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Review

A Review of Cinnamon

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	Abstract
Published on: 03.02.2026	Cinnamon is a well-known aromatic spice obtained from the dried inner bark of plants belonging to the genus <i>Cinnamomum</i> of the Lauraceae family. It has been extensively used in traditional medicine systems for centuries due to its therapeutic properties. This review presents a comprehensive overview of cinnamon, emphasizing its botanical classification, phytochemical composition and pharmacological activities. Cinnamon contains several bioactive constituents, such as cinnamaldehyde, eugenol, cinnamic acid, and various polyphenolic compounds, which contribute to its biological effects. Numerous studies have demonstrated that cinnamon exhibits antioxidant, antimicrobial, anti-inflammatory, antidiabetic, and anticancer activities. The review also discusses the cultivation, physiochemical properties, and toxicity profile of cinnamon.
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	Keywords: Chemical constituents, antioxidant, anti-inflammatory activity, toxicity profile.

1.INTRODUCTION

Native to South India and Sri Lanka, cinnamon (*Cinnamomum zeylanicum*) is a tiny evergreen tree that grows to a height of 10 to 15 meters. It belongs to the family Lauraceae. The Greek word kinnaamomun is where the word "cinnamon" originates. ^[1] Aromatic evergreen trees and shrubs make up the genus "Cinnamomum." This genus has over 300 species that are found in tropical and

subtropical areas of Asia, Australia, South America, North America, Central America, and Oceania. The most well-known characteristic of a few species is their fragrant bark. One of the most significant and widely used spices in the world, cinnamon is utilized in both ancient and contemporary medicine, as well as in the scent and essence industries and cookery. ^[2] Cinnamon's therapeutic qualities have long been acknowledged, and its traditional applications span

many civilizations. Astringent, warming stimulant, carminative, blood purifier, digestive, antiseptic, antifungal, antiviral, antibacterial, antioxidant, anti-inflammatory, and immunomodulatory properties are among the documented medicinal qualities of the plant extracts. [3]

COMMON NAME

Cinnamon, cassia, cinnamon twig, cassia aromaticum and cassia bark. [4]

Tamil: Lavangapatta, Karuvapattai [2]



Figure 1: Cinnamon [26]

1.1.HISTORY

For thousands of years, cinnamon has been used in many different culinary purposes. Because of its great healing value, it has been used in Ayurvedic medicine as an antiemetic, antidiarrheal, flatulent, and stimulant. The Egyptians used it for mummification. Portuguese traders introduced the spice (*C. zeylanicum*) to Europe in the 16th and 17th centuries. The East India Company introduced cinnamon to Europe when it was first cultivated in Java during the Dutch colonization in the 17th century. Sri Lanka became the main supplier of cinnamon oils, which are used in the culinary and medicinal industries, as Ceylon's cinnamon crop dwindled. Chinese cinnamon oil is also used by pharmaceutical businesses. [8]

1.2.TYPES OF CINNAMON

There are mainly four types of cinnamon:

- True cinnamon or Ceylon cinnamon or Mexican cinnamon (*Cinnamomum zeylanicum*)
- Indonesian cinnamon (*Cinnamomum burmanni*)
- Vietnamese cinnamon (*Cinnamomum loureiroi*)
- Cassia cinnamon or Chinese cinnamon (*Cinnamomum aromaticum*). [5]

1.3.TAXANOMY

Kingdom: Plantae

Subkingdom: Viridiana

Infrakingdom: Streptophyta

Super division: Embryophyte

Division: Tracheophyte

Sub division: Spermatophyta

Class: Magnoliopsida

Super order: Magnolianaec

Order: Laurales

Family: Lauraceae

Genus: *Cinnamomum schaeff*

Species: *Cinnamomum verum* [6]

1.4.ORGANOLEPTIC CHARACTER

Colour: Its outer surface is dull yellowish-brown, and its inner surface is dark yellowish brown.

Odour: Fragrant

Taste: Aromatic and sweet

Size: Approximate 1m in length and 1cm in diameter. Its bark thickness is about 0.5mm.

Shape: It is found in the form of compound quills.

