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A COMPREHENSIVE REVIEW OF CINNAMON BARK IT'S PHARMACOLOGICAL ACTIVITY

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ABSTRACT

Many studies have been conducted on the pharmacological 2 characteristics and possible therapeutic uses of cinnamon bark, a spice that is frequently used in both traditional medicine and cooking. The objective of this review is to give a thorough analysis of the bioactive substances found in cinnamon bark, their modes of action, and their potential advantages in treating a range of illnesses. Numerous bioactive substances found in cinnamon bark, such as eugenol, cinnamaldehyde, and cinnamic acid, have been demonstrated to have anti-inflammatory, anti-bacterial, antidiabetic, and antioxidant qualities. Because of these qualities, cinnamon bark may be used as an adjuvant treatment for a number of illnesses, such as diabetes, heart disease, and neurological conditions. Cinnamon bark may also be used to treat a number of illnesses because it has been demonstrated of possess antibacterial qualities. The possible therapeutic applications are highlighted in this review.

Crucial oils and other compounds including cinnamon aldehyde, cinnamic acid, and cinnamonate are the main ingredients of cinnamon. Cinnamon has been shown to have properties against neurological conditions including Parkinson's and Alzheimer's illnesses in addition to being an antioxidant, anti-inflammatory, antidiabetic, antibacterial, anticancer, lipid-lowering, and cardiovascular disease-lowering substance. The pharmacological potential of cinnamon and its everyday applications are demonstrated in this paper. It stops cancer cells from growing. A "N" number of pharmacological studies have verified that this plant has antimicrobial, anti-diabetic, anti-cancer, and cardioprotective properties. You will find comprehensive information about the majority of cinnamon's characteristics in this article.

KEYWORDS: Cinnamon bark, Cinnamaldehyde, Pharmacological properties, Therapeutic applications, Diabetes, Cardiovascular disease, Neurodegenerative disorders.

INTRODUCTION

The plant known as cinnamon, Cinnamomum zeylanicum Blume (Family Lauraceae), belongs to the class Magnoliopsida in the botanical division Magnoliophyta. Cinnamomum zeylanicum is typically grown in southern India. However, it comes from the island of Sri Lanka, which was originally known as Ceylon, which is located southeast of India. Cinnamaldehyde, the main ingredient and essential oil of cinnamon, together with a host of other components, such as eugenol, give it its flavour and scent. Commercial cinnamonomum cultivation is limited to a few species. Although the majority of cinnamon used in international trade comes from the related species Cinnamomum cassia, popularly known as "cassia," Cinnamomum verum is occasionally regarded as "true cinnamon." China and Indonesia generated 70% of the world's cinnamon supply in 2018, with Indonesia contributing approximately 40%.[1]

The fracture is short and splintery, and the surface is striated lengthwise. Each kilogramme of it comprises a minimum of 12 millilitres of essential oil that has been steam-distilled. Its distinct scent is both seductive and agreeable. It has a mucilaginous, highly spicy, slightly sweet, and barely sharp flavour.[2] Cinnamaldehyde (60–75%) makes up up to 4% of the essential oil in cinnamon bark. It is followed by cinnamyl acetate (1–5%), eugenol (1–10%), -caryophyllene (1-4%), linalool (1-3%), and 1.8-cineole (1-2%). Cinnzeylanol and its acetyl derivative, cinnzeylanine, and the sugar mannitol are pentacyclic diterpenes.[3] Mucilage polysaccharides, L-arabino-Dxylanose, L-arabino-Dxylose, Dxylose, and D-glucane Cinnamon possesses anti-inflammatory, anti-microbial, blood glycaemic, cardiovascular, cognitive, and anticarcinogenic qualities, according to research.[4,5]

Mucilage polymers, D-xylose, D-glucane, L-arabino-Dxylanose, and L-arabino-Dxylose Numerous studies have demonstrated the pharmacological properties of cinnamon, including its anti-inflammatory, anti-microbial, blood glucose, cardiovascular, cognitive, and anticarcinogenic properties (6,7). Diarrhoea and other digestive system issues have also been treated with it. Cinnamon has a lot of antioxidant properties. Additionally, the antibacterial qualities of cinnamon essential oil help to preserve some goods. According to reports, "cinnamon" has amazing pharmacological effects when used to treat type II diabetes.

