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Cinnamon: A Common Medicinal Spice

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ABSTRACT

Cinnamon is the dried inner bark of stems of *Cinnamomum zeylanicum* belonging to the family Lauraceae. It is extensively used as spice since centuries worldwide. Apart from this it has been widely used for different medicinal purposes in Unani as well as Ayurveda system of medicine. Its trees are widely distributed throughout Sri Lanka, south-western India and Burma. It has been used in traditional systems of medicine for the treatment of various diseases like epilepsy, hemiplegia, chronic bronchitis, asthma, jaundice, skin and gastrointestinal disorders etc. The qualitative phytochemical analysis of the plant extracts shows the presence of essential oils, tannins and mucilage. Recent pharmacological and clinical studies revealed its antibacterial, antifungal, antitumour, immunomodulatory, wound healing and anti-inflammatory activities. This review is an effort to summarize the detailed prospects of ancient literature on *C. zeylanicum* along with modern researches.

Keywords: Antibacterial, Cinnamon, *Cinnamomum zeylanicum*, Unani.

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INTRODUCTION

Cinnamon is a commonly used spice and a well-known medicinal plant. It consists of the dried inner bark (devoid of cork and cortex) of the coppiced shoots of the stem of *Cinnamomum zeylanicum* Blume. belonging to the family Lauraceae.^{1,2} Cinnamon and cassia are mentioned as precious odoriferous substances in the mosaic writings and by Theophrastus. According to Galen these two species are of similar in nature, but cassia is inferior to cinnamon. Dioscorides also describes several varieties of cinnamon and cassia. The Arabians called the spice *Kirfat-ed-darsini*, or more shortly *Kirfah* (the bark par excellence). Darsini is the Arabian form of the Persian darechini, and signifies “China tree,” dar being an old Persian name for a tree; it is therefore probable that the Arabs first obtained the spice from the Persians by the overland route from China. The same name is still current in India for Chinese cinnamon, whereas the Indian bark is properly called *Taj*, a word derived from the Sanskrit *Tvach*. Haji Zein (1368 AD) says “the best darchini is that which comes from Ceylon and cassia is the *Salikkeh*”.³ It is used in Unani as well Ayurveda systems of medicine since millennia for various ailments of gastrointestinal, Integumentary, Reproductive, Respiratory and Nervous systems. Chemical analysis of *C. zyalenicim* reveals that it contains volatile oil, resin, tannin and starch etc. Various pharmacological and experimental studies have been conducted which showed its antibacterial, antifungal, hypolipidemic and hypoglycaemic activities etc. In this review an attempt is made to explore the potential of this common spice.

Vernacular Names

Arabic : Darsini, Qirfa, Qirfahesailaniyah,⁴ **Persian** : Darchini, Darchinisailaniyah⁴ **Assamese** : Dalcheni, Dalchini,¹ **Bengali**: Darchini, Daruchini, Qalamidarchini,⁵ **English** : Cinnamon Bark, Chinese cassia,¹ **Gujarati** : Dalchini, Taj,¹ **Hindi** : Dalchini, Darchini, Qalmi Darchini,¹ **Kannada** : Dalchini Chakke¹ **Kashmiri** : Dalchini Dalchin,¹ **Malayalam** : Karuvapatta, Ilavarnghately, Ethunai lavangam,¹ **Marathi** : Dalchini,¹ **Oriya** : Dalochini, Gudotwako, Daruchini,¹ **Punjabi** : Dalchini, Darrchini,¹ **Sanskrit** : Darusita, Tvaka, Tamalapatra,⁶ **Tamil** : Lavankapattai,⁷ Karuvapattai, **Telegu** : Lavangapatta, Dalchini chekka,⁷ **Urdu** : Darchini.¹

Habitat and distribution

C. zyalenicum is believed to be indigenous to Sri Lanka.^{5,8} It is found in moist tropical evergreen and semi-evergreen forests of south-western India, up to an altitude of about 1500 m from western Karnataka through Kerala, as well as in Burma.⁹ In India it is cultivated mainly in Tamil Nadu, Karnataka and Kerala and to a limited extent in eastern India for its bark and leaves.⁵

