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PHYTOCHEMICAL, PHARMACOLOGICAL AND TRADITIONAL IMPORTANCE OF *CINNAMOMUM TAMALA* (TEJPAT)

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ABSTRACT

The leaves of *Cinnamomum tamala,* are commonly known as Tejpāt in Unani System of Medicine. It belongs to the family Lauraceae, and is widely distributed throughout South Asian countries. The leaves are used for culinary and medicinal purposes. Other than leaves, its bark and essential oil obtained from both leaf and bark have been widely used for their therapeutic activity. In Unani System of Medicine, it has been used for centuries for treating various cardiac, neurological, gastrointestinal, and ophthalmic diseases. Recent scientific studies have also revealed its antibacterial, antifungal, antidiabetic, antioxidant, anti-inflammatory, diuretic, and other pharmacological activities. The present review showed the importance of Tejpat as a culinary spice as well as a drug of multitudinous therapeutic value. In view of this, it can be inferred that the plant is valuable for the researchers to study in detail.

Keywords: *Cinnamomum tamala,* Tejpat, Unani

INTRODUCTION

Tejpāt (*Cinnamomum tamala*) belongs to Lauraceae family and is widely distributed throughout South Asian countries. The tree is commercially known as Indian cassia **[1]**. In Classical Unani Literature, its leaf is mentioned by an Arabic name "*Sāzaj*" and the leaf obtained from Indian-origin trees is named as "*Sāzaj Hindi*." These are the dried mature leaves obtained from a small to moderately sized evergreen tree which is upto 7.5 meters high and occurs in tropical, sub-tropical Himalayas between 900-2300 m. The leaves (*Tejpāt*) are collected usually in dry weather from about ten years old plants **[2]**. In Unani System of Medicine, it has been used for centuries for treating various cardiac, neurological, gastrointestinal, and ophthalmic diseases. Avicenna also described the characteristics of this plant in his famous book The Cannon of Medicine and wrote stomachic and diuretic as its pharmacological actions **[3]**. Besides the classical literature, recent scientific pharmacological studies also proved its multitudinous therapeutic potential. Numerous phyto-pharmacological studies showed that the drug has potent antibacterial, antifungal, antidiabetic, antioxidant, anti-inflammatory, diuretic, and other activities. In this review, an attempt has been made to summarize the available classical as well as scientific knowledge on *Tejpāt*.

MATERIALS AND METHOD

This review summarizes published literature collected from the Classical Unani texts, online databases, and various scientific search engines including PubMed, Elsevier, Google Scholar, Science Direct, Scopus, and Research Gate. The Plant List (www.theplantlist.org) database was used to provide the scientific names, subspecies of plants.

VERNACULAR NAMES [2]:

Arabic	:	*Sāzaj*
Persian	:	*Sāzaj*
Assamese	:	*Tejpāt, Mahpāt, Dopttī*
Bengali	:	*Tejpatrā, Tejpatā*
English	:	*Indian Cinnamon, Cassia Cinnamon*
Gujarati	:	*Tamāla Patrā, Deveīl, Taj*
Hindi	:	*Tejpatrā, Tejpāt, Dārchīni*
Kannada	:	*Tamalapatra, Dalchīni Ele*
Kashmiri	:	*Dalchīni pān, Tajpatrā*
Malayalam	:	*Karuvapattā Patram, Karuva Ela, Karuntoli*
Marathi	:	*Tamālpatra, Dālchīnitiki, Sāmbharpana*
Oriya	:	*Tejpatra*
Punjabi	:	*Tajpater*
Sanskrit	:	*Tejpartra, Varānga Coca, Tamālaka*
Tamil	:	*Lavangapatri, Tālishapattiri*
Telgu	:	*Akupatri, Tālisapatri*
Urdu	:	*Tejpāt*

DESCRIPTION

(a) **Macroscopic:**

Leaves: Leaves are opposite, subopposite or alternate **[4]**, 12.5 -20 cm long, 5-7 .5 cm wide at the center, 3 converging nerves from base to apexyoung leaves pink; petiole 7.5 -13 mm long; margin entire, apex acute or accuminate, taste, slightly sweet, mucilaginous and aromatic. **Figure 1**.

Bark: Bark is dark brown or blackish, slightly rough. Blaze 1.3 cm, pinkish or reddish-brown with whitish streaks towards the exterior **[4]**.

