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PHARMACOGNOSTICAL EVALUATION OF *CINNAMOMUM ZEYLANICUM* (BLUME.) BARK: A WIDELY USED TRADITIONAL INDIAN MEDICINE WITH PROMISING THERAPEUTIC POTENTIAL

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ABSTRACT

Cinnamomum zeylanicum, commonly known as Dalchini or cinnamon, is a revered botanical species in Indian traditional medicine owing to its diverse therapeutic properties. This study presents a comprehensive botanical and pharmacognostic evaluation of *zeylanicum* bark aimed at understanding its medicinal potential and ensuring quality control measures. Botanical evaluation involved morphological characterization, including macroscopic and microscopic features, to identify the distinctive traits of *zeylanicum* bark. Additionally, physicochemical characteristics include total ash and acid-insoluble ash, moisture content, and water-soluble and alcohol-soluble extractive values were determined according to standard procedures. Pharmacognostic evaluation encompassed the determination of phytochemical constituents using various chemical tests. Primary and secondary metabolites, including tannins, alkaloids, flavonoids, phenols, and terpenoids, are present and investigated, providing insights into the chemical composition of *zeylanicum* bark. The research's conclusions add to establishing quality control parameters for *zeylanicum* bark, ensuring its authenticity, purity, and efficacy in traditional medicine formulations. Moreover, the detailed pharmacognostic analysis provides valuable information for further exploration of its therapeutic potential and pharmacological applications in modern healthcare practices.

Keywords: *Cinnamomum zeylanicum,* Dalchini, Pharmacognostical

INTRODUCTION

Cinnamomum zeylanicum is a medicinal plant.[1] It can be used to treat a variety of illnesses, including rheumatoid arthritis (an autoimmune disease), diarrhoea, dyspepsia, poor appetite, low vitality, kidney disease, angina, heart palpitations, hypertension, and nervous disorders. It can also be used to treat spasms, vomiting, and infections. It can also be used to lower blood sugar in diabetics and as a skin antiseptic.[2-6] It is often known that spices have therapeutic, antibacterial, and antioxidant qualities in addition to adding flavour and strong stimulation. Owing to their numerous potential benefits, spices are a great way to preserve food and help extend its shelf life by preventing rancidity through their antioxidant activity.[7] *Cinnamomum zeylanicum* bark can be used to treat high blood cholesterol, type 2 diabetes and may also have a potentiating effect on insulin. Food spoiling caused by bacterial contamination can be avoided using the antifungal and antibacterial properties of *Cinnamomum zeylanicum* essential oil.[8-9] Through botanical and pharmacognostical evaluation, a comprehensive understanding of *zeylanicum* bark can be achieved, elucidating its chemical composition and medicinal potential. This knowledge validates its traditional use and provides a foundation for further research into its pharmacological activities and therapeutic applications in modern healthcare. As such, this study aims to support the continued initiatives to build a bridge between the gap between traditional knowledge and contemporary science in herbal medicine.

Table 1: Vernacular names[10]

Language	Name
Sanskrit	Darusita
Assamese	Dalcheni
Bengali	Daruchini, Darchini
English	Cinnamon bark
Hindi	Dalchini
Gujarati	Dalchini
Kannada	Dalchini, Chakke
Kashmiri	Dalchini, Dalchin
Malayalam	Karuvapatta, Ilavarngathely
Marathi	Dalchini
Oriya	Dalechini, Gudatwak
Punjabi	Dalchini, Darchini
Tamil	Lavangapattai, Karuvapattai
Telugu	Lavangapatta, Dalchini, chekka
Urdu	Darchini

Table 2: Taxonomic Hierarchy[11]

Kingdom	Plantae
Sub-kingdom	Viridiplatae
Phylum	Magnoliophyta
Class	Magnoliopsida
Super-Order	Magnolianae
Order	Laurales
Family	Lauraceae
Genus	*Cinnamomum*
Species	*zeylanicum*

