Dalchini (*cinnamomum zeylanicum*): a versatile spice with significant therapeutic potential
Shifali Thakur, Bhawna Walia, Gitika Chaudhary*
Shuddhi Ayurveda, Jeena Sikho Lifecare Pvt. Ltd. Zirakpur 140603, Punjab

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**Abstract**

*Cinnamomum zeylanicum* is a widely utilized condiment for its therapeutic uses since ancient times. It is indigenous to Sri Lanka and Southern India. Cinnamon is an ancient spice which belongs to the Lauraceae family. In the modern era, it is widely utilized as candies, chewing gums, mouthwash and toothpaste for commercial benefits. It is a well-considered plant which is used for treating many diseases in a traditional system like Ayurveda and the Folk system of medicine. *Cinnamomum zeylanicum* is utilized in many polyherbal formulations for curing various ailments. The plant is enriched with many volatile oils which mainly consist of cinnamaldehyde, cinnamic acid and cinnamate. Eugenol is the active principle constituent associated with many biological activities. The main therapeutic actions of the plant are antimicrobial, wound healing, antidiabetic, anti-HIV, anti-anxiety and anti-Parkinson’s. The current review has summarized the therapeutic and pharmacological value of *Cinnamomum zeylanicum* along with its utilization in the Folklore medicinal system.

**Keywords:** Dalchini, Cinnamaldehyde, Anti-Parkinson’s, Antimicrobial, Ayush-Kwath.

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**Introduction**

Cinnamon herb is used by different cultures around the world for several centuries. The tropical evergreen plant *Cinnamomum* has two varieties; *Cinnamomum zeylanicum* (CZ) and *Cinnamomum cassia* (CC) and obtained from the inner bark [1]. The plant is also named as Cinnamomum aromaticum/Chinese cinnamon [2]. In Ayurveda, it is utilized for the respiratory system, digestive and gynecological disorders. The volatile oils are present in each parts of the plant such as bark, leaf and root barks. There are more than 200 species comprised of genus *Cinnamomum* out of which 20 species occurred in India [3]. Each part of the plant possesses the same hydrocarbons in varying proportions, with primary constituents such as cinnamaldehyde (Bark), eugenol (leaf), and camphor (root). Camphor, is the active compound extracted from the root part of the plant and has commercial value unlike the leaf and bark [4]. In Sri-Lanka and India, plant is also called ‘true cinnamon’ [5]. There are main 3 constituents of the essential oils of *Cinnamomum zeylanicum* i.e. trans-cinnamaldehyde, eugenol, and linalool which represent 82.5% of the total composition [6]. The major 2 components of *Cinnamomum zeylanicum* plant are Cinnamaldehyde and eugenol [7]. Cinnamon is considered as a potent neuroprotective agent [8] as well as a medicine for the treatment of type 2 diabetes mellitus in the conventional Chinese system [9]. Many studies demonstrated the pharmacological properties of cinnamon such as anti-inflammatory, anti-microbial, blood glucose, reducing cardiovascular, increasing cognitive function and anticarcinogenic [10-11]. Coumarin is the chemical constituent present in trace amount in *C. zeylanicum* [12]. Presence of coumarin is the main difference between CC and CZ. The percentage of coumarin is very high in CC as compared to CZ. The vernacular names and taxonomical classification are mentioned in table no. 01 and table no. 02 respectively.
Table 01. Vernacular names of *Cinnamomum zeylanicum* (Dalchini)

<table>
<thead>
<tr>
<th>Hindi</th>
<th>Dalchini</th>
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<tbody>
<tr>
<td>English</td>
<td>Cinnamon</td>
</tr>
<tr>
<td>Punjabi</td>
<td>Dalchini, Darchini</td>
</tr>
<tr>
<td>Telugu</td>
<td>Lavanga Patta</td>
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<tr>
<td>Tamil</td>
<td>Ilayangam</td>
</tr>
<tr>
<td>Bengali</td>
<td>Daruchini</td>
</tr>
<tr>
<td>Malayalam</td>
<td>Karuvapatta, llavargathely</td>
</tr>
<tr>
<td>Oriya</td>
<td>Dalechini, Guda twa</td>
</tr>
<tr>
<td>Gujarati</td>
<td>Taja</td>
</tr>
<tr>
<td>Urdu</td>
<td>Darchini</td>
</tr>
<tr>
<td>French</td>
<td>Cammelle</td>
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<tr>
<td>Spanish</td>
<td>Canela</td>
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</table>

