Review Article

Review Based Upon Ayurvedic and Traditional Uses of *Cinnamomum tamala* (Tejpatta)

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ABSTRACT

Cinnamomum tamala is an evergreen plant native to Sri Lanka and India. This herbal plant is commonly called Indian cassia, Tejpatta and Indian bay leaf. There are many bioactive constituents isolated from plant *Cinnamomum tamala.* Leaves of the plant possess aromatic fragrance and are also utilized as a flavoring agent. It is used in food curry, pickles and other spices. Besides food application, the leaves have also been used for curing a number of ailments. All parts of the plant possess many major bioactive chemical constituents like cinnamaldehyde, trans-cinnamaldehyde, 3,4,5,7- tetrahydroxyflavone, 3,3,4,5,6- pentahydroflavone (non-glycoside compounds), kaempferol, eugenol, etc. These phytochemical compounds have many pharmacological activities such as anticancer, antidiabetic, antimicrobial, hepatoprotective, antidiarrheal and immunomodulatory. In the past time, it is also considered for medicinal use. Their medicinal use was also mentioned in the literature of ayurveda, yunani and other traditional systems of medicine. Due to aromatic fragrance, it is also utilized in the perfume industry. The major aim of this review is to give a brief knowledge about the plant *Cinnamomum tamala* based on their phytochemical constituents, ayurvedic view, folk view and pharmacological application.

Keywords: *Cinnamomum tamala*, Tejpatta, Antidiabetic, Ayurveda, Eugenol.

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INTRODUCTION

India is a plant-based country and also famous for its spices production. Spices played a vital role in the history of exploration and development. Spices are widely utilized in meat, sauce, canning, frozen foods industries and food manufacturing industries. They are also utilized in the cosmetic and perfumery industries including their use in soap and toothpaste. The essential oils extracted from the spices are also used in various ayurvedic and allopathic formulations. *Cinnamomum* are known to be the oldest spices which have a sweet fragrance and warm taste. *Cinnamomum tamala* (Figure 1) is a plant that belongs to the Lauraceae family. It is locally named as Indian bay leaf and Tejpat. Cinnamomum is one of the genus which has been extensively utilized for the treatment of a wide array of disorders in various traditional systems of medicine including western herbal medicine [1,2]. *C. tamala* is used as a spice for cooking purposes across the world. The plant is native to India, Nepal, Bhutan and China. *Cinnamomum* family contains about 55 genera and over 2000 species worldwide [3]. The Himalayan region contains around eight species that is *Cinnamomum bejolghota (Buch-Ham)* Sweet, *Cinnamomum comphora (L.) J. presl, Cinnamomum glanduliferum (wall.) Meisn, Cinnamomum glaucescens (Nees) Hand-Mazz., Cinnamomum impressinervium Mesin., Cinnamomum parthenoxylon (Jack) Meism., Cinnamomum tamala (Buch-Ham) Nees and Eberm.,* and *Cinnamomum zeylanicum Breyn*. In all of the above species, *C. tamala* is reported for the improvement in digestion as well as appetite stimulation [4]. The suitable cultivation condition for the plant *Cinnamomum tamala* is a warm and tropical region. The plant is cultivated commercially in various areas of the country. In India, leaf production and essential oil of *Cinnamomum tamala* are utilized for commercial benefits. Many active components are isolated from the plant *Cinnamomum tamala. Cinnamon* bark oils were found to include cinnamaldehyde, eugenol and linalool. These compounds are reported to possess chemoprotective activity [5]. In ancient times various formulations were prepared from this plant like sudarshan choorna and chandraprabhavati [6]. It also possesses various pharmacological properties for the cure and prevention of many diseases. There are several phytochemicals responsible for their therapeutic action. These bioactive compounds are cinnamaldehyde, trans-cinnamaldehyde, 3,4,5,7- tetrahydroxyflavone, 3,3,4,5,7-pentahydroxyflavone (non-glycoside compounds), kaempferol-3-O-rutinoside, quercetin-3-O-sophoroside (flavonoid glycoside), kaempferol-3,7 di-O-rhamnopyraoside, α-pinene, myrcene, camphene, p-cymene limonene, eugenol (4-hydroxy-3-methoxy-allylbenzene), methyl ether eugenol and eugenol acetate [7,8,9]. Some reported studies showed that leaf oil of the plant also possesses many major bioactive compounds including Furanogermenone, β- caryophyllene,

germacerene d, curcumenol, curzerenone, furanodiene and furanodienone. These chemical compounds are reported to possess various pharmacological activity such as anti-hyperlipidemic, anti-diabetic activity, gastro-protective, anti-helminthic/ antiprotozoal activity, anti-diarrhoeal, antifungal, antibacterial and others [10]. The vernacular names and taxonomical classification of *C. tamala* are shown in table no 1 and table no. 2 respectively.