Table 3. Ayurvedic Classifications of *Cinnamomum zeylanicum*

Sushruta Samhita	Eladi Gana[12]
Bhavaprakasa Nighantu	Karpooradivarga[13]

Geographical Distributions: This plant is native to Sri Lanka and is grown in the West Indies, South America, India, and Burma. It is grown in India on the Western Ghats and surrounding slopes.[14-16]

Botanical description

Habit: It is an evergreen moderate-sized tree about 6-9 meters.
Bark: Bark is smooth, thick and reddish-brown.
Leaves: Leaves are opposite / sub-opposite the leaves, 4-7 inches long, ovate or lanceolate, glabrous, hard and coriaceous.
Flower: Axillary or sub-terminal cymes or panicles of flowers are present.
Fruits: The fruits are dark purple, oval or oblong, up to 2 cm long, minutely apiculate, dry or somewhat fleshy.

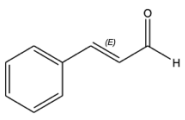
Macroscopic character of Bark: Bark fragments approximately 0.5 mm in thickness, brittle; they appear as single or double compound quills, length about 1com or more and up to 1 cm in diameter; the outer surface is light yellowish-brown, dotted with indistinct, wavy longitudinal lines; the inner surface is darker in colour, longitudinally striated with a reticulation pattern; fracture short; it is devoid of all but the traces of cork; it smells sweet and aromatic and has a warming sensation.[17]

Microscopic Description: T.S. of bark exhibits pericyclic sclerenchyma, though only in specific locations; three or four rows of isodiametric cells, occasionally tangentially elongated; the inner and radial walls are often thicker than the outer wall; few contain starch grains; small groups of pericyclic fibre's embedded periodically in the Sclerenchyma; tangential bands of phloem sieve tissue alternating with parenchyma cell and axially elongated secreting cell containing volatile oil.[18]

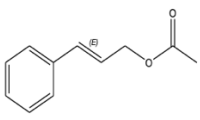
Chemical Constituents: Cinnamaldehyde (60–75%), eugenol (1–10%),1.8-cineole (1-6%), cinnamyl acetate (1–5%), beta-caryophyllene (1-4%), and linalool (1-3%), are the most common chemical constituents in cinnamon bark. Additionally, pinene, verbenone, pinene oxide, verbenol, and verbenylhydroperoxide are present in up to 4% of the essential oil. To investigate antimycobacterial properties of *Cinnamomum zeylanicum* and its main components. The cinnamaldehyde value is determined. The front-line anti-tuber drugs were used as a positive control.[19-24]

Figure 1: Bark of *Cinnamomum zeylanicum*

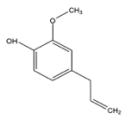
Figure 2: Powder of *Cinnamomum zeylanicum*



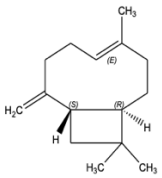
Cinnamaldehyde



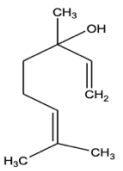
Cinnamyl acetate



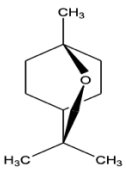
Eugenol



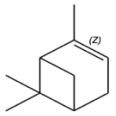
Beta-Caryophyllene



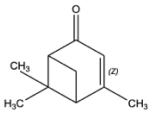
Linalool



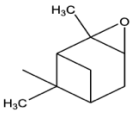
1,8- Cineol



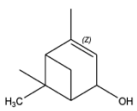
Pinene



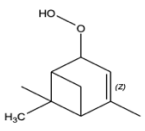
Verbenone



Pinene oxide



Verbenol



Verbenyl-hydroperoxide

Table 4: Rasapanchaka (Properties) of *Cinnamomum zeylanicum*[25]