Botanical Description

It is a moderate sized evergreen tree, 8 to 18 meter in height and 50 cm in diameter¹⁰ with rough brownish bark 16 cm in thickness,¹¹ wood light-red, moderately hard and scented. When cultivated for its bark, it is usually grown in coppices, hence the shape of the leaf is variable. Flowers in panicles with long peduncles. Fruit is a single seeded berry, ovoid, dark purple with a persistent perianth and 12 cm long. It bears flower and fruits in spring.^{9, 11}

Part Used

Bark^{5, 10, 11} and Leaf^{5, 11}

Therapeutic Dose

Bark powder: 1 to 3 gm^{2, 12}

Oil : 2 to 5 drops¹¹

Chemical Constituents

It contains Eugenol, O-methyl eugenol, Benzaldehyde, Cinnamaldehyde, I- α -pinene, I- α - and I- β -phellandrene, p-cymene, Caryophyllene, Benzyl benzoate, Linalool, Safrole, Acetyleneugenol, Cinnamyl acetate and Cinnamyl alcohol.^{10, 13}

It has Essential oil, tannin and mucilage² and Cinnacassiol A, B and C, trans-cinnamic acid, protocatechuic acid, cinnamaldehyde and eugenol.⁷

Actions Mentioned In Unani Medicine

Mudire Haiz^{14,15,16,17,18} (Emmenagogue), *Mudire Boul*^{14,15,16,17,18} (Diuretic), *Muhallil*¹⁸ (antiinflammatory), *Muqawwie Maida*^{14,17,19} (Stomachic), *Hazim*^{18,19} (Digestive), *Muqawwie Qalb*^{14,16,18,19,20} (Cardiac Tonic), *Dafe Taffun*^{14,16,21} (Antiseptic), *Muqawwie Bah*^{15,17,18,19} (Aphrodisiac), *Kasire Riyah*^{15,16,17,18} (Carminative), *Muqawwie Jiger*^{14,17,19} (Liver Tonic), *Musaffiud Dam*¹⁸ (Blood Purifier), *Munzij*¹⁶ (Foul smell scavenger in lungs), *Mulaiyyan*¹⁶ (Laxative), *Mufatteh*^{14,18} (Deobstruent), *Muqawwie Dimagh*^{16,18} (Brain Tonic), *Mufattite Hisat*¹⁹ (Lithortriptic), *Jazib*^{14,18} (Absorbent), *Musakhkhin*¹⁶ (Rubifacient).

Uses In Unani Medicine

*Mirgi*¹⁸ (epilepsy), *Falij*¹⁹ (Hemiplegia), *Laqwa*^{18,19} (Facial Paralysis), *Rasha*^{16,19} (Chorea), *Aasabi Amraz*¹⁹ (Neurological Disorders), *Kalaf wa Namash*^{16,18,19} (Melasma), *Khafqan*^{15,17,18,19} (Palpitation), *Muzmin Khansi*^{14,16,17,18,19,22} (Chronic Bronchitis), *Quroohe Ria*^{19,22}, *Suddae jigar*^{14,15,16,19} (Hepatic Obstruction), *Istasqa*^{14,15,16,17,18,19} (Ascites), *Darde Rahem*^{14,16,19}, *Tape Larza*^{14,16,19} (Fever), *Darde Kulliya*^{14,16,18} (Renal Colic), *Muhasa*^{14,16} (Acne), *Bawaseer*^{14,17,18} (Hemorrhoids), *Darde Uzn*^{14,18} (Otagia), *Zatul Janab*^{16,17} (Plurisy), *Darde Shikam*¹⁶ (Abdominal Pain), *Hichki*^{16,17} (Hiccups), *Amraze baridae Dimagh*¹⁷, *Darde Sir*^{17,18}