Figure 1. *Cinnamomum tamala* (Tejpatta)

Table 1: Vernacular Name of *Cinnamomum tamala*

English	Indian Bay Leaf, Indian cassia, Mlabar Leaf, Indian Bark, Malabathrum
Hindi	Tejpatta, Tejpatta and Tejpat
Urdu	Tezpat
Arabic	Saynamum tamalaam
Japanese	Tamara-nikei, Tejipatto
Chinese	Chai gui
French	Laurier des Indes
German	Indisches
Burma	Thitchabo
Nepal	Tejpatta, Sisi, Sinkauli
Greek	Malabathron
Sanskrit	Tamalpatra
Marathi	Tamalpatra
Tamil	Talishappattiri
Assam	Tejpat
Malayalam	Tamalapatram/ Karuntoli
Telugu	Talisapatri
Bengali	Tejpat
Gujrati	Tamaal patra
Tangkhul	Sakomna
Kannada	Patraka
Manipuri	Tejpat

Table 2: Botanical Classification of *Cinnamomum tamala*

Taxonomical classification	Taxon
Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular Plant)
Division	Magnoliophyta
Class	Magnoliopsida
Order	Laurales
Genus	Cinnamomum Schaeff
Family	Lauraceae
Species	*Cinnamomum tamala*
Common Name	Cinnamomum albiflorum Nees, Tejpata

Botanical Description of *C. tamala*

Cinnamomum tamala is a perennial small evergreen plant which is long up to 8-12 meter's height and a girth of 150cm. All parts of the plant possess various properties. The botanical description of the plant parts is discussed below:

Bark: The height of the plant is up to 7cm and its branches up to 95cm width, rugged bark changes its color from greenish-red to dark brown. The bark of the plant produces a mucllage/gum.

Leaves: Leaves of the plant are utilized as a spice and flavoring agent. Leave are thickened, pointed/acuminate ovate. It is 12-20cm in length, 5-8 cm in width. Young leaves are reddish-pink and after some time leaves color changes into dark green that gives a glossy appearance. Leaves consist of a three nerves line from the base to the top. The taste of leaves is similar to the taste of clove and odor is like pepper.

Flower: The plant *Cinnamomum tamala* contains a small epicene flower, white in color and height up to 7.5 mm. The twigs of the flower are long same as the calyx. Flowers are cross-fertilized by honey bees.

Fruit: The ripe fruit of *Cinnamomum tamala* is a dark purple, and ovate drupe (fruit with thin skin and they contain a seed). The plant contains a drupe long up to 13mm [11,12,13].

Geographical Distribution of *C. tamala*

The major area of the production of *Cinnamomum tamala* is Sri Lanka along with Seychelles, Madagascar and India [14]. The best quality of *Cinnamomum* bark is mainly as quills. It is produced in Sri Lanka in approx. 24000 ha and 3400 ha area [15].

Phytochemical Constituents of *Cinnamomum tamala*

There is very little research work done on the phytochemicals of *Cinnamomum tamala*. The plant is reported to contain various chemotypes such as eugenol, cinnamaldehyde or cinnamaldehyde-linalool. The plant was reported to contain 41.2% to 55.19% cinnamaldehyde