Rasa (Taste)	Madhura (Sweet), Katu (Pungent), Tikta (Astringent)
Guna (Property)	Laghu (light), Ruksha (Dry), Tiksna (Pungent)
Virya (Metabolic Property)	Ushna (Hot)
Vipaka (Potency)	Katu (Pungent)

MATERIALS AND METHODS

Collection of raw Drugs: The Bark of *Cinnamomum zeylanicum* was collected from Gola Deenanath Market Varanasi, UP, India. Dr. Ashwini Kumar Kushwaha, Assistant Professor, Department of Dravyaguna, Faculty of Ayurveda, IMS, RGSC, BHU, Varanasi, UP, India, verified the authenticity of the plant material and Voucher specimen no. 2023/13, this authenticated bark allowed the shade to air dry for three to six days after washing. The Physiochemical phytochemical and AAS instrumental analysis testing are performed in RGSC BHU, Mushroom Building and Naveen Pharmacy.

Preparation of Powder: Dried medications were ground up using a mechanical grinder to reduce size. The fine powder was used for the experiment and extract preparation after running through a mess size of forty. It was then stored in airtight containers.

Preparation of Extract: Two hundred grams of powdered *Cinnamomum zeylanicum* drugs were separately macerated with a mixture of water and methanol (3:7) and soaked for 7 days. The Whatman filter paper was then used to filter the extracts, producing a clear filtrate. An 800 °C rotatory evaporator was used to decrease the filtrates in order to produce a solid residue. The extract was dried over a desiccator, and residues were weighed. The extract was concentrated and stored in a refrigerator for further analysis.

Storage and Labelling: The plant extract was packed in air tight container for protection from light and moisture. Clear, legible labelling, i.e., plant extract (*Cinnamomum zeylanicum*), was done to identify the extract and avoid mixing or contamination with other plant extracts in the laboratory.

Figure 3: Phytochemical Testing

Figure 4: AAS Instrument

Figure 5: Standard preparation (Zn, Cd, Pb)

Table 5: Physiochemical Analysis of *Cinnamomum zeylanicum*[26]

Test Name	Value Obtained w/w
Total Ash	2.97
Acid-insoluble Ash	0.5
Water soluble Ash	9.2
Alcohol Soluble Extractive Value	4
Water Soluble Extractive Value	3.5
Loss on drying	10.5
Foreign Organic Matter	6.5
pH	5.1

Phytochemical testing of *Cinnamomum zeylanicum*

Test of Alkaloids: 2 ml of each extract was treated with 2 ml of Wagner's reagent. A brownish-red precipitate indicates the presence of alkaloids.

Test of cardiac glycosides: After treating 2 millilitres of extract with 2 millilitres of chloroform and conc., a layer of sulphuric acid was carefully applied. Heart glycosides are present at the steroid ring interface, indicated by a deep reddish-brown colour.

Test of Flavonoids: 2% lead acetate was applied to 2 millilitres of the extract. A yellowish-green colour indicates the presence of flavonoids.

Test of Saponins: Benedict's reagent was applied to two millilitres of extract. The blue-black precipitate indicates the presence of saponins.

Test of Terpenoids: Concentrated sulfuric acid was carefully applied to 2 millilitres of extract after it had been treated with 2 millilitres of chloroform to create a coating. When terpenoids are present, the colour becomes reddish-brown.

Test of Tannins: 0.1% ferric chloride was applied to 2 millilitres of extract. A brownish tint indicates tannins.

Tolle's Test: Test samples were added to 1 millilitre of recently made Tallen's reagent, and after a gentle heating period, a silver mirror or black precipitate was seen.