Table 02: Morphological Classification of *Cinnamomum zeylanicum* (Dalchini)

<table>
<thead>
<tr>
<th>Taxonomical Rank</th>
<th>Taxon</th>
</tr>
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<tbody>
<tr>
<td>Kingdom</td>
<td>Plantae</td>
</tr>
<tr>
<td>Phylum</td>
<td>Magnoliophyta</td>
</tr>
<tr>
<td>Class</td>
<td>Magnoliopsida</td>
</tr>
<tr>
<td>Order</td>
<td>Laurales</td>
</tr>
<tr>
<td>Family</td>
<td>Lauraceae</td>
</tr>
<tr>
<td>Genus</td>
<td>Cinnamomum</td>
</tr>
<tr>
<td>Species</td>
<td>Zeylanicum</td>
</tr>
</tbody>
</table>

**Botanical Distribution of *Cinnamomum zeylanicum* (Dalchini)**

*Cinnamomum zeylanicum* (Dalchini) is an evergreen tropical plant attaining the height of about 6-8 meters with thick, smooth, reddish-brown bark. The opposite or sub-opposite leaves are glabrous, ovate and lanceolate, hard and coriaceous. Leaves are shinning from above, slightly pale beneath with 3-5 main nerves. Petiole flattened up to ½-1 inch. Flowers are in axillary or sub-terminal cymes or panicles. Fruit is ovate or oblong, about 1.5-2cm long, minutely apiculate, dry or slightly fleshy and dark purple in color.

**Geographical Distribution of *Cinnamomum zeylanicum* (Dalchini)**

This plant is indigenous to Sri Lanka, India, and Myanmar (Burma) and is also cultivated in South America and the West Indies. Sri Lanka is known as best Cinnamomum growing country. Sri Lanka and Seychelles are also producer of best quills. This country also produced Cinnamon leaf oil through distillation [13-15].