Fracture: Splintery [7]

1.5.BOTANICAL DISTRIBUTION

Cinnamon is the small evergreen tree that can grow up to 18 m long. The plants possess oval lanceolate 4–14 cm long, glossy green, rough-textured oppositely arranged leaves. The fruit is 1 cm long and one-seeded ovoid-shaped. They have small yellowish-white flowers with a disagreeable odour. The bark is about 10 mm thick and strongly aromatic. Cinnamon is the dried bark which is yellowish-brown externally while the inner surface is darker. The aromatic odour is warm, sweet, and fragrant due to the presence of active constituents in oil cells located in the phloem. [9]

1.6.PROPROPAGATION

Propagation of cinnamon is by rooted cuttings, air layering and seedling. [11]

1.7.CULTIVATION

Approximately 27,000–35,000 tons of cinnamon are produced annually worldwide. Madagascar, China, the Seychelles, Sri Lanka, and Vietnam grow cinnamon on a small scale. It is a hardy plant that is often grown using vegetative propagation and dried seed in a variety of climatic conditions at an ideal

temperature of 20 to 30°C and a range of 1250 to 2500 mm. [10]

1.8.HARVESTING AND PROCESSING

Harvesting and processing accounts for about 60% of the cost of production of cinnamon as removal of bark from the stem is very labour intensive and is usually done by hand and by skilled labourers. From generation to generation, the skills of peeling cinnamon bark have been laid down as a regular exposure to next generation. Cinnamon is started harvesting after 2 to 3 years but better yields can be achieved after 4th to 5th years of harvest following planting for different cinnamon species in different countries by skilful workers who manoeuvre their knives to remove the bark in two halves and then pack one inside the other until cigar like quills are obtained. Quill is the highest grade of cinnamon bark. It is usually 1 m long, 1 cm in thickness and is brownish-yellow in colour. It is thin, brittle and smooth in texture. Quilling's are comparatively large pieces of quills. They break during transportation, sorting and bailing. Featherings consist of the inner bark of the stalks and tender twigs and cannot be made into quills of regular size. Quills are known to keep the flavour for a long time while powdered cinnamon loses its flavour quickly. Various grades of cinnamon bark are available in the trade such as quills, quilling's and featherings. Weeding and mulching help in reducing weed growth. Weeding must be done every year for the first two years. Thereafter two weeding's in a year during June July and October – November is sufficient. If there is a prolonged drought, the seedlings require irrigation until they get established. Plants are harvested when they are 23 years old at a height of 15 cm above ground level. Side shoots growing from the base are cut to encourage growth of more side shoots. [12]

1.9.YIELD OF CINNAMON

Numerous variables, including cultivar, tree age, soil, climate, and other crop management techniques, affect crop yield. After reaching the appropriate producing stage, a hectare of cinnamon crop typically produces 200–350 kg of quills and 2-3 kg of leaf oil annually. ^[12]

2. CHEMICAL CONSTITUENTS

Cinnamaldehyde, cinnamate, cinnamic acid, and many essential oils are among the many resinous

chemicals that make up cinnamon. According to Singh et al., the presence of cinnamaldehyde and the absorption of oxygen are responsible for the spicy flavor and scent. Cinnamon's resinous constituents improve as it ages and darkens in color. Sangal described a number of cinnamon's physiochemical characteristics. Numerous essential oils, including trans-cinnamaldehyde, cinnamyl acetate, eugenol, L-borneol, caryophyllene oxide, b-caryophyllene, L-bornyl acetate, E-nerolidol, and α -cubebene, are present. ^[13]

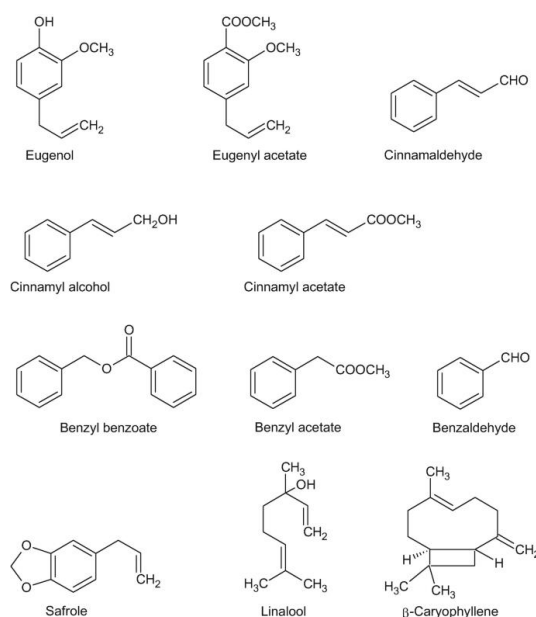


Figure 2: Structure of chemical constituents present in cinnamon ^[27]

Table2: Chemical constituents of different parts of cinnamon ^[14]