Table 6: Phytochemical Analysis of *Cinnamomum zeylanicum*

Test	Present
Alkaloids	+
Cardiac glycosides	+
Flavonoids	+
Saponins	+
Terpenoids	+
Tannins	+
Tollen's	+

Determination of heavy metals

The elemental composition of samples was analyzed employing Flame Atomic Absorption Spectrometry (FAAS). The elements Cd, Zn, and Pb were found using the hollow cathode lamp-equipped AVANTA GBC flame atomic absorption spectrometer. This instrument offers high sensitivity and consumes minimal sample volume.[27-30] Because of the specificity of this spectrometer, the results obtained are typically accurate and rarely necessitate further confirmation. Elemental concentrations in samples of medicinal plants and their substrate were determined using the calibration curve method based on absorber concentration. Various solutions of known concentrations were prepared, and the elemental concentration in unknown samples was extrapolated from the calibration curve. All concentrations of samples were reported as mg/100gm dry weight of material.

Several necessary measures were taken to ensure the analytical precision and accuracy and to uphold the quality of analytical results in this study. Duplicate sample analysis was conducted, enhancing result quality and gauging their reliability. Calibration of the devices utilized blank and standard solutions. A standard set of calibration curves exhibiting good linear regression and improved relative standard deviations was employed to measure heavy metal concentrations in mushrooms and their substrate samples. Standard solutions were also tested regularly to confirm the measuring device's accuracy. Medicinal plants and their substrate quality control tests were used to evaluate accuracy. The results showed a degree of agreement between standard values and measured values, with deviations of less than 5%.[31-33]

Digestion procedure

The heavy metals were extracted from the powdered *Cinnamomum zeylanicum* samples using a wet digestion technique. Two grams of the material were obtained in a Nesseler's tube, combined with fifteen millilitres of 10% HNO3 v/v, and incubated for three hours at 100 ^{0}C in a water bath. The final digested solution was subjected to two reflux treatments with HNO3 to measure lead, cadmium, and zinc using an Atomic Absorption Spectroscopy (AAS) device. The following are the acceptable thresholds for various heavy metals: Zinc (0.5 ppm), Cadmium (3 ppm), and Lead (10 ppm).[34]

Procedure for Standard Preparations

Cadmium (Cd)

4 ppm- 0.4 ml standard solution and maintained up to 100 ml
2 ppm- 0.2 ml standard solution and maintained up to 100 ml
1 ppm- 0.1 ml standard solution and maintained up to 100 ml

Zinc (Zn)

2 ppm- 0.2 ml standard solution and maintained up to 100 ml
1 ppm- 0.1 ml standard solution and maintained up to 100 ml
0.5 ppm- 50 ml of the above solution and maintained up to 100 ml

Lead (Pb)

5 ppm- 0.5 ml standard solution and maintained up to 100 ml
10 ppm- 1 ml standard solution and maintained up to 100 ml
20 ppm- 2 ml standard solution and maintained up to 100 ml

RESULT

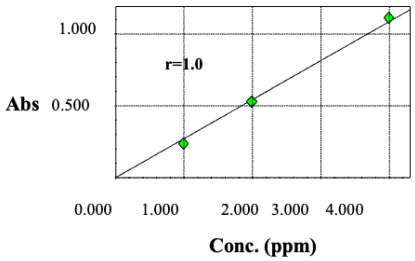
The outcomes shown in Table 6 of the qualitative phytochemical screening of *Cinnamomum zeylanicum* stem bark extracts revealed the presence of amino acid, quinine, phenol, reducing sugar, coumarin, steroids, terpenoids, glycosides, flavonoid, saponins, tannins, and alkaloids in bark extract. The physiological parameters include moisture content, alcoholic soluble extractive, total ash, water-soluble extractive, and acid-insoluble extractive. The physiochemical parameter values are listed in (Table 5). Certain trace elements, like zinc, lead, and cadmium, are essential to the human body's operation. The following describes the particular functions of these identified elements. We performed preliminary trials by assessing spiked samples at three distinct concentration levels (low, medium, and high) to evaluate our study's accuracy. Metals from stock solutions were added to 100 mL volumetric flasks holding 1 gm of material to create these samples. All metal recoveries varied from 90 to 101% in the spiked samples.