**Phytochemical constituents of *Cinnamomum zeylanicum* (Dalchini)**

Cinnamon contains numerous resinous compounds, including cinnamaldehyde, cinnamate, cinnamic acid, and numerous essential oils. Cinnamon has a spicy taste and pungent fragrance due to cinnamaldehyde compound [16]. There are various cinnamon essential oils i.e. trans-cinnamaldehyde, cinnamyl acetate, eugenol, L-borneol, caryophyllene oxide, b-caryophyllene, L-borneol acetate, E-nerolidol, alphacubebene, alpha-terpineol, terpinolene, and alpha thujene [17-18]. *Cinnamomum zeylanicum* consists class of chemical compounds like aldehydes, alcohols, esters, phenols, acids, monoterpenes, diterpenes, sesquiterpenes, benzopyrones, hydrocarbons and flavonoids. Cinnamaldehyde, methoxycinnamaldehyde, hydrocinnamic, benzaldehyde, vanillin, cinnamaldehyde, benzenepropanal, 2-methyl-3-phenyl-propanal, citronellal are the aldehydes present in the bark essential oil of *C. zeylanicum*. The alcohols compounds extracted from the *Cinnamomum zeylanicum* plant are: Cinnamyl alcohol, α-terpineol, linalool, α-Bisabolol; Esters compounds are cinnamyl acetate, cinnamaldehyde diethyl acetyl, methyl cinnamate, hydrocinnamyl acetate, benyl benzoate, bornyl acetate and phenols are eugenol, pyrogallol. Cinnamic acid, ferulic acid, caffeic acid, gallic acid, protocatechuic acid, oleic acid and p-hydrobenzoic acid are also present in different parts of the plant. *Cinnamomum zeylanicum* consists of various monoterpenes including p-cymene, limonene, α-terpinene, α-pinene, camphene, camphor, 1,4-cineole, β-pinene, β-Phellandrene, α-phellandrene and 3-carene; Diterpenes such as cinnzeylanine, cinnzeylanol and Sesquiterpenes i.e. humulene, caryophyllene oxide, β-caryophyllene, α-Murolene, α-copaene, cedrene, α-tumerone, β-tumerone, α-cadinol, t-cadinol, calamene and α-Ylangene isolate mostly from the plant leaves [19-20]. There are many essential oils, so the isolation and separation process can be long and tedious.
Hydro-distillation method is the most commonly used method for separation. In this, chemical compounds are extracted from the bark, leaves, fruits, buds, and stalks of the plant [22-28]. The method is a rapid and less expensive. The disadvantage of this method is chemical alteration and the heat-sensitive compounds get easily destroyed [29]. For completing this limitation supercritical fluid extraction method was introduced. This method is appropriate for the isolation of thermally and chemically unstable compounds. Eugenol is the main compound present in the leaves of cinnamon while α-ylangene, methyl, and ethyl cinnamate are also present in the leaf oil [30]. Benzyl benzoate in bark oil and terpinene-4-ol in root-bark oil were also present in cinnamon. The analysis of different parts of *C. zeylanicum* such as leaf, stem bark, and root bark oils indicated 72 compounds out of which 32 compounds were reported in a study by Jayapraksha and Jagan Mohan Rao. The reported new compounds were 11 monoterpenes, 4 sesquiterpenes 2 aliphatic, and 15 aromatic compounds. In addition, Isogai et al., also reported two new compounds named cinnzeylamine and cinnzeylanol from the dried bark of *C. zeylanicum* [31]. Vermin et al., reported the presence of p-cymene (21.35%) and eugenol (16.7%) by analyses of *C. zeylanicum* leaves oil. Forty-seven chemical constituents were identified using GC-MS analysis of essential oils from cinnamon leaf grown in India [32]. Some structures of major compounds of *C. zeylanicum* are shown in fig 02.

![Some structures of major chemical constituents of C. zeylanicum](image)

**Fig 02: Some structures of major chemical constituents of C. zeylanicum**

**Traditional and Modern View**

a. **Ayurvedic View:** Dalchini (*Cinnamomum zeylanicum*) is a most common aromatic herb with various medicinal properties. Cinnamon is the dried inner brown bark of a cinnamon tree. The flavor of Dalchini is owing to an aromatic essential oil that is about 0.5 to 1% of its composition. The plant possesses amazing medicinal activities like antifungal, antioxidant, antibacterial, lowering cholesterol level in the body, gastrointestinal tract infection and mentioning sugar level and many more. This herb manages Vata and pitta component of body [33-34]. Table no. 03 represents the rasa panchak of Dalchini plant.

<table>
<thead>
<tr>
<th>Sanskrit/English</th>
<th>Sanskrit/English</th>
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<tbody>
<tr>
<td>Rasa/Taste</td>
<td>Katu, Madhura, Tikta/ Pungent, Bitter, Sweet</td>
</tr>
<tr>
<td>Guna/Physical Property</td>
<td>Laghu, Rooksha,Tikshna/Light, Dry, Piercing</td>
</tr>
<tr>
<td>Virya/Potency</td>
<td>Ushana/Hot</td>
</tr>
<tr>
<td>Vipaka/Metabolic Properties</td>
<td>Katu/Pungent</td>
</tr>
</tbody>
</table>

**Some Major Ayurvedic Medicinal Uses of Dalchini are:**

- It provides relief in sore throat, influenza, common cold and headache.
Many chemical drugs are in the lack of required. The finding revealed potent \textit{Shifali et al., Int J. Pharm. Drug. Anal, Vol: 9, Issue:2, 2021; 126-136}

\begin{itemize}
  \item It is also used as an expectorant and have antitubercular activity.
  \item It is a natural remedy in the case of rheumatoid arthritis.
  \item Also helpful in reducing cholesterol levels and tends to strengthen the heart muscles.
  \item It provides relief in menstrual pain. A study says women should drink a cup of warm cinnamon water every day it helps in experiencing less pain during menstruation for a short duration.
\end{itemize}

Dalchini is utilized for good digestion and possess anti-inflammatory properties. Reported studies also demonstrated the use of dalchini in neurodegenerative diseases like Alzheimer’s, Parkinson’s diseases and, multiple sclerosis.