and 15.56-15.28% linalool from two types of sample collections i.e. natural and market-based analysis [16]. There are various marker phenylpropanoids such as (E)-cinnamaldehyde, (Z)- cinamaldehyde, (E)- cinnamyl alcohol, eugenol, hydrocinnamyl acetate, (Z)- cinnamyl acetate, (Z)-cinnamic acid and (E)-cinnamyl acetate have been also reported from *Cinnamomum tamala* oils. Eugenol and Cinnamaldehyde are the active biochemicals formed from shikimic acid pathway while linalool is formed from mevalonic acid. Similarly, cinnamaldehyde is reported to be directly formed by the first year reduction of cinnamic acid, which is a part of phenylalanine pathway. (Z)-Cinnamic acid was only found in the oils of the first-year samples of *Cinnamomum tamala* [17,18]. Some scientific research was comparable in terms of major compound cinnamaldehyde reported in *Cinnamomum tamala* [19,20]. Earlier phytochemical studies have revealed the presence of important compounds such as eugenol [21], cinnamaldehyde [22,23], β-caryphyllene and linalool, trans-sabinene hydrate, (Z)- β-ocimene, myrcene, α-pinene and β-sabinene, germacrene A and α-gurjunene [24]. Cinnamomum leaf contains three flavonoid compounds named as quercetin, laempferol and quercetrin. These are responsible for antioxidant activity [25,26].

Showkat et al., reported the chemical constituents from essential oil of *Cinnamomum tamala* and other constituents were evaluated earlier. Eugenol was reported as a major chemical constituent in *Cinnamomum tamala*. Reported studies demonstrated, the chemical composition of the essential oils obtained from the leaves of *C. tamala* was determined by Gas-Chromatography Mass spectrometry. The yield of the oil on a dry weight basis ranged from 1.2% to 3.9% (w/w). Phenyl propanoids (88.9-95.0%) is the major portion of the oils. Firstly, eugenol (41.8-91.4%) was the active compound that followed by eugenyl acetate (0.0-47.1%) and α-phellandrene (0.6-2.5%) in the analysed oils [27]. A study reported that the GS-MS analysis showed the presence of eighty-one components from Cinnamom leaf volatile oil representing 94.1% of the total amount and eugenol (66.1%) [28].

Traditional and Modern View

A. Ayurvedic View: *Cinnamomum tamala* is also known as Tejpatta and Indian Bay leaf. Tejpatta is utilized to impact a characteristic flavor in various dishes. In India, it is used in various cuisines because of its peppery, clove-cinnamon-like flavor. The plant species is also beneficial for various medicinal uses. Some Ayurvedic studies reported that Tejpatta is useful for diabetes as it helps to manage blood glucose levels by enhancing insulin secretion due to its antioxidant property. According to Ayurveda, diabetes is caused due to an aggravation of Vata (Air compound) and impaired digestion. Impaired digestion leads to an accumulation of Ama (toxic remains in the body due to improper digestion) in the pancreatic cells and impairs the function of insulin. Tejpatta has hot potency that promotes healthy digestion and reduces Ama (fire produced in the stomach). Tejpatta helps to lower the bad cholesterol and maintains blood pressure by removing excessive sodium due to its diuretic property. Therefore, Tejpatta is also beneficial for heart health. Rasa Panchak of Tejpatta is mentioned in table no. 3 below [29,30].

Table 3: Rasa Panchak of Tejpatta (*Cinnamomum tamala*)

Sanskrit/English	Sanskrit/English
Rasa/ Taste	Tikat, katu/ Astringent, bitter
Virya/Potency	Ushana/Hot
Vipaka/ Methabolic Property	Madhur/Sweet
Guna/ Physical Property	Laghu,Tikshan/Little, Pungent

According to Ayurveda, Tejpatta balances all the Dosha (Disorder) i.e. Vata (Air component), Pitta (Fire+Water), and Kapha Dosha (Earth+Water) of human body.

Various benefits and uses of Tejpatta (*Cinnamomum tamala*)

1. Tejpatta is an effective herb for the treatment of the common cold. It controls cough, releases mucus and cleanes the air passages because of its Kapha balancing property. It is suggested to swallow with water or honey after lunch and dinner to treat common cold and cough .

2. According to Ayurveda, the main Doshas (Disorders) involved in Asthma are Vata and Kapha. An aggravated Vata dosha imbalances the Kapha dosha in the lungs. This produces an obstruction in the air passages that makes breathing tough. Tejpatta helps to remove extra mucus from the lungs by melting it due to its hot potency which helps for the treatment of asthma [31].