Table 7. Gives, expressed in mg/100g dry weight of the sample, the average elemental analysis results for *Cinnamomum zeylanicum* bark obtained using the AAS technique. Each result shows the average of three separate, triplicate measurements.

Lead (Pb), Cadmium (Cd), and Zinc (Zn)

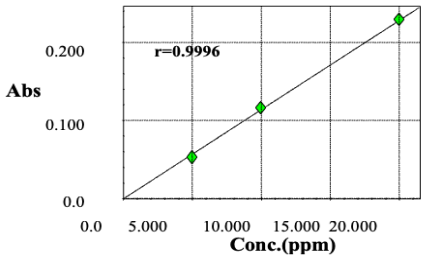
Less than 0.03 mg/100 g dry weight of Pb, less than 0.01 mg/100 g dry weight of Cd, and 0.052 mg/100 g dry weight of Zn are present in the *Cinnamomum zeylanicum* bark sample. These substances are known to be harmful, and industrial pollution may be the source of their trace amounts in the several examined medicinal plant samples.

Calibration Curve (C#:01)

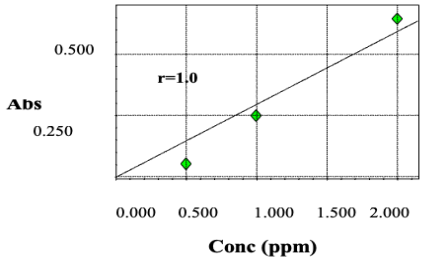


In the graph, the Calibration curve of Cd (228.8 nm) shows that a concentration of 1.00 ppm absorbance is 0.2346, at a concentration of 2.000 ppm absorbance is 0.5279, and another concentration of 4 ppm absorbance is 1.104.

Calibration Curve (C#:01)



In the graph, the Calibration curve of Pb (283.3 nm) shows at a concentration of 5.00 ppm, the absorbance is 0.0521, and at a concentration of 10 ppm, the absorbance is 0.1156, and at another concentration of 20 ppm, the absorbance is 0.2290.



In the graph, the Calibration curve of Zn (213.9 nm) shows at a concentration of 0.500 ppm; absorbance is 0.0518; at a concentration of 1.000 ppm, absorbance is 0.250, and at another concentration of 2 ppm, absorbance is 0.6428 Cadmium is particularly hazardous to human health, contributing to conditions such as high blood pressure and damage to the liver and Kidneys. The WHO has set acceptable levels for lead and cadmium, which are 0.1 to 10 ppm and 0.2 to 0.81 ppm, respectively. Consequently, the lead and cadmium amounts observed in *Cinnamomum zeylanicum* bark are within these bounds.

Table 7: **Condition of instrument analysis in AAS**

Metal	Wavelength (nm)	Slit (nm)	Lamp current (mA)	Gas flow (L/min)	
				Acetylene	Air
Cd	228.8	0.7	8	1.8	15
Pb	283.3	0.7	10	2	15
Zn	213.9	0.7	8	2	15

* nm; nanometre, *L/min; Litre per minute

CONCLUSION

The varying concentrations of elements found in *Cinnamomum zeylanicum* bark suggest that these stem barks may have different roles in treating different diseases. The findings of this study provide important information regarding the presence of various essential elements, which may be valuable for the formulation of enriched foods and dietary guidance for food fortification purposes. This research comprehensively investigates the levels of 3 trace elements in *Cinnamomum zeylanicum.* The dry ash method combined with atomic absorption spectrometry was used to determine the trace element content in *Cinnamomum zeylanicum*. The concentrations of toxic heavy trace elements such as Cd, Pb and Zn were extremely low (<0.03 mg/100 g dry weight of sample), posing no threat to the consuming population. This analytical technique is considered reliable for routine analysis of element concentrations in various botanicals and dietary supplements.

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