Flowers: Flowers are 7.5 mm long, pale yellowish, in axillary and terminal lax puberulous panicles 5-15 cm long **[4]**.

(b) **Microscopic:**

Petiole and Midrib: Transverse section of petiole and midrib shows epidermis externally covered with cuticle, uniseriate, multicellular (1 to3 cells), trichomes present, oil cells single or in group, isolated large stone cells, much lignified showing striations found scattered, most of the parenchymatous cells of cortex with reddish-brown contents; pericyle represented by a few layers of sclerenchymatous cells, stele more or less planoconvex as in the midrib of leaf; xylem on upper and phloem on lower side consisting of usual elements, present **[2]**.

Lamina: Transverse sections of lamina show dorsiventral structure, represented by palisadetissue on upper and spongy parenchyma on lower side; epidermis same as in midrib, externally covered with cuticle; below upper epidermis single row of closely packed palisade layer followed by multilayered, irregular, thin-walled cells of spongy parenchyma without intercellular spaces; idioblasts containing oil globules present in mesophyll and also in palisade; lower epidermis covered externally with cuticle; lamina intervened by several small veinlets; vascular bundles covered with thick-walled fibers on both side **[2]**.

Taxonomic Hierarchy [5]

Kingdom	:	Plantae
Subkingdom	:	Viridiplantae
Infrakingdom	:	Streptophyta
Superdivision	:	Embryophyta
Division	:	Tracheophyta
Subdivision	:	Spermatophytina
Class	:	Magnoliopsida
Superorder	:	Magnolianae
Order	:	Laurales
Family	:	Lauraceae
Genus	:	Cinnamomum
Species	:	Cinnamomum tamala

Pharmacological action (*Afal*) as per Unani literature:

Mufarriḥ (exhilarant) **[6], [8], [9]** *Muqawwī Dimāgh* (brain tonic) **[6], [8]** *Muqawwī Mi'da* (stomachic) **[3], [6], [7], [9]** *Muqawwī Qalb* (cardio-tonic) **[8], [9]**, *Muḥallil-i-Riyaḥ* (anti-flatulent) **[9]**, *Mudir-i-Baul* (diuretic) **[3], [6],**

[7], [8], [9], *Mudir-i-Ḥayḍ* (emmenagogue) **[6], [8], [9]**, *Dāfi'-i-Ta'affun* (antiseptic) **[6]**, *Muḥallil Aurām Bārida* (resolvent) **[6]**, *Mudir-i-Laban* (galactagogue) **[8], [9]**, *Mudir-i-'Araq* (diaphoretic) **[8], [9]**, *Mufattit-i-Ḥisāt* (lithotriptic) **[8], [9]**.

Therapeutic Uses and Indication as per Unani Literature:

Cardiac Diseases: *Khafqān* (palpitation) **[6], [7], [8], [9]**, *Ḍu'f-i-Qalb* (cardiac insufficiency) **[6]**

Neurological Disorders: *Waswās* (paranoia) [6],[9] *Junūn* (insanity) [6],[8],[9] *Waḥshat* (phobia) **[6], [8], [9]**, *Darde Sar* (headache) **[8]**

Gastrointestinal Diseases: *Waja' al-Fawād* (gastro-oesophageal reflex disease) **[6], [8]**, *Ḍu'f-i-Mi'da* (gastric insufficiency) **[6]**, *Ḍu'f-i-Haḍam* (delayed digestion) **[6]**, *Dard-i-Shikam* (abdominal pain) **[6], [8]**, *Istisqā* (ascites) **[8], [9]**, *Yarqān* (jaundice) **[8], [9]**, *Ḍu'f-i-Ishtiha* (anorexia) **[9]**.

Ophthalmic Diseases: *Bayāz* (corneal opacity) **[6], [8]**, *Sulāq* (blepharitis) **[6], [8]**, *Nākhūna* (pterygium) **[6], [8], [9]** *Ānkhon ke garam waram* (acute conjunctivitis) **[7]**, *Ẓulmat-i-Baṣar (diminished vision)* **[8]**, *Jālā* (nebula) **[9]**.

Genito-urinary: *Raḥim ki riyāḥ* (queefing) **[8]**, *Usr wilādat* (dystocia) **[8]**, *Dard-i-zah* (labour pain) **[8]**, *Ḥayḍ ki rukāwat* (amenorrhea) **[8], [9]**.