(Headache), *Dama*¹⁸ (Asthma), *Yarqan* (Jaundice),¹⁸ *Qai* (Vomiting),¹⁸ *Ishal* (Diarrhoea),¹⁸ *Darde Dandan* (Toothache).¹⁸

Important Formulations

Habb-e-Ambar Momyaee, *Dawa-ul-Misk Motadil Sada*, *Jawarish-e-Bisbasa*, *Jawarish-e-Jalinoos*, *Jawarish-e-Pudina*, *Majoon-e- Dabeedulward*, *Majoon-e-Falasifa*, *Majoon-e-Mughalliz*, *Majoon-e-Ushba*, *Raughan-e-Darchini*.¹

Ethnobotanical Actions

Oxytotic,^{8,11} Anthelmintic, Deodorant,¹⁰ Febrifuge,¹⁰ Aromatic,^{4,8,10} Astringent,^{4,5,6,8,10,12,22} Stimulant,^{4,5,6,8,10,11,22} Antitubercular, Haemostat,^{11,12} Emmenagogue,⁹ Diuretic,^{10,11} Analgesic,¹¹ Stomachic,^{8,9,11,24} Dentifrice, Digestive,¹¹ Cardiotonic,¹¹ Antiseptic,^{8,12} Antibacterial^{12,25} Aphrodisiac,^{10,11} Carminative,^{4,5,6,8,9,10,12,22,23,24,25} Liver Stimulant,¹¹ Blood Purifier,¹¹ Foul smell scavenger in lungs,¹¹ Antispasmodic,^{8,12,25,26} Germicide,⁸ Vascular Stimulant,⁸ Nervine Stimulant,⁸ Ulcerhealer, Antidiabetic,¹² Antipyretic,²⁴ Astringent,^{24,25} Balsamic,²⁴ Diaphoretic,²⁴ Antithrombotic²⁴ and Antitumor.²⁴

Ethnobotanical Uses

Neural debility,¹¹ paralysis,¹¹ Neuralgia,^{5,8,12,24} Restoring normal skin colour,^{9,10} Cardiac debility,^{9,10,11} Bronchitis,^{9,10} Tuberculosis,⁵ Amenorrhoea,^{8,11} Fever,^{9,10,12} Uropathy,^{9,10} Haemorrhoids,¹¹ Abdominal Pain,^{8,9,11} Headache,^{5,8,11,24} Asthma,^{9,10} Mouthwashes,¹² Dysentery,^{5,8,12} Diarrhoea,^{4,5,8,9,10,12,25,26} Nausea and vomiting,^{4,5,6,8,9,12,22,24,25,26} Tooth ache, Dental cavity,^{5,8,12} Paralysis of tongue,^{5,8} Gastric trouble,^{6,22} Weakness of Stomach,⁴ Anorexia,¹² Enteric fever,^{5,8,11} Dyspepsia,^{8,12,25,26} Flatulence,^{8,9,10,12,25} Menorrhagia,^{5,8,26} Lupus,⁸ Enteralgia,⁸ Gonorrhoea,^{5,8} Cancer of stomach, rectum and uterus,⁵ Cramps of Stomach,^{5,12} Rheumatism,^{5,12,24} Sinusitis,¹² Common cold,^{24,25} Dysmenorrhoea,²⁶ Infant Colic,²⁶ and Halitosis.²⁴

MODERN SCIENTIFIC RESEARCHES

Antifungal Activity

The essential oil of plant inhibited mycelia growth of *Aspergillus flavus* and *Aspergillus niger* completely. The minimum inhibitory count (MIC) of the oil was found to be 400 ppm against both the test fungi. While the oil was fungistatic in nature at its MIC, it was proved to be fungicidal at higher doses.²⁷

In another study it is found that *Cinnamomum zylanicum* exhibited 61mm, 62.66mm, 62mm, 31.33mm, 54.66mm and 54mm inhibition zone against *Tricophyton spp.* (scalp isolate),