**Various Ayurvedic Product of \textit{Cinnamomum zeylanicu}m**

Madatyahar Churna, Kaas-har Churna, Arjun Tea, Praanarakshak Churna, Stholyantak Churna, Detox tea, Chanderprapha Vati.

Dalchini is also utilized against Covid-19. Ayush-Kwath is the ayurvedic herbal formulation used to improve immunity and combat infection. The Ministry of Ayush, Government of India has prescribed “Ayush Kwath” in Covid patients to improve their immunity. The formulation consists of various medicinal plants i.e. Tulsi, Dalchini, Sunthi and Marich. These medicinal herbs possess immune-modulatory effects, antiviral, antioxidant, anti-inflammatory, antiplatelet, anti-atherosclerotic, hepatoprotective and renoprotective properties. All these properties seem to be effective in immune-regulation for controlling viral infections like Covid-19 [35].

**b. Folk View:** From ancient times, cinnamon is used as a condiment and flavoring agent [36]. Some reports suggested that it improves the health of the colon, thereby reducing the risk of colon cancer [37]. It is used to prevents bleeding [38]. Cinnamon increases the blood circulation in the uterus and advances tissue regeneration [39]. The herb has many traditional properties including antimicrobial [40-43], antifungal [44], antioxidant [45-49], antidiabetic [50-55], anti-inflammatory [56], antitermitic [57], nematicidal [58], mosquito larvicidal [59], insecticidal [60] and anticancer agent [61]. Cinnamon has also been traditionally utilized for toothaches, dental problems, oral microbiota and bad breath [62-63].

**c. Modern View:** Many chemical drugs are in the market against various diseases but still, plant based medicines are considered for their negligible adverse impacts and least toxicity. As we all know that chemical drugs are action-oriented for specific disorders, while plant extracts work synergistically and possess more than one therapeutic activity. Singh et al., reported that one pathway activated via cinnamon is involved in other complications too, so treatment of one disease can prevent the other diseases automatically [64]. Adulteration and substitution are the most common malpractices in any market of crude drugs. Therefore, the authentication of medicinal plants is very important [65]. There are several factors that directly or indirectly promote the quality degradation of herbal medicine by unavailability of required species, similar morphological appearance, conflict in vernacular names of herbal plants mishandling and improper storage and deliberate substitution [66-69]. Many other threats have the ability to create hardship for herbal drug markets such as lack of skilled traditional AYUSH professionals having a scientific background, insufficient research and development activities, lack of regulatory standards and documented information on herbal plants and influence of western medication etc. [70] Some standardization can be initiated by proper pharmacognostical study of drug as it provides whole information about crude drugs [71].

**Reported Pharmacological and Therapeutic Activities of \textit{Cinnamomum zeylanicum}**

**Antimicrobial Activity**

Various studies states that \textit{Cinnamomum zeylanicum} is a well-documented antimicrobial agent because of its strong hydrophobic nature [72-73]. Naveed et al., evaluated the antimicrobial activity of essential oils of \textit{C. zeylanicum} along with three other herbs i.e. \textit{Cuminum cymicinum, Annonum subulatam} and \textit{Syzygium aromaticum} via broth micro-dilution method against \textit{Salmonella typhi, Salmonella para-typhoid, Escherichia coli, staphylococcus aureus, Bacillus licheniformis} and \textit{Pseudomonas fluorescens}. The finding revealed potent antimicrobial activity of \textit{C. zeylanicum} against all bacteria’s than the other three herbs [74]. Abdalla and Abdelgadir also reported antimicrobial activity of methanol, ethanol, petroleum ether and ethyl acetate extracts of \textit{C. zeylanicum} against \textit{staphylococcus aureus, Bacillus subtilis, Escherichia coli} and \textit{Pseudomonas...
**Antioxidant Activity**

