects. Furthermore, in view of its stress adaptogenic property, it may prove to be beneficial as dietary supplement to patients with coronary artery disease.^[18]

Cardamom reduce the influx of Ca^{++} through calcium channels in cardiac muscle and to decrease aortic pressure. This ability of cardamom has been achieved directly by blocking the Ca - channel, and indirectly by inhibition the high K^{+} -induced contraction^[19]

Administration of one capsule of cardamom three times daily for a total of 3g per day for 3 months resulted in significant decrease in systolic and diastolic blood pressure, This decrease in blood pressure is very necessary to prevent or at least to reduce the risk of myocardial infarction and/or stroke because myocardial infarction and stroke which are both complications of hypertension, predominantly occur as a result thrombosis. The phytochemical analysis outcomes displayed that cardamom contains alkaloids, flavonoids, sterols, saponins, and tannins. Cardamom contains many bioactive phytochemicals and other essential oils, among the major constituents are 1,8-cineole, terpinyl acetate, limonene, terpinolene and Mycenae.^[20]

CONCLUSION

Many previous studies have confirmed the pharmacological properties that associated with cardamom due to the high content of bioactive compounds. Especially its action in lowering blood pressure, this can be achieved by its role as

Anti-oxidant: Oxidative stress can result in endothelial dysfunction and reduction in endothelium dependent vasodilation causing increase in peripheral vascular resistance as a result of lowering nitric oxide production. These structural changes can lead to hypertension. Cardamom, reduce these structural alterations via its action as antioxidant and so, will lower hypertension.

Calcium channel blocker: cardamom reduce the influx of Ca^{++} through calcium channels in cardiac muscle and to decrease aortic pressure. This ability of cardamom has been achieved directly by blocking the Ca - channel

Cholinomimetic: Cardamom has cholinomimetic activity by its action on M3 receptor causing vasodilation and decrease peripheral resistance.

Diuretic: The diuretic effect has been achieved by its action to increase urine volume in addition, enhancing K^{+} and Na^{+} excretion

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