Tricoophyton spp. (nail isolate), *Microsporum nanum*, *Candida spp.* *Aspergillus niger* and *Rhodotorula spp.* respectively. It also showed inhibition zone of 42.66mm, 43.33mm, 36.66mm and 41.33mm against *E.coli*, *Bacillus spp.*, *Shigella spp.* and *Streptococci* respectively.²⁸

Sessou Philippe et.al assess in vitro antifungal activity of essential oils extracted from fresh leaves of *Cinnamomum zeylanicum* and *Ocimum gratissimum* against spoilage and pathogens moulds *Aspergillus terreus*, *Aspergillus ustus*, *Aspergillus niger*, *Aspergillus aculeatus*, *Penicillium brevicompactum* and *Scopulariopsis brevicaulis* both isolated from wagashi. The screening of their antifungal activity was carried out by determination of antifungal activity parameters as mycelial growth inhibition, minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC). Results obtained from this study showed that *C. zeylanicum* had total inhibited effect only on *Aspergillus terreus* (MIC= 400 mg/L and MFC = 600mg/L), *Scopulariopsis brevicaulis* (MIC= 600 mg/L and MFC =800 mg/L) and *Penicillium brevicompactum* (MIC= 1000mg/L). *Aspergillus aculeatus* was the most resistant strain to *Cinnamomum zeylanicum* essential oil with MGI equal to 59.52% whereas *Aspergillus terreus* and *Scopulariopsis brevicaulis* were the most sensible on which the two volatiles extracts tested had fungicidal activity with MFC ranged from 600 to 1000 mg/L.²⁹

Antibacterial Activity

Essential oil of *cinnamomum zeylanicum* was found to check the growth of *Vibrio cholera* and *Salmonella paratyphi*.²⁷

In a study, in vitro antibacterial activity of ethanolic and acetone extracts of cinnamon bark by disc diffusion method has been evaluated against two gram negative food spoilage bacteria *Pseudomonas sp.*, *Escherichia coli* and two gram positive bacteria *Bacillus subtilis* and *Staphylococcus aureus*. Result shows that Ethanolic extract of cinnamon has antibacterial activity against *Pseudomonas sp.*, whereas acetone extract exhibited highest activity against *Escherichia coli*.³⁰

Immunomodulatory Activity

In an experimental trail the bark of *C. zeylanicum* was administered orally at a dose of 10 mg/kg and 100 mg/kg in swiss albino mice. Levamisole (2.5 mg/kg p.o) was used as standard drug. The low dose of cinnamon bark (10 mg/kg p.o) produce only an increase in serum immunoglobins levels while the high dose of cinnamon bark (100 mg/kg p.o) decrease pasteurella multocida induced mortality by 17%, increased the phagocytic index in carbon clearance assay, increased neutrophil adhesion, increased immunoglobulin levels and antibody titre values. Hence it was concluded that cinnamon in high doses possess immunostimulant activity.³¹

Antitumor and Immunomodulating potential

In vitro antitumor and immunomodulating activities of aqueous and methanol extracts of *Coriandrum sativum* (leaf and seed), *Piper nigrum* and *Cinnamomum zeylanicum* seeds were evaluated and observed that aqueous extract of *C. sativum* (leaf), *P. nigrum*, and *C.zeylanicum* caused significant ($P<0.05$) 24, 39 and 61 percent L5178Y-R lymphoma cells toxicity at 31.2, 31.2 and 7.8 $\mu\text{g/ml}$ (MICs) respectively, whereas the methanol extract of *C. sativum* (seed and leaf), *P. nigrum*, and *C. zeylanicum* caused 40, 31, 26 and 39 percent cytotoxicity at 7.8, 62.5, 15.6 and 7.8 $\mu\text{g/ml}$ (MICs), respectively. In addition, *C. sativum* leaf aqueous extract stimulated significant ($P<0.01$) 14 to 45 percent splenic cells lymphoproliferation at 7.8 to 125 $\mu\text{g/ml}$ respectively, whereas *P. nigrum* caused significant ($P<0.01$) 79 percent proliferation at 125 $\mu\text{g/ml}$; similarly, *C. zeylanicum* aqueous extract significantly ($P<0.01$) induced 20 and 37 percent thymic cells lymphoproliferation at 62.5 and 125 $\mu\text{g/ml}$ respectively, whereas the methanol extracts of *C. sativum* leaf extract caused significant ($P<0.01$) 43 to 59 percent lymphoproliferation at the concentrations tested. Furthermore, all spice aqueous extracts tested were observed to significantly ($P<0.01$) reduce up to 100% nitric oxide production by LPS-stimulated macrophages.³²