Saraya et al., reported antioxidant activity of hexane, chloroform and methanol extract of cinnamon, black pepper, ginger and turmeric via DPPH, phosphomolybdate and ferric reducing antioxidant power assay. Methanol extract of cinnamon showed strongest antioxidant activity than others [78]. Another study by Elgendy et al., evaluated strongest antioxidant activity of cinnamon essential oil than lemon oil [79]. Beji et al. reported antioxidant activity of cinnamon powder in alloxan-induced diabetic rats. The antioxidant enzymes such as glutathione, peroxidase, catalase and superoxide dismutase present in the cinnamon powder significantly increased and reduce the blood glucose level in the rats [80].

**Anti-inflammatory Activity**

Durak et al., reported anti-inflammatory activity of the methanolic and ethanolic extracts of *C. zeylanicum* by inhibiting the lipooxygenase (LOX) enzyme activity in the mice. The mice were artificially induced with collagen-mediated arthritis. Both extracts were found to reduce the production of pro-inflammatory cytokines in the model [81]. Qabaha et al., evaluated the anti-inflammatory activity of ethanolic extract of *C. zeylanicum* along with *C. longa* in lipopolysaccharide (LPS)-induced interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α) of polymorph nuclear cells. The in-vitro study showed anti-inflammatory activity of cinnamic acid via decreasing the level of IL-6 and TNF-α in the cells [82].

**Anticancer Activity**

*In-vitro* study by Goyal et al., examined the anticancer activity of the water-soluble polysaccharide and other different extracts of cinnamon against macrophage cell lines via cell proliferation assay. The cinnamon polysaccharide fraction was found to possesses more immunostimulatory effects as compared to other cinnamon extracts [83]. Mehrin and Salem studied various herbal plants including *C. zeylanicum* for their anti aflatoxin activity on 360 randomly selected fishes. The result showed that *C. zeylanicum* has a significant effect against aflatoxin [84]. Bhagwathey and Latha mentioned in their study that various types of ulcers and cancers were treated with the *C. zeylanicum* plant [85]. Ezzat et al., reported anticancer activity of cinnamon bark aqueous extract on 7,12-dimethylbenz anthracene (DMBA) induced oral cancer in sixty male Syrian hamster’s cheek pouch (HCP) mucosa via various cytotoxicity assay such as 3-(4,5-di-methlthiazol-2yl)-2,5-diphenyl tetrazolium bromide (MTT) assay, DNA fragmentation assay, etc. The finding revealed that cinnamon aqueous extract significantly suppressed oral cancer progression [86].

**Antidiabetic Activity**

Shokri et al., reported antidiabetic activity of methanol extract of cinnamon along with 50 green teas in 50 streptozotocin (STZ) induced diabetic rats. The treatment was 6-week long. After the treatment, a significant reduction in glucose levels in the rats were found. The extracts have shown a synergistic effect to balance diabetes [87]. Elwahab evaluated the antihyperglycemic effect of *C. zeylanicum* and ginger in 40 adult albino male rats. The finding revealed that *C. zeylanicum* was more effective against diabetes than ginger [88]. El-Desoky et al., reported antidiabetic activity of aqueous extract of cinnamon in alloxan-induced diabetic rats. The rats were administered with different doses (200, 400,600 and 1200 mg/kg) of cinnamon aqueous extracts for 30 days. After 30 days of treatment, a significant reduction in FBG, HDL, cholesterol, LDL, cholesterol, triglucerides and serum contents were observed. The result showed that 200mg/kg of the dose has higher antidiabetic effects than others [89]. Li et al., evaluated the antidiabetic activity of cinnamon in diabetic mice. The mice were induced with streptozocin. Cinnamon was administered in mice for 14 days. Later, diabetic mice were evaluated via glucose oxidase (GOD) and radioimmunoassay (RIA). Result revealed that cinnamon maintains the blood glucose level and insulin level in the rats [90].