3. There are many scientific evidence present to support the role of Tejpatta for bad breath.

4. Tejpatta leaf oil is rich in good constituents. These chemical constituents showed good enzyme activity that helps in melanin production. Tejpatta is also beneficial against wound infections. 2-5 drops of tejpatta oil mixed with coconut oil is suggested for eczema-like skin disorder[32,33].

Some formulation of Tejpatta are citrakkadi Taila, kasisadi Taila and vajraka Taila

B. Folk View: *Cinnamomum tamala* plant is utilized many years ago in the Indian medicinal system, Ayurvedic system and also the folk system for its therapeutic activity. The Sanskrit name of Tejpatta is 'Tamalapattra' which means 'dark leaf' although that seems to be poorly motivated. The Greek traders took that name to their language, but later it is identified Sanskrit word as a plural form with a definite article, (ta) malabathra for which they back formed to a singular malabathron. Malabathrun or Malobathrum was taken by Romans. Ancient literature revealed that dried leaves and bark of Tejpatta were prescribed for fever, anemia and body odour. Tejpatta is utilized for its aromatic fragrance. Apart from flavoring agent it is also used as a

mouth refresher and used in chewing gums. Folk people used Tejpatta powder for some dental problems like reducing tooth pain. The plant is useful for the treatment of many diseases and disorders including colon cancer, diabetes, cardiac diseases, CNS disorders and bleeding disorders (useful for increasing blood circulation in the uterus) and it is also beneficial in appetite problem, mouth problems like dryness, unpleasant /poor breath problem and rheumatism [34].

C. Modern View

Many issues are faced by the Global herbal drug industry in today's scenario mostly the practice of making these drugs adulterated. This is the major reason why people lost faith in these herbal drugs nowadays [35,36,37,38,39,40]. In today's time, intentional adulteration is practiced in many different ways like by substituting standard commercial variety, by substituting superficially similar but inferior drugs, by substituting artificially manufactured drugs, the substitution of exhausted drugs and by substituting toxic materials. Adulteration can be either intentional or unintentional. These adulteration processes ultimately degrade the quality of the original drugs. The herbal plant vendors use these adulteration techniques so smartly that these remain undetectable until and unless examination on a microscopic level and chemical level are implied[41,42,43]. The major disadvantages associated with adulteration are deterioration and degradation of drugs. Adulteration also increases the cost of drugs and produces adverse effects instead of showing actual biological affect [44,45]. The traditional herbal drugs and their formulations are associated with negligible toxicity and are free from any kind of adulteration [46]. Traditional Ayurvedic herbal formulations of Tejpatta plants are associated with a wide range of medicinal properties too which cures a variety of ailments without causing any severe harm to the human body. Health risks are usually associated with modern adulterated drugs. For instance, the modern anti-diabetic drugs have side effects associated with them whereas the anti-diabetic activity of *Cinnamomum tamala* is well demonstrated by many studies where the least toxicity and adverse effects were observed. Commercially, *Cinnamomum tamala* is utilized as a flavouring agent and plant leaves are utilized for medicinal uses [47].

Reported Therapeutic and Pharmacological Studies of *Cinnamomum tamala*

Various studies have been conducted on this plant to know its pharmaceutical and therapeutic uses. Large-scale clinical studies are still needed to prove the clinical efficacy of this herb, especially in skin diseases, immunomodulatory disorders and diabetes. Some reported studies on this plant are shown in table no. 4.

1. Antioxidant Activity: Gupta and Sharma have reported the antiperoxidative effect of ethanolic extract of *Cinnamomum tamala* leaves on ferrous sulfate-induced lipid peroxidation in isolated rat liver homogenate. It was determined by Thiobarbituric Acid Reactive Substances assay. The result showed significant antiperoxidative effects in the models [48]. Prasad et al., investigated that the leaves of five species of Cinnamomum including *C. tamala* have antioxidant properties. Results showed that *C. tamala* exhibited higher superoxide anion scavenging than others. Singh et al., reported that the volatile oil and acetone extract of *Cinnamomum tamala* leaves possesses strong radical scavenging activity [49]. Bajpai et al., reported that the total polyphenols content and water extract of leaves of *Cinnamomum tamala* possess antioxidant activity [50]. The antioxidant activity was determined by β-carotene linoleic acid auto-oxidation assay.