Traditionally, cinnamon has been used to heal toothaches and foul breath. It is also said to help with digestion and prevent colds when taken regularly.[8]

In addition to being used as a spice to make tea, cinnamon bark has been utilised as a seasoning in oriental medicine to cure chronic GI (gastrointestinal) and medical speciality issues, as well as common colds and vascular ailments. Dalchini has also been used to treat stomach discomfort, cramping in the abdomen, coughing, and sore throats. Cinnamon's synthetic resin components and essential oils are fully beneficial to human health. Recent research has demonstrated the beneficial effects of cinnamon in the management of coronary artery disease, diabetes, arthritis, and Alzheimer's disease. Throughout Asia, Africa, and Europe, cinnamon has been used traditionally as a spice to season meats or as a treatment to treat nausea, chills, and other symptoms. Cinnamon bark has shown promise as a treatment for a number of illnesses, including diabetes, heart disease, and neurological conditions, according to recent research. The goal of this paper is to present a thorough analysis of cinnamon bark's pharmacological characteristics and its medical uses.[9,10]

HISTORY AND ORIGIN

Native to Myanmar (Burma), Sri Lanka (formerly Ceylon), and India's Malabar Coast, cinnamon is also grown in South America and the West Indies. The brown spice, which is made from the dried inner bark, has a warm, sweet fragrance and a subtle scent. Since ancient times, people have been aware of cinnamon. Although it was brought to Egypt as early as 2000 BC, people who claimed it originated in China mistook it for a related species called cinnamon cassia. Cinnamon was used to embalm mummies in ancient Egypt. Cinnamon and cassia were utilised in Ancient Egyptian recipes for kyphi, a burning aromatic, starting in the Ptolemaic Kingdom.[11] Sometimes, cassia and cinnamon were given to temples by Hellenistic rulers as presents. While seeking for spices for Spain in the 1500s, Ferdinand Magellan discovered Cinnamomum mindanaense in the Philippines. This plant was closely related to C. zeylanicum, the cinnamon that is found in Sri Lanka.[12,13]

Figure 1: Flowers Of Cinnamon.

Botanical Classification

Kingdom : Plantae

Phylum : Magnoliophyta

Class : Magnoliopsida

Order : Laurales

Family : Lauraceae

Genus : Cinnamomum

Species : Zeylanicum

Synonym: Dalchini, Cinnamon Bark.

Biological Source: The biological Source of cinnamon is the dried inner bark of trees from the genus Cinnamomum.

Family : Lauraceae.

Geographical Source : Shrilanka, India, China, Vietnam, Indonesia.

Chemical Constituents

1. **Volatile Oils (0.5-4%)**

These are responsible for cinnamon' s characteristic aroma

Cinnamaldehyde **:** Major component, gives the spicy flavour and aroma.

Eugenol **:** more abundant in C. Verum, has a clove – like aroma.

2. **Polyphenols**

Proanthocyanidins : strong antioxidants, Tannins.

3. **Coumarin**

Found mainly in C.cassia, toxic in high doses (potentially hepatotoxic and carcinogenic in large amounts).

4. Mucilage and Triterpenes

Found in the bark and contribute to medicinal properties like anti – inflammatory effects.

5. Other Compounds

Cinnamic acid, Cinnamyl alcohol,

Chemical Composition

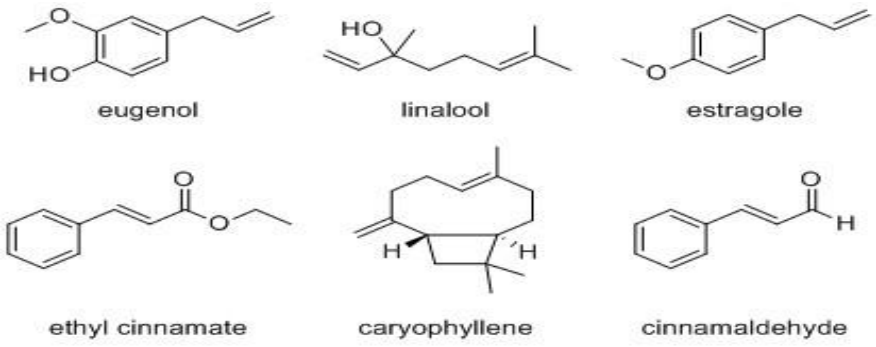

Figure 2: Chemical Composition of cinnamon bark.