Anti-secretagogue and antiulcer effects

The gastric antisecretory and antiulcer activities of *Cinnamomum zeylanicum* is investigated in rats . The aqueous suspension (250 and 500 mg/kg) has been screened using pylorus ligation (Shay) rat model, necrotizing agents and indomethacin-induced ulceration in rats. Histopathological assessment was done on gastric tissue of rats. Gastric wall mucus and nonprotein-sulfhydryl contents were also estimated. Cinnamon suspension pretreatment decreased the basal gastric acid secretion volume and rumenal ulceration in pylorus ligated rats. The suspension effectively inhibited gastric hemorrhagic lesions induced by 80% ethanol, 0.2 M sodium hydroxide, and 25% sodium chloride. The cinnamon suspension also showed antiulcer activity against indomethacin. Pretreatment with cinnamon suspension offered a dose-dependent protection against various histological indices. Treatment of rats with cinnamon replenished the ethanol-induced decreased levels of gastric wall mucus and nonprotein-sulfhydryl concentrations. The gastroprotection of cinnamon observed is attributed to its effect through inhibition of basal gastric secretion (attenuation of aggressive factors) and stimulation mucus secretion (potentiation of defensive factors); and increase in nonprotein-sulfhydryl concentration probably due to prostaglandin-inducing abilities mediated through its antioxidant property.³³

Wound healing activity

Mohammad Reza Farahpour et al conducted an experimental trial to determine the effect of *Cinnamomum zeylanicum* on experimentally induced excision wounds in rats. The result shows that cinnamon extract had a significant effect on wound healing; it accelerated the healing process of the wounds. Significant enclosure rates were seen after 7 days of study. This study proves that *C. zeylanicum* is effective in treating experimentally induced wounds and hasten healing. It especially increases the process of epithelialization.³⁴

Effect on male reproductive system

In a study different doses of hydro-ethanolic extract of Cinnamon were injected, intraperitoneally to test group mice for 20 days while the control group received normal saline plus ethanol. Variation in testicles weight, histological changes in testes, changes in number of sexual cells and density of LH, FSH and testosterone in blood of the subjects are the parameters included in this study. The results of the study indicated that cinnamon can significantly increase the level of LH and FSH in doses of 200, 400 mg/kg. The density of testosterone increased in dose of 50, 100 mg/kg also the number of sperms and primary spermatocytes raise in 100, 200 and 400 cinnamon extract while no significant changes were observed in weight of testicles and also in histological findings. The findings of this research indicated the positive effects of cinnamon extract on male reproductive system and hormonal changes in pituitary-gonad axis.³⁵

Anti-diabetic and Lipid homeostatic activity

In a study biochemical parameters viz lipid profile and glycogen biosynthesis were analyzed and differential regulation and expression of glucose homeostatic enzymes were evaluated in streptozotocin (STZ)-induced type-I diabetic rats to validate the anti-diabetic activity of the Cinnamon bark aqueous extract. Results of the study show that Total cholesterol (TC), triglyceride (TG), LDL-cholesterol (LDL) and VLDL-cholesterol (VLDL) levels decreased significantly in the diabetic animals by 12.5, 23.86, 14.96 and 20 %, respectively, compared to their initial values. The extract increased HDL-cholesterol (HDL) and tissue glycogen levels by 25.0 and 172.3 %, respectively, in diabetic rats.³⁶