2. Antidiabetic activity: Sharma et al., investigated the hypoglycaemic and antihyperglycemic activity of 50% ethanolic extract of *C. tamala* leave in normal and streptozotocin-induced hyperglycemic rats. The observation showed that the blood glucose level of untreated rats decreased from 69.3 to 64.2 mg/100ml after 12 hours, and for those treated with the extract of *C. tamala* at doses of 100, 250 and 500 mg/kg the blood glucose declined from 68.1-69.5 to 42.9-49.1 mg/100ml over the same period [51]. Dhaliwal et al., reported that one antidiabetic formulation containing epicatechin and gymnemic acid as major active constituents and Cinnamomum leaves along with it too resulted in the production of insulin in human pancreas [52]. Kar et al., investigated that the ethanolic extract of *C. tamala* leaves has been found to lower blood glucose in alloxan diabetic albino rats after two weeks of treatment. The result showed a significant reduction of blood glucose levels in rats [53]. Pushpangadan and Prakash patented an herbal nutraceutical formulation in 2006 to provide health benefits to diabetes patients. The formulation includes powder/extract of *C. tamala* leaves as an essential component along with other herbs [54]. Chakraborty and Das investigated the antidiabetic and antioxidant activity of aqueous extract of *Cinnamomum tamala* leaves. Diabetes was induced in albino rats by the treatment with streptozotocin. The *C. tamala* extract was administrated for three weeks in rats. Hence, *C. tamala* extract was found to be potent for balancing blood glucose levels in the models [55].

3. Anticancer Activity: Saluja et al., investigated the anticancer activity of *Cinnamomum tamala* leaf extract against Ehrlich ascites carcinoma (EAC) in Swiss albino mice. The ethanolic and acetone extract of *Cinnamomum tamala* leaves were found to be significant for the anticancer activity in the mice [56].

4. Hepatoprotective Activity: ThamizhSelvam et al., reported hepatoprotective activity of methanolic extract of *C. tamala* leaves against paracetamol-induced toxicity in Swiss albino mice. Hepatic injury caused a rise of cellular enzymes in plasma. Mice was treated with *C. tamala* extract at doses of 100 and 200 mg/kg for eight days. Higher hepatoprotective activity was observed when model was treated with 200mg/kg of dose [57].

5. Anti-inflammatory Activity: Gambhire et al., reported the anti-inflammatory effect of aqueous extract of leaves of *Cinnamomum tamala*. The extract was found to significantly inhibit the carrageenam-induced paw edema in mice. The dose of 400mg/kg was administrated in the mice. The results showed inhibition of about 54.4% against edema in the mice model [58].

6. Effect on Gastro-Intestinal Tract: Eswaran et al., investigated the gastroprotective activity of *C. tamala* leaf extract in rats. Models were administrated with the extract of *C. tamala* in the doses of 50,100 and 200 mg/kg twice daily for five days to protect against ethanol, cold restraint stress and pylorus ligation-induced ulcers. The results showed a significant reduction in lesion index in the models [59].

7. Antidiarrheal Activity: Rao et al., examined the antidiarrheal activity of 50% ethanolic extract of *C. tamala* leaves in the rats. The extract was administrated orally in doses of 25,50 and 100 mg/kg. Result showed a significant reduction in castor oil-induced diarrhoea. A dose of 100 mg/kg resulted in a significant reduction in a gastrointestinal fluid produced in rats [60].

8. Antimicrobial Activity: Yadav et al., investigated that *Cinnamomum tamala* have fungicidal/fungistatic activity. The essential oils of *Cinnamomum tamala* leaf have been found to inhibit the growth of two ringworm fungi, *Trichophyton mentagrophytes* and *Microsporum audounil*. The minimum 500 ppm of concentration of essential oil of *C. tamala* inhibited fungal growth in poisoned food method. In this method, the test dose was mixed in the culture medium. The essential oil showed better effectiveness as compared to some synthetic antifungal agents [61]. Methmood et al., reported antimicrobial activity of alcoholic extract of *C. tamala* leaves against *Trichophyton rubrum, Microsporum gypseum* and *Epidermophyton floccosum*. An inhibition zone was also observed against *Candida albicans* with alcoholic extract [62]. Kapoor et al., reported antifungal activity of volatile oil and oleoresins from *Cinnamomum tamala* leaf against some fungi like *Apergillus niger*, *A. Flavans*, *A. salani* etc. Oleoresins were showing less inhibition as compared to volatile oil [63]. De et al., tested the antimicrobial activity of 35 Indian spices in which fifteen spices were found to possess antimicrobial activity. The leaf extract of *C. tamala* has been found to inhibit the growth of *Saccharomyces cervisiae* [64]. Singh et al., reported antibacterial activity of volatile oils and acetone extract of *C. tamala* leaves against *E. coli, Salmonella typhi, Pseudomonas aeruginosa, Bacillus cereus, Bacillus subtilis* and *Staphylococcus aureus* [65].