***Mizāj* (Temperament):**

Hot^2 Dry^2 **[3] [6]**, Hot^3 Dry^3 **[7]**

***Miqdār-i-Khurāk* (Dose):**

In *Safūf* (powder) & *Ma'jūn* (electuary) form: 2gm **[6]**

In *Joshānda* (decoction) form: 3-4 gm **[6], [8]**

***Badal* (Substitute):**

Sumbul-ut-Ṭīb (Nardostachys jatamansi) **[3]**

PHARMACOLOGICAL ACTIONS

Antibacterial Activity:

Antibacterial Activity of Leaf Extract

In a study acetone, petroleum ether, and aqueous extracts of the leaf of *Cinnamomum tamala* were evaluated against various gram-positive and gram-negative bacteria (*E. coli., Klebsiella pneumoniae, P. vulgaris, Pseudomonas aeruginosa, Streptococcus pneumoniae and Staphylococcus aureus*). Amongst all the extracts of leaf, acetone, and aqueous extracts at the concentration of 5 mg/disk exhibited maximum antibacterial efficacy against bacteria **[10]**.

In another study, very less zone of inhibition i.e., 7 mm and 3.25 mm were observed by Parekh J and Chanda S against *Klebsiella pneumoniae* and Proteus mirabilis respectively using ethanolic extract of leaf of *Cinnamomum tamala* **[11]**.

In an *in-vitro* study, the antimicrobial potential of *Cinnamomum tamala* leaves extracts was assessed by agar well diffusion method. All the evaluated extracts showed variable degree of inhibition zones against the selected six gram-negative (*Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi, Klebsiella pneumoniae, Erwinia carotovora & Agrobacterium tumefaciens*), three gram-positive (*Bacillus subtilis, Bacillus atrophaeus, and Staphylococcus aureus*) bacterial strains and a fungus (*Candida albicans*). Extracts were found equally effective against gram-positive and gram-negative bacteria. All the extracts showed their best inhibitory activity against *B. atropheous* **[12]**.

Another study also showed moderate antibacterial activity of methanolic extract of the leaves against *Bacillus subtilis, Staphylococcus aureus, Bacillus cereus and Vibrio cholera* **[13]**.

Rahman M *et al* assessed the antibacterial and antifungal properties of the leaf extract by conventional disc diffusion method against 19 pathogenic bacterial and fungal strains, and the results were compared with the activity of the positive control, kanamycin (30 µg/disc). The extract showed considerable antibacterial activities against most of the test organisms. The most prominent anti-bacterial profile was exhibited against *Salmonella typhi* with the zones of inhibition of 17 and 21 mm, in the concentration of 400 and 600 µg/disc respectively **[14]**.

Antibacterial Activity of Leaf's Essential Oil

In a study antibacterial efficacy of essential oil of *Cinnamomum tamala* was evaluated against six bacterial strains (*E. coli, Klebsiella pneumoniae, P. vulgaris, Pseudomonas aeruginosa, Streptococcus pneumoniae* and *Staphylococcus aureus*). The ZOI ranges from 23-33 mm, best result observed against gram-positive bacteria (streptococcus and staphylococcus) followed *K. pneumoniae, Pseudomonas* and *E. coli*. Minimum inhibitory disc concentration (MIDC) towards six bacterial strains ranges from 0.90-2.25 µg/disc. The study revealed that the essential oil of *Cinnamomum tamala* has a strong killing potential at low concentrations than extracts **[10]**.

Antibacterial Activity of Stem-bark Extracts

Goyal *et al* evaluated the in-vitro antibacterial potential of stem-bark extracts (ethanol, methanol, ethyl acetate, hexane, aqueous) of *Cinnamomum tamala* by agar well diffusion assay. Results showed that the Gram-positive (*Staph. aureus, Bacillus subtilis* and *Bacillus cereus*) bacteria were more susceptible as

compared to Gram-negative (*E.coli, S. typhi, Strep. pyogenes*) bacterial species. The hexane extract was found completely inactive **[15]**.

Anti-Fungal Activity of Leaf Oil

The fungicidal potential of *Cinnamomum tamala* Nees & Eberm (Lauraceae) leaf oil against five food spoilage and pathogenic fungi was reported by Pandey *et al*. The oil demonstrated potent antifungal activity against *Aspergillus niger, A. fumigatus, Candida albicans, Rhizopus stolonifer* and *Penicillium* spp. in agar diffusion assay. Zone of inhibition ranged from 17-25 mm. The MFC values of oil against all the test fungi were found to be 230µg/ml **[16]**.

