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# A REVIEW ARTICLE ON DALCHINI (*CINNAMOMUM VERUM* - A MULTIFACETED MEDICINAL PLANT -A REVIEW

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## ABSTRACT

Cinnamon is a spice obtained from the inner bark of several tree species from the genus *Cinnamomum*. Cinnamon is used mainly as an aromatic condiment and flavoring additive in a wide variety of cuisines, sweet and savory dishes, breakfast cereals, snack foods, tea and traditional foods.The bark of various cinnamon species is one of the most important and popular spices used worldwide not only for cooking but also in traditional and modern medicines. Overall, approximately 250 species have been identified among the cinnamon genus, with trees being scattered all over the world.[1,2]

**KEYWORDS:** Cinnamon, Anti-oxidant, cultivation, Anti-Microbial.

## INTRODUCTION8

Cinnamon is mainly used in the aroma and essence industries due to its fragrance, which can be incorporated into different varieties of foodstuffs, perfumes, and medicinal products.[3] The most important constituents of cinnamon are cinnamaldehyde and *trans*-cinnamaldehyde (Cin), which are present in the essential oil, thus contributing to the fragrance and to the various biological activities observed with cinnamon.[4] Cinnamon bark contains procyanidins and catechins.[8] The components of procyanidins include both procyanidin A-type and B-type linkages.[9–11] These procyanidins extracted from cinnamon and berries also possess antioxidant activities.[10, 12]

**SYNONYMS:** Dalchini, Ceylon Cinnamon, Cinnamon bark.

## BIOLOGICAL SOURCE

Cinnamon consists of dried bark, freed from the outer cork and from the underlying parenchyma, from the shoots growing on the cut stumps of Cinnamomum zeylanicum Nees

**Family – Lauraceae**.

**Geographical source**

Sri Lanka, Malabar Coast of India, Jamaica and Brazil.

## CULTIVATION AND COLLECTION

- It is generally cultivated by seed propagation method but sometimes plant cuttings are also preferred. It mainly needs sandy or siliceous soil which should be rich in humus. The other requirements for its better cultivation are altitude (800 to 1000 meter) and annual rainfall (200 to 250 cm). It is shade loving plant.
- The seeds are propagated in nursery beds in the month of June and July. The distance should be 10 cm in between two plants. The plants should be watered time to time. Generally, the seeds are germinated within 20 days. Shading is provided to the plants and allowed to grow for about 1 year. Then transplantation in open field should be done in the month of October or November or in rainy season.
- The distance should be kept at least 2 meters in between two plants. Weeding should be done 2 to 4 times in a year. The plants should be manured in the first year and subsequently increased depending upon the age of plant.
- The fertilizers are applied first in monsoon and second in October-November. It will encourage the growth of shoots. Coppicing should be done to induce the formation of shoots.
- Harvesting should be done in rainy season because in this season peeling of bark from shoots is easy. The peeled strips are made into bundles, wrapped in coir mats and allow to ferment for 24 hours. This will loosen the outer cork and cortex which should be removed from curved brass knife.
- The collected bark contracts and converted into quill form after drying. The smaller quills are placed in between larger quill sand forms compound quills.
- The soft and fresh quills are rolled by hand and lightly pressed so it will avoid the splitting of bark into pieces. Then the drug should be shade dried and dried quills are packed into bundles of different grades and marketed.
- The small pieces and debris are used for the production of Cinnamon oil.

- The average yield of bark is about 200- 300 kg per hectare and 2-3 kg leaves per hectare, annually.

**Cinnamon plant description. Fig. (a) and (b).**

**Description**

**Cinnamon Bark**

- **Colour:** Externally dull yellowish brown, internally dark yellowish brown.
- **Odour:** Aromatic.
- **Taste:** Warm and very refined (Sweetish and aromatic followed by warm sensation).
- **Fracture:** Splintery.
- **Size:** Length is about 1 meter, diameter is nearly 1 cm and thickness is approximately 0.5 mm.
- **Shape:** Compound quill form.

The wavy longitudinal striations are present on external and internal surfaces of bark (bark freed from cork).