**Wound Healing Activity**

Farahpour and Habibi evaluated ethanolic extract of cinnamon for wound healing property in mice. The mice
were administered with 1.5% and 3% of cinnamon extract for 14 days. Result showed that 3% cinnamon extract has significant wound healing property [91]. Ahmadi et al., reported wound healing property of cinnamon oil in an artificial wound-induced mice model. The models were treated with the ointment which contains 2% and 4% of essential oil of cinnamon. Cinnamon essential oil was found to enhances the mRNA levels of insulin-like growth factor, fibroblast growth factors and vascular endothelial growth factor (VEGF) [92].

**Anti-HIV Activity**

Semenya et al., reported that C. zeylanicum was effective against acquired immunodeficiency syndromes (AIDS). In the study, 26 plants were used to treat HIV/AIDS. Out of 26 plants, Burkea Africana, Citrullus lanatus, Cinnamomum zeylanica, Eucaea crispa, Elephantorrhiza elephantina, Euphorbia maloedens, Geigeria aspera, Plectranthus ciliates, Sarcostemmaviminale, Zanthoxylum capense and Zanthoxylum humile were recorded for the treatment of HIV/AIDS [93].

**Antianxiety and Antidepressant Activity**

Sohrabi et al., evaluated that anti-anxiolytic and antidepressant activity of cinnamon essential oil. They carried various tests like forced swim test (FST), tail suspension test (TST) to determine the antidepressant activity of Cinnamon essential oil. Elevated plus maze test (EPM) and open field test were also carried out to determine the anti-anxiety activity of CEO. The finding revealed that CEO possesses both anti-depressant and anti-anxiety activity in rats [94]. Another study reported antianxiety and anti-depressant activity of the cinnamon hydroalcoholic extract in lead acetate-induced rats. The dose of 200 mg/kg of cinnamon extract was administered for 30 days. FST test revealed that cinnamon has significantly reduced the immobility time delay and enhanced the total time of immobility and EPM test revealed the significant reduction of open arms entries. Therefore, cinnamon extract has both anti-anxiolytic and antidepressant activity [95].

**Anti-Parkinson Activity**

Khasnavis et al., reported antiparkinsonian effects of Cinnamomum zeylanicum in MPTP-intoxicated mice. The dose of 100 µl of cinnamon powder solubilized in 0.5% methylcellulose (MC) was administered in mice. It was observed that dose has stimulated the sodium benzoate production in the brain and brain cells of mice models. Result suggested that cinnamon is beneficial for the treatment of Parkinson’s disease [96].

**Toxicological Studies**

Isaac et al., examined the consumption of cinnamon-associated intraoral allergic contact dermatitis (ACD). Cinnamic aldehyde is widely used as a flavoring agent in foods and dentifrices. However, intraoral allergic contact dermatitis (ACD) induced by cinnamon agents has been occasionally reported [97]. Cardoso et al., reported the toxicity of cinnamic acid, a compound derived from cinnamon essential oil. The study revealed that the toxicity of the compounds was dose-dependent when added to perfumery and oral care products [98].

**Conclusion**

*Cinnamomum zeylanicum* is an extensively utilized medical herb for numerous pharmacological potential. This herb is included in almost each medication system worldwide. Several reports have mentioned numerous properties of *Cinnamomum zeylanicum* like anti-diabetic, antimicrobial, antioxidant, anti-inflammatory and anticancer. Each of these properties plays a key role in the advancement of human health. Eugenol, cinnamaldehyde, cinnamyl acetate, camphor and camphor are present as major constituents of the *Cinnamomum zeylanicum* plant. Cinnamaldehyde has been extensively explored for its pharmacological actions. Each aspect of the plant from morphological description to phytochemical profile and therapeutic action has been thoroughly explored in the present study.

**Conflict of Interest**

None

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**Author Contribution**

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Dr. Gitika Chaudhary drafted the article and contributed in writing Ayurvedic view of the article. Shifali Thakur contributed in drafting and writing pharmacological portion of plant. Bhawna Walia contributed in data collection and writing the paper.
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