S.NO	CHEMICAL COMPOUND	AMOUNT	PARTS
01	Cinnamaldehyde	1.00 to 5.00%	Leaves
	Eugenol	70.00 to 95%	
02	Cinnamaldehyde	65.00 to 80.00%	Bark
	Eugenol	5.00% to 10.00%	
03	Camphor	60.00%	Root bark
04	trans-Cinnamyl acetate	42.00 to 54.00%	Fruit
	Caryophyllene	9.00 to 14.00%	
05	Terpene hydrocarbons	78.00%	Bud
	alpha-Bergamotene	27.38%	

	alpha-Copaene	23.05%	
	Oxygenated terpenoids	9.00%	
06	(E)-Cinnamyl acetate	41.98%	Flower
	trans-alpha-Bergamotene	7.97%	
	Caryophyllene oxide	7.20%	

3.CHEMICAL AND PHYSICAL PROPERTIES

Cinnamaldehyde, sometimes referred to as cinnamic aldehyde, is the main chemical component of cinnamon oil and makes up 60–90% of it. Cinnamyl acetate, cinnamyl alcohol, cuminaldehyde, eugenol,

linalool, and pinene are other components. When compared to *C. zeylanicum*, *C. cassia* has a higher average content of cinnamaldehyde. Coumarin, which is typically found in *C. cassia* but not in *C. zeylanicum*, is occasionally employed as a marker to differentiate between the two species.^[15]

Table 2: Physical and chemical properties of cinnamon, cinnamon oil and cinnamaldehyde ^[15]

S.NO	PROPERTY	CHARACTERISTIC/VALUE
01	Molecular formula	C ₉ H ₈ O (Cinnamaldehyde)
02	Molecular weight	132.159(cinnamaldehyde)
03	Percentage composition	Cinnamon bark oil: Cinnamaldehyde (75-90%); linalool, eugenol, cinnamyl acetate; cinnamic acid; cinnamon alcohol; various other terpenoids
04	Physical state at 25°C/1 Atm.	Liquid (oil) Solid (powder)
05	Colour	Yellow/amber/dark brown/clear
06	Odour	Distinct cinnamon spice aroma (cinnamon bark oil); cinnamon-clove odour (cinnamon leaf oil)
07	Density /specific gravity	1.010-1.030
08	Melting point	-7.5°C (Cinnamaldehyde)
09	Boiling point	253°C (Cinnamaldehyde)
10	Solubility	Soluble at 10% in ethyl alcohol 96%; soluble in most vegetable oils and glacial acetic acid. Soluble in propylene glycol. Slightly soluble in water. Insoluble in glycerine, mineral oil.

4. PHARMACOLOGICAL ACTIVITY OF CINNAMON

4.1. ANTI-INFLAMMATORY ACTIVITY

Cinnamaldehyde, one of the primary components of cinnamon, has anti-inflammatory qualities. It stops the production of nitric oxide, which is what causes inflammatory illnesses in people. Furthermore, it has been shown that cinnamon prevents the production of the proinflammatory chemical COX-2. Cinnamon contains anti-inflammatory properties as a result. [16] The essential oil of *C. osmophloeum* twigs was shown by Tung et al. to have strong anti-inflammatory properties and to be cytotoxic to HepG2 (Human Hepatocellular Liver Carcinoma Cell Line) cells. Additionally, research showed that the components of *C. osmophloeum* twig shown outstanding anti-inflammatory properties by inhibiting the formation of nitric oxide by macrophages activated by lipopolysaccharide (LPS). [17]

4.2. ANTIBACTERIAL ACTIVITY

According to Imadet al. (2016), E-cinnamaldehyde is primarily responsible for *C. zeylanicum* exceptional antibacterial activity. These results suggest that *C. zeylanicum* methanolic extract has antifungal and antibacterial properties. Natural biocides including essential oil from *C. zeylanicum* bark have significant antibacterial potential, however this potential is diminished by the essential oil's instability and rapid breakdown. [18] The antibacterial activity of a mixture of clove and cinnamon oils against Gram-negative bacteria (*Salmonella choleraesuis*, *Escherichia*) and Gram-positive organisms (*Listeria monocytogenes*, *Enterococcus faecalis*, *Staphylococcus aureus*, and *Bacillus cereus*) was reported by Goni et al. [19]

4.3. ANTIOXIDANT ACTIVITY

Antioxidant chemicals found in cinnamon include polyphenols, phenolic acid, and flavonoids. These

compounds provide health advantages by preventing oxidative stress in the body by responding to free radicals and reducing damage from metabolic illnesses. [20] Numerous studies have demonstrated the effectiveness of cinnamon extract/oil and cinnamaldehyde isolated from cinnamon species in preventing the production of reactive oxygen species (ROS) through thioredoxin signalling pathways and the activation of the oxidative stress defence system, including nuclear factor erythroid 2-related factor 2 (Nrf2). [21]