PHARMACOLOGY OF CINNAMON

1. Antioxidant

Antioxidants are frequently added to food to stop radical chain reactions of oxidation, according to Shahidi et al. They work by blocking the initiation and propagation step that results in the reaction's termination and delaying the oxidation process. Butylated hydroxy anisole (BHA) and butylated hydroxy toluene (BHT), two widely used synthetic antioxidants, are, according to Madhavi and Salunkhe, subject to legal restrictions due to concerns about their potential for toxicity and cancer. Exploring natural sources of antioxidants has therefore become more urgent due to the food industry's significant interest in finding natural antioxidants to replace synthetic compounds in food applications and a growing trend in consumer preferences for natural antioxidants.[14]

2. Anti – ulcer

In conclusion, we have found that using cinnamon extract to prevent H. pylori growth and urease activity in vitro is more successful than using thyme extract. According to Tabak et al., the effectiveness of cinnamon extracts in liquid media and their resilience to low pH levels may increase their impact in an environment like the human stomach. It has been shown by Kreydiyyeh et al. to have an inhibitory effect on alanine transport in the rat jejunum as well as intestinal and kidney Na+/K+ ATPase activity.[15]

3. Antimicrobial

Cinnamon bark has been shown to have antibacterial properties by Matan et al. When combined with a modified atmosphere that contains a high concentration of CO2 (40%) and a low concentration of O2, the volatile gas phase of cinnamon and clove oil combinations demonstrated good potential to inhibit the growth of spoilage fungi, yeast, and bacteria typically found on IMF (Intermediate Moisture Foods).[16]

4. Anti – Diabetics

According to Sung Hee et al., cinnamon has anti-diabetic properties in db/db transgenic mice. Subash et al. have demonstrated that taking cinnamon aldehyde orally has a notable antihyperglycemic effect. reduces triglyceride and total cholesterol levels while simultaneously raising HDL cholesterol in rats with STZ-induced diabetes. Cinnamaldehyde has the potential to be used as a natural oral medication with hypoglycemic and hypolipidemic effects, according to this analysis. According to new research by Cao et al., 3T3-L1 Adipocytes' levels of TTP (thrombotic thrombocytopenic purpura), IR (insulin resistance), and GLUT4 (glucose transporter-4) may be raised by cinnamon extract and polyphenols including procyanidin type-A polymers. According to the study's findings, the mechanism underlying cinnamon's insulin-like activity may involve an increase in TTP, IRβ, and GLUT4 levels, and cinnamon polyphenols may also have anti-inflammatory and/or anti-angiogenesis properties.[17]

5. Diabetics

Diabetes mellitus is a glucose metabolism illness associated with insulin resistance and insulin insufficiency brought on by an autoimmune attack on the pancreatic β cells (Kumar, Kumari, and Mishra 2019). Because its active ingredients increase glucose absorption by triggering IR kinase activity, autophosphorylation of the IR, and glycogen synthase activity, cinnamon has been demonstrated to have insulin mimic capabilities (Medagama 2015). Limited dosages of cinnamon (5, 10, and 20 mg/kg) have been shown in studies to improve insulin secretion and glycaemic control in diabetics. According to Rao and Gan (2014), cinnamon dosages lower OS and protect β cells. (Shi et al. 2017) also looked into the potential of cinnamon consumption to prevent insulin resistance-related metabolic syndrome. When consuming carbohydrate meals, cinnamon extracts helped limit the activity of enzymes to stop the bloodstream from absorbing glucose. According to recent research, people with type 2 diabetes who took supplements of cinnamon extract showed positive treatment signs

with blood sugar markers (Zaidi et al. 2015). Another study found that eating cinnamon increases the number of GLUT4 receptors, which also increase IRs (Couturier et al. 2010). This facilitates the entry of glucose into cells. show that CE facilitates the dose-dependent translocation of GLUT 4 to the plasma membrane in peripheral tissue (Kumar, Kumari, and Mishra 2019).