9. Effect on Immune system: Chaurasia et al., reported immunosuppressive effect of hexane fraction of leaves of *Cinnamomum tamala* in rats. Rats were sensitized with Sheep red blood cells and administered *C. tamala* extract at 400, 800, and 1600 mg/kg body weight. For standard cyclophosphamide was used in the rats. After seven days, the extract of *C. tamala* inhibited the hypersensitivity in rats whereas no inhibition was found when models treated with cyclophosphamide [66].

10. Miscellaneous Activity: Karerat et al., tested dried *Cinnamomum tamala* leaf powder/extract along with several other plant components against the poisonous effect of tobacco smoking. Some herbal formulations include powder extract of *C. tamala* which acts against addiction to tobacco-related products [67]. Palpu et al., have patented an Ayurvedic herbal soft drink with immunity enhancing, hepatoprotective, antifatigue, antioxidant and antistress activity. The formulation includes decoction of leaves of *Cinnamomum tamala* [68]. Abbas et al., reported the nematicidal effect of *Cinnamomum tamala* leaf extract against Meloidogyne javanica. Ethanolic extract of leaves at 1000ppm concentration was found to be significant for inhibition of egg hatching of the nematode Meloidogyne javanica [69]. Some of reported pharmacological activities are shown in table no. 4.

Table 4: Reported experimental and Clinical studies of *Cinnamomum tamala*

Sr. No.	Extract	Method *In-vivo / In-vitro*	Pharmacological Activity	References
1.	Ethanolic Extract	Rat model	Antioxidant	48
2.	Ethanolic Extract	Diabetic Rat model	Antidiabetic	51,53,55
3.	Ethanolic Extract	Albino rats		
4.	Aqueous Extract of leaves	Albino rats		
5.	Leaf Extract	Swiss Albino Mice	Anticancer	56
6.	Methanolic Extract	Swiss Albino Mice	Hepatoprotective	57
7.	Aqueous Extract	Mice	Anti-inflammatory	58
8.	Leaf oil	*Trichophyton mentagrophytes and Microsporum audounil.*	Anti-fungal	61, 62
9.	Alcoholic Extract	*Trichophyton rubrum, Microsporum gypseum and Epidermophyton floccosum*		
10.	Volatile oil & Acetone extract	*E. coli, Salmonella typhi, Pseudomonas aeruginosa, Bacillus cereus, Bacillus subtilis and Staphylococcus aureus*	Antibacterial	63
11.	Leaf Extract	Rat model	Immunomodulatory	67

CONCLUSION

Herbal plants have been played a significant role in maintaining the health of the community since past times. *Cinnamomum tamala* (tejpatta) is one of the most commonly used spices in Indian food. This plant also possesses various therapeutic activities. All parts of the plant possess many major bioactive chemical constituents like Cinnamaldehyde, trans-cinnamaldehyde, 3,4,5,7-tetrahydroxyflavone, 3,3,4,5,6- pentahydroflavone (non-glycoside compounds), kaempferol, eugenol etc. These phytochemicals are useful for the treatment of various diseases or disorders such as cancer, diabetes, ulcer, gastrointestinal infections and possess many pharmacological activities like anti-diabetic, anti-inflammatory, anti-microbial, antidiarehoeal, anti-fungal and hepatoprotective activity. Many reported studies are suggested that *Cinnamomum tamala* possessed a wide range of benefits in diabetic problem. Clinical researches are also required to know other pharmacological activities of *Cinnamomum tamala* so in this review article authors tried to compile all the reported Ayurvedic and pharmacological properties of the plant.

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