In another study the anti-diabetic potential of ethanolic extract of *Cinnamomum zeylanicum* leaves was investigated. The administration of ethanolic extract of *C. zeylanicum* orally in the doses of 100, 150 & 200 mg/kg body weight to white Wistar albino rats significantly reduced their blood sugar level in allxon induced diabetic rats under acute and sub acute studies.³⁷

Anti-diarrhoeal activity

The aqueous extract of the bark of *Cinnamomum zeylanicum* at graded doses (100mg/kg, 200mg/

kg body weight) was investigated for its anti-diarrhoeal activity in terms of the reduction in the rate of defaecation and the consistency of faeces in castor oil, MgSO₄ induced diarrhoea. Results of the study showed significant inhibitory activity and significant reduction in the gastro intestinal motility was also noted by using the charcoal meal test in mice.³⁸

Anti-inflammatory activity

In a study anti-inflammatory activity of *C. zeylanicum* was investigated by using its ethanol extract obtained from bark. *In vitro* and *in vivo* experiments were performed targeting TNF- α using flow cytometry. Ethanol extract of *C. zeylanicum* showed suppression of intracellular release of TNF- α in murine neutrophils as well as leukocytes in pleural fluid. The extract was found to inhibit TNF- α gene expression in LPS-stimulated human PBMCs at 20 μ g/ml concentration.³⁹

Toxicity study

In a study ethanolic extracts of *Cinnamomum zeylanicum* bark and Piper longum fruits were given orally in mice to carried out Acute (24 hours) and chronic (90 days) oral toxicity studies. Acute dosages were 0.5, 1.0 and 3 g/kg while the chronic dosage was 100 mg/kg/day. All external morphological, hematological and spermatogenic changes, in addition to body weight and vital organ weights, were recorded. Result shows that the extracts of both the plants caused no significant acute or chronic mortality compared to the control during the study. During chronic treatment there was no significant change in the pre and post treatment body weight of the test animals while the weight gain in the control group was significant. *C. zeylanicum* treatment caused reduction in liver weight while *P. longum* caused a significant increase in the weight of the lungs and spleen of the treated animals compared to the control. Hematological studies revealed a significant fall in hemoglobin level of *C. zeylanicum* treated animals. Both of the extracts induced a significant increase in reproductive organ weights, sperm motility, sperm count and failed to illicit any spermatotoxic effect.⁴⁰

Adverse Reactions

Powdered bark if ingested orally, it is generally well tolerated.²⁶

Oil – may cause allergic reactions as Cinnam aldehydes may cause allergic contact dermatitis.²⁶

Pregnancy Use

Usually dietary intake is safe.²⁶

Contraindication and Precaution

It is contraindicated in people with an allergy to cinnamon or Peru balsam and in active stomach or duodenal ulcer.^{26, 41}

- Cinnamon bark may cause an allergic reaction in some individuals.^{26, 41}
- Cinnamon bark is not recommended for pregnant or nursing women.^{26, 41}
- Do not take essential oil of cinnamon bark internally more than prescribed quantity.^{26,41}
- Essential oil of cinnamon bark is one of the most hazardous essential oils and should not be used on the skin in large quantity.^{26, 41}
- External application of the oil may cause redness but if applied more than the prescribed amount it may cause burning of skin.^{26, 41}

CONCLUSION

Cinnamon is truly a remarkable spice as well as medicine with a long history of human usage for the treatment of a variety of disorders like diarrhoea, vomiting, dyspepsia, flatulence, hemiplegia, chronic bronchitis, asthma and jaundice etc. The various extracts of *C. zeylanicum* showed antibacterial, antifungal, hypolipidemic and hypoglycaemic activities. The essential oil of plant is a commonly used antifungal and antibacterial agent. Aqueous and methanolic extracts were seen to have antitumor and immune modulating activities. The cinnamon suspension possesses antiulcer activity. The presence of Eugenol, O-methyl eugenol, Benzaldehyde, Cinnamaldehyde are responsible for these effects. Further investigations should be carried out to isolate and characterize the specific active components of this plant which are responsible for other actions.

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