showed the same effect, including an increase in GLUT4 membrane translocation from 42.8% to 73.1% in animals treated with cinnamon in comparison to controls (Ranasinghe et al. 2017). In order to reach the therapeutic possibility for CE as a comparable medication for the treatment of diabetes mellitus, the results might be concentrated on the impacts of insulin and its mechanism in the body.[18]

6. cardiovascular Disease

A recent study reports on the chemicals CD and CA that were separated from cinnamon and their potential to treat IHD (Wavell and Heggland 2020). In a rat model of ischaemic myocardial disadvantage, another study (Mohammed, Kadhim, and Abbood 2020) (Song et al. 2013) examined the therapeutic effects of CA and CD as cardioprotective. The anti-inflammatory and anti-oxidative qualities are what give this treatment its effectiveness. According to the results, cinnamic acid and aldehyde diminish cardiac ischemia-induced damage, raise serum NO activity, and lower levels of creatine kinase, lactate dehydrogenase, and interleukin-6. And elevated activity of superoxide dismutase (Kadhim, Mohammed, and Abbood of 2020). Research showed that chemicals derived from bark cassia exhibited anti-oxidative and cardioprotective benefits. They may also have helped cardioprotective medications lessen negative effects for cardiac treatment.[19]

7. Neurological Disorders

C. philippinensis is the source of cinnamonophilin, a new thromboxane A2 receptor antagonist. According to a study, when given at 80 mg/kg at various intervals (2, 4, and 6 hours after the insult), cinnamonophilin protects rat brains from ischaemic damage. The effects were observed to further improve neurobehavioral outcomes and have a significant impact (by 34–43%) on shortened brain infarction. In organotypic hippocampus slices from experimental rats, cinnamonophilin also significantly reduces the neuronal damage brought on by oxygen glucose deprivation. By regulating the flow of intracellular calcium [Ca2+]i, a compound known as procyanidin type-A trimer (trimer 1) that was separated from the water-soluble extract of cinnamon shown that trimer 1 may lessen cell swelling. Additionally, trimer

1 significantly reduces the depleting effects of oxygen glucose deprivation on glutamate absorption.[20]

Trimer 1's protective actions in reducing the decrease in glutamate uptake may be mediated through their effects on the mitochondria. With a 2% prevalence in those 65 and older, Parkinson's disease (PD) is the second most common neurological illness after Alzheimer's disease. Changes in the DJ1 gene induce PD protein 7 (PARK7), an autosomal recessive type of early-onset parkinsonism. The Khasnavis According to Pahan, by modifying mevalonate metabolites, sodium benzoate, a metabolite of cinnamon, increases DJ-1. In the central nervous system of mice, cinnamon and its metabolite sodium benzoate also increase the neurotropic factors neurotrophin-3 (NT-3) and BDNF (brain-derived neurotropic factors). An useful molecule that could be included in the therapeutic intervention for Parkinson's disease is PARK7, one of the primary neuroprotective proteins that shield cells from harm and the additional harmful effects of oxidative stress.[21]