4.4. CARDIOVASCULAR ACTIVITY

According to studies, cinnamon can enhance heart health by reducing risk factors such high blood pressure, triglycerides, and cholesterol (Akilen et al. 2010; Rao and Gan 2014). Additionally, cinnamon helps prevent heart attacks, heart disease, and stroke by improving circulation and regenerating heart tissue. [22]

4.5. ANTIDIABETIC ACTIVITY

In 50 rats with streptozotocin-induced diabetes, cinnamon methanol extract and 50 green teas show anti-diabetic effects (STZ). The course of treatment lasted six weeks. Following treatment, the rats' glucose levels were significantly reduced. It has been discovered that the extracts work in concert to treat diabetes. The mice were stimulated with streptozocin. Mice were administered cinnamon for a duration of 14 days. Next, a glucose oxidase (GOD) assay and a radioimmunoassay (RIA) were used to evaluate diabetic mice. The results show that cinnamon keeps rats' blood glucose and insulin levels stable. [24]

4.6. ANTICANCER ACTIVITY

Goyal et al.'s in vitro study used a cell proliferation assay to investigate the anticancer potential of the water-soluble polysaccharide and other cinnamon extracts against macrophage cell lines. Compared to

other cinnamon extracts, the cinnamon polysaccharide fraction was found to have greater immunostimulatory properties. [23]

4.7.ANTI-PARKINSON ACTIVITY

In MPTP-intoxicated mice, *cinnamomum zeylanicum* exhibits antiparkinsonian effects. 100 µl of cinnamon powder dissolved in 0.5 percent methylcellulose (MC) was administered to mice. The results suggest that

cinnamon may be useful for treating Parkinson's disease. [24]

4.8.CHOLESTEROL AND LIPID LOWERING EFFECT

Two substances that were separated from *Cinnamomum cassia*, cinnamic acid and cinnamic aldehyde, have also shown encouraging results against myocardial ischemia. This suggests that cardiovascular disorders may be treated with cinnamon. [25]

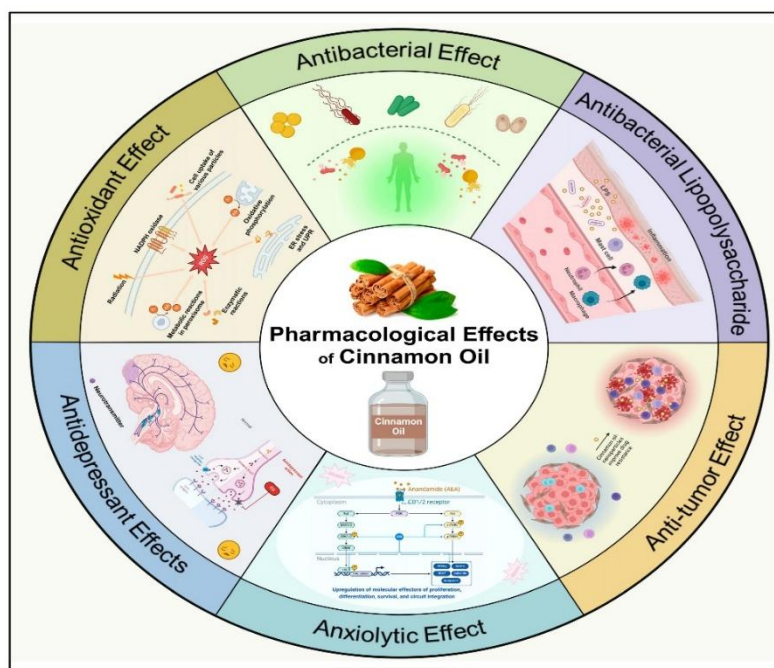


Figure 3 : Pharmacological activities of cinnamon oil [28]

5.TOXICITY PROFILE

Since cinnamon is utilized as a spice in Asian cuisine, its safety is clear. According to Budavari et al., Benzaldehyde (LD50 orally, 1300 mg/kg rat), cinnamaldehyde (LD50 orally, 2220 mg/kg rat), linalool (LD50 orally, 2790 mg/kg rat), and salicylaldehyde (LD50 orally, 520 mg/kg rat) have very low acute toxicity in animals. Satoshi discovered that this chemical has a low level of toxicity, therefore its use as an antifungal agent in food and as a dermatomycosis treatment may be anticipated. [17]

6. CONCLUSION

In conclusion, cinnamon, a globally important spice from the *Cinnamomum* genus, is historically significant and possesses diverse pharmacological activities, including anti-inflammatory, antibacterial, antioxidant, antidiabetic, and anticancer effects, with generally low toxicity.

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