**Cinnamon Oil**

- Colour: Yellow to reddish in colour.
- Specific gravity: 1.00 to 1.030.
- Optical rotation: 0 to − 2.
- Refractive index: 1.562 to 1.582.

**Traditional Uses**

In addition to being used as a spice and flavoring agent, cinnamon is also added to flavor chewing gums due to its mouth refreshing effects and ability to remove bad breath.[13] Cinnamon can also improve the health of the colon, thereby reducing the risk of colon cancer.[14]

Cinnamon is a coagulant and prevents bleeding.[15] Cinnamon also increases the blood circulation in the uterus and advances tissue regeneration.[16] This plant plays a vital role as a spice, but its essential oils and other constituents also have important activities, including antimicrobial[17–20], antifungal[21], antioxidant[22–26], and antidiabetic.[27–33]

Cinnamon has been used as anti-inflammatory[34–36], antitermitic[36], nematicidal[37, 38], mosquito larvicidal[39], insecticidal[40], antimycotic,[40–43] and anticancer agent.[44–47] Cinnamon has also been traditionally used as tooth powder and to treat toothaches, dental problems, oral microbiota, and bad breath.

**CHEMICAL CONSTITUENTS**

cinnamate, cinnamic acid, and numerous essential oils[50] (Table 1).the spicy taste and fragrance are due to the presence of cinnamaldehyde and occur due to the absorption of oxygen. As cinnamon ages, it darkens in color, improving the resinous compounds.[51] various physiochemical properties of cinnamon (Table 2). The presence of a wide range of essential oils, such as *trans*-cinnamaldehyde, cinnamyl acetate, eugenol, L-borneol, caryophyllene oxide, b-caryophyllene, L-bornyl acetate, E-nerolidol, $\alpha$-cubebene, $\alpha$-terpineol, terpinolene, and $\alpha$-thujene, has been reported.[35, 36]

- Cinnamon bark contains polycyclic diterpenes and proanthocyanidinoid oligomers. It contains volatile oils (0.5 to 1 percent), phlobatannins (1.2 percent), mucilage, calcium oxalate, starch and mannitol (responsible for sweetish taste).
- The cinnamon oil obtained from distillation method which is light yellow in colour and upon storage changes to reddish in colour.
- The essential oil (5 to 20 ml/kg) is composed of phenylpropane derivatives. Cinnamon oil mainly contains cinnamaldehyde (60 to 70 percent), eugenol (5 to 10 percent), benzaldehyde, cuminaldehyde and other terpenes such as phellandrene, pinene, cymene, caryophyllene.

**Table 1: Chemical Constituents of Different Parts of Cinnamon.**

| PART OF PLANT | COMPOUND |
|---|---|
| LEAVES | CINNAMALDEHYDE 1.00-5.00%<br>EUGENOL 75.00-95.00% |
| BARK | CINNAMALDEHYDE- 65.00-80.00%<br>EUGENOL- 5.00-10.00% |
| ROOT BARK | CAMPHOR 60.00% |
| FRUIT | TRANS-CINNAMYLACETATE 42-54%<br>CARYOPHYLLENE |
| *C. ZEYLANICUM* BUDS | TERPENE HYDROCARBONS: 78.00%<br>*ALPHA*-BERGAMOTENE: 27.38%<br>*ALPHA*-COPAENE: 23.05%<br>OXYGENATED TERPENOIDS: 9.00% |
| *C. ZEYLANICUM* FLOWERS | (E)-CINNAMYL ACETATE: 41.98%<br>*TRANS-ALPHA*-BERGAMOTENE: 7.97%<br>CARYOPHYLLENE OXIDE: 7.20% |

**Table 2: Physicochemical Properties of Cinnamon.**

| PARAMETER | LEAF OIL | BARK OIL |
|---|---|---|
| Specific gravity (20° c) | 1.030–1.050 | 1.010–1.030 |
| Optical rotation (°) (20°c) | 1°96′–0°40′ | Slightly levorotatory |
| Refractive index (20°c) | 1.529–1.537 | 1.573–1.591 |
| Aldehyde content | 4% | 65–76% |
| Eugenol content | 77.3–90.5% | 4–10% |
| Solubility characteristics | Soluble in 1.5 volumes of 70% alcohol | Soluble in 2.0–3.0 volumes of 70% alcohol |