8. Anti-H. pylori and gastro protective

The plant has been used to treat stomach issues like vomiting, flatulence, and diarrhoea in Pakistan's traditional Unani medical system (Zaidi et al., 2009). One of the frequent causes of dyspepsia and other stomach disorders is H. pylori (Muhammad et al., 2012). Despite being a non-invasive organism, H. pylorus triggers a strong immunological and inflammatory response. The pathophysiology of disorders linked to H. pylori involves bacterial colonisation, persistence and virulence, and the innate and adaptive host immunological responses that follow (Muhammad et al., 2013). According to an in vitro study, methylene chloride extracts exhibit strong anti-H. pylori activity, the mechanism of which was not disclosed, while cinnamon ethanol extract has weak anti-H. pylori activity by inhibiting the urease enzyme, which is implicated in the pathophysiology of H. pylori infection of the gut (Tabak et al., 1999). When exposed to C. cassia, human gastric epithelial cells infected with H. pylori show decreased IL-8 release. The strongest effects are shown at dosages of 50 µg/ml and 100 µg/ml, which nearly completely prevent H. pylori-induced IL-8 release. Additionally, TNF-α (tumour necrosis factor-alpha) stimulated cells, which are non-infectious inflammatory agents, also have a comparable anti-inflammatory impact (Zaidi et al., 2012). Additionally, we discovered that C. cassia and its main component, cinnamonaldehyde, inhibited hummingbird morphology, a trait of H. pylori-infected cells, in AGS gastric epithelial cells.[22]

9. Anti-melanin

To make their skin more pigmented, guinea pigs were subjected to UV-B light. To lessen the pigmentation, cinnamic acid was subsequently administered topically. According to the results, topical application of cinnamic acid decreased skin melanin by 29% without causing any negative side effects. Although it does not exhibit significant activity against dopachrome tautomerase, cinnamic acid mediates its impact by blocking the tyrosinase enzyme (Kong et al., 2008). Because cinnamon affects the melanin biosynthesis pathway in skin cells, it may be used in cosmetics and beauty products to improve skin whitening. Research is needed to investigate potential effects on the expression of the microphthalmia transcription factor (Mitf) and alpha-melanocyte stimulating hormone for the depigmenting pathway.[23]

10. Anti-allergy

Cinnamaldehyde is believed to treat allergic illnesses involving mucosal mast cells, including food allergies. Cinnamaldehyde has been demonstrated to inhibit the phospholipase C (PLC) signalling pathway in human embryonic kidney cells (Kim et al., 2008). It is believed that similar mechanisms are crucial for the intracellular mobilisation of Ca++ ions in mucosal mast cells. This is supported by Yahara et al.'s demonstration that the PLCγ1 signalling pathway is suppressed in order to prevent mucosal mast cell activation (Yahara et al., 2011).[24]

SIDE EFFECTS AND RISK

1. Body heat.
2. Antiobiotic Conflict.
3. Increased Heart Rate.
4. Skin Irritation.
5. Allergies.
6. Blood Thinner.
7. Reduce blood sugar level.
8. Problem for Pregnant womem..
9. Liver damage.
10. Mouth sores.

AYURVEDIC MEDICINAL USES

1. It calms headaches, flu, the common cold, and sore throats.
2. Moreover, it functions as an expectorant and possesses antitubercular qualities.

3. It is a natural therapy for rheumatoid arthritis.
4. Moreover, it helps to decrease cholesterol and strengthen the heart's muscles.
5. It eases the discomfort of menstruation : According to a research, women should drink a cup of warm cinnamon water every day since it temporarily reduces the Discomfort associated with menstruation.

CONCLUSION

A spice with a long history of usage in both traditional medicine and cooking is cinnamon bark. Its bioactive ingredients, such as eugenol, cinnamaldehyde, and cinnamic acid, have a range of pharmacological characteristics that make it a possible supplementary treatment for a number of illnesses. To completely investigate its medicinal potential and clinical applications, more research is required. In everyday life, cinnamon has been used as a spice with no discernible negative consequences. The various qualities of cinnamon, such as its bark, essential oils, bark powder, phenolic compounds, flavonoids, and separated components, have been the subject of several studies. Every one of these characteristics is essential to improving human health. While anti-inflammatory, anticancer, and antidiabetic effects happen indirectly through receptor-mediated pathways, antioxidant and antimicrobial effects can be directly attributed to action on oxidants or bacteria. Numerous varieties of cinnamon have been shown to have substantial health advantages by extensive research. To give further clinical support for the traditional applications of this spice against cancer as well as inflammatory, cardioprotective, and neurological conditions, more research is needed.

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