## Pharmacological Importance

### Antioxidant Activity

Antioxidant compounds present in foodstuffs play a vital role in human life, acting as health-protecting agents. In addition to this role, antioxidants are one of the key additives used in fats and oils. Even in the food processing industry, antioxidants have been used to delay or prevent food spoilage. Spices and medicinal plants have received rapid consideration as sources of beneficial antioxidants against various diseases.[52] Antioxidants have been considered the most important drivers in the progress and existence of humans, as they respond to free radicals and damage in metabolic diseases and age-related syndromes of humans and other animals.[53, 54]

The essential oils and some of the major compounds present in cinnamon, including (E)-cinnamaldehyde, eugenol, and linalool, were investigated in reference to peroxynitrite-induced nitration and lipid peroxidation. Eugenol and the essential oils were more effective than the other two compounds. In a comparative study among 26 spices, cinnamon showed

the highest antioxidant activity, indicating that it can be applied as an antioxidant used in foods.

**Anti-Inflammatory Activities**

Several studies on medicinal plants and their components have indicated the anti-inflammatory activities of cinnamon. Various studies reported the anti-inflammatory activity of cinnamon and its essential oils.[34–36] To date, there are several flavonoid compounds (e.g., gossypin, gnaphalin, hesperidin, hibifolin, hypolaetin, oroxindin, and quercetin) that have been isolated and have anti-inflammatory activities.

**Neurological Disorders**

Cinnamophilin is a novel thromboxane A2 receptor antagonist isolated from *C. philippinensis*. A study reported that cinnamophilin confers protection against ischemic damage in rat brains when administered at 80 mg/kg at different time intervals (2, 4, and 6 h) after insult. The effects were found to have a considerable effect (by 34–43%) on abridged brain infarction and further enhance neurobehavioral outcomes. Cinnamophilin also dramatically condenses the oxygen glucose deprivation-induced neuronal damage in organotypic hippocampal slices in experimental rats. A substance called procyanidin type-A trimer (trimer 1) isolated from cinnamon's water-soluble extract showed that trimer 1 may reduce cell swelling by controlling the movement of intracellular calcium [$Ca^{2+}$]. Trimer 1 also considerably alleviates the oxygen glucose deprivation-induced diminishing effects on glutamate uptake. The protective effects of trimer 1 in attenuating the diminution in glutamate uptake are possibly arbitrated via their effects on the mitochondria.

Parkinson's disease (PD) is the second major widespread neurodegenerative disorder after Alzheimer's disease, Cinnamon and its metabolite sodium benzoate also upregulate the neurotropic factors BDNF (brain-derived neurotropic factors) as well as neurotrophin-3 (NT-3) in the mouse central nervous system. PARK7 is one of the main neuroprotective proteins that protects cells from damage and from the further detrimental effects of oxidative stress; therefore, this protein may be an effective molecule that can be incorporated into the therapeutic intervention of Parkinson's disease.

A natural compound isolated from cinnamon extract (CEppt) significantly reduces the formation of toxic $\beta$-amyloid polypeptide (A$\beta$) oligomers and prevents its toxicity on neuronal pheochromocytoma (PC12) cells.

**Antidiabetic Activity**

A substance from cinnamon has been isolated and coined as "insulin-potentiating factor" (IPF), while the antidiabetic effects of cinnamon bark have been shown in streptozotocin-induced diabetic rats.[33] Several studies have also revealed that cinnamon extracts lower not only blood glucose but also cholesterol level.

A study comparing the insulin-potentiating effects of many spices revealed that the aqueous extract of cinnamon was 20-fold higher than the other spices. Methyl hydroxychalcone polymer (MHCP) is the purified polymer of hydroxychalcone with the ability to stimulate glucose oxidation.[30]

**Antimicrobial Activity**

To date, several antimicrobial activities of cinnamon and its oils have been reported in various studies.[20, 28] For example, Matan et al. reported the effects of cinnamon oils on different bacterial (*Pediococcus halophilus* and *Staphylococcus aureus),* fungal *(Aspergillus flavus, Mucor plumbeus, Penicillium roqueforti,* and *Eurotium sp.),* and yeast species (*Candida lipolytica, Pichia membranaefaciens, Debaryomyces hansenii,* and *Zygosaccharomyces rouxii*)[19], indicating that cinnamon is a natural antimicrobial agent. the antibacterial activity of a combination of cinnamon and clove oils against Gram-positive organisms *(Listeria monocytogenes, Enterococcus faecalis, Staphylococcus aureus,* and *Bacillus cereus*), as well as against Gram-negative bacteria (*Salmonella choleraesuis, Escherichia coli, Pseudomonas aeruginosa,* and *Yersinia enterocolitica).*

**Anticancer Activity**

The aqueous extract and the fraction of cinnamon (procyanidins) from HPLC inhibit vascular endothelial growth factor subtype 2 (VEGFR2) kinase activity, thereby inhibiting the angiogenesis involved in cancer. The results of the study revealed that cinnamon could potentially be used in cancer prevention.[44] Cinnamaldehydes have been synthesized and tested as inhibitors against angiogenesis. a chemical that can be synthesized from 2′-hydroxycinnamaldehyde derived from cinnamaldehyde, can inhibit tumor growth. Overall, the antitumor and growth-inhibitory properties of CB403 in animal-based studies as well as in cell culture-based studies indicate the potential of cinnamon to be used as an anticancer agent. cinnamic aldehyde inhibits the activity of NF-$\kappa$B and the production of tumor necrosis factor alpha (TNF$\alpha$-) induced interleukin-8 (IL-8) in A375 cells. This inhibition provides additional support to the existing unrecognized role of cinnamic acid as a potential anticancer

agent. Fang and others reported the anticancer effect of *trans*-cinnamaldehyde from *C. osmophloeum*, finding that *trans*-cinnamaldehyde showed potential effects in restraining tumor cell growth and in enhancing tumor cell apoptosis.

**Cardiovascular Diseases**

One of the active components isolated from *C. cassia* named 2-methoxycinnamaldehyde (2-MCA) decreases the expression of vascular cell adhesion molecule-1 (VCAM-1) in TNF*α*-activated endothelial cells, suggesting that ischemia/reperfusion (I/R) injury is ameliorated due to the induction of hemeoxygenase- (HO-) 1. A recent study reported the potential effects of two compounds, cinnamic aldehyde and cinnamic acid, isolated from *C. cassia* against myocardial ischemia, indicating that cinnamon also has the potential to be used to treat cardiovascular diseases.

The ability of cinnamaldehyde in vasodilatory function may be because it impedes both $Ca^{2+}$ influx and $Ca^{2+}$ release. Cinnamaldehyde averts the progress of hypertension in types 1 and 2 diabetes by abridging vascular contractility, in addition to its insulinotropic effect in insulin deficiency.

**Cholesterol- and Lipid-Lowering Effects**

The administration of cinnamon to mice positively affected the lipid profile, whereby the high-density lipoprotein (HDL) cholesterol levels decreased, and plasma triglycerides were reduced.[27] Another study by found a reduction in the total cholesterol, triglycerides, and low-density lipoproteins in rats administered *Cinnamomum cassia* powder (15%) for 35 days.

## CONCLUSIONS

Cinnamon has been used as a spice in daily life without any side effects. Several reports have dealt with the numerous properties of cinnamon in the forms of bark, essential oils, bark powder, phenolic compounds, flavonoids, and isolated components. Each of these properties plays a key role in the advancement of human health. The antioxidant and antimicrobial activities may occur through the direct action on oxidants or microbes, whereas the anti-inflammatory, anticancer, and antidiabetic activities occur indirectly via receptor-mediated mechanisms. The significant health benefits of numerous types of cinnamon have been explored. Further investigations are necessary to provide additional clinical evidence for the traditional uses of this spice against cancer and inflammatory, cardioprotective, and neurological disorders.

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