Antioxidant Activity:

Antioxidant potential of Leaf extract

C. tamala leaf extracts prepared in different solvents exhibited various degrees of antioxidant activities in *β*-carotene bleaching assay. Potential extract fractions exhibited about 30 to 67% antioxidant activities at a concentration of 100 µg/ml **[16]**.

Antioxidant activity of leaf oil

GC and GC-MS analyses were done by Amma *et al.* to find out the chemical composition of *tezpāt* and pimento leaf oils and the main constituent identified in these two leaf oilswas eugenol. Both the oils showed significant radical scavenging activity against DPPH and superoxide radicals with a potent metal chelating activity and were compared with that of standard compound, eugenol. **[17]**.

In vitro antioxidant activity

In a study conducted on streptozocin induced diabetic rats, it was found that the radical-scavenging activity of leaf oil of *Cinnamomum tamala* increased with increasing concentrations. IC_{50} for DPPH radical-scavenging activity and H_2O_2 scavenging activity of oil was found 250 ± 1.2 µg/ml and 180 ± 1.4 µg/ml respectively. Similarly, the IC_{50} values for cinnamaldehyde, BHT and BHA were found 120 ± 0.8, 19 ± 0.1 and 18.3 ± 0.1 µg/ml and 140 ± 1.1, 40 ± 0.2 and 54.0 ± 0.2 µg/ml respectively. They also showed good Fe2+ chelating ability **[18]**.

In another experiment, anti-peroxidative effect of alcoholic extract of *Cinnamomum tamala* have been studied in rat liver homogenate where ferrous sulphate has been used as inducer to induce lipid per oxidation. Results showed that cinnamon extracts at 500 mg/d for twelve weeks decreased oxidative stress and improved impaired fasting glucose **[19]**.

In vivo antioxidant activity

The same study also showed that administration of *Cinnamomum tamala* leaf oil at a dose of 200 mg/kg body weight p.o.

significantly reduced the level of malondialdehyde (MDA) in streptozocin-induced diabetic rats. Its chronic administration at 200 mg/kg body weight significantly increased the level of glutathione in diabetic rats **[18]**.

Anti-diabetic activity:

Anti-diabetic activity of Leaf extract

Antidiabetic potential of *Cinnamomum tamala* leaves extract was evaluated in streptozotocin-induced diabetic rats. The study showed that the group which was treated with ethanolic leaf extract of *C. tamala* (200 mg/kg body weight, orally) for a period of 40 days, significantly lowered the blood glucose level, maintained body weight and lipid-profile parameters towards near normal range **[20]**.

In another study, the anti-hyperglycemic activity of the aqueous extracts of *Cinnamomum tamala* leaves was evaluated on the blood glucose of streptozotocin-induced diabetic albino rats. Administration of the extracts for 3 weeks at the dose of 250 mg/kg body wt. /day resulted in a marked decrease in the levels of fasting blood glucose and urine sugar, with a concomitant increase in body weight. The extract also produced a significant decrease in peroxidation products, viz., thiobarbituric acid reactive substances **[21]**.

In an experiment, Ajit *et al*. evaluated 30 hypoglycemic medicinal plants in alloxan diabetic rats. Twenty-four plants showed significant blood glucose-lowering activities. Among them, the ethanolic extract of the leaf of *Cinnamomum tamala* at a dose of 250 mg/kg twice daily for two weeks significantly reduced the blood glucose level from 186 mg/dl to 95 mg/dl **[23]**.

Shibly *et al* evaluated the anti-hyperglycemic activity of the aqueous extracts of *C. tamala* leaves (CTLEt) in alloxan-induced diabetic albino rats. A comparison was made between the action of CTLEt and glibenclamide. The result showed a significant ($P<0.5$) decrease in the fasting blood glucose level when compared to untreated control, this revealed the dose-dependent activity of the extract **[24]**.

Anti-diabetic activity of Leaf oil

Similarly, leaf oil of *Cinnamomum tamala* and cinnamaldehyde were investigated to evaluate their antidiabetic potential in streptozotocin induced diabetes in rats. The oil (100 mg/kg and 200 mg/kg body weight) and cinnamaldehyde (20 mg/kg body weight) treated groups showed a significant decrease in the level of glucose as compared to the control group. Results showed that oil (100 mg/kg and 200 mg/kg) and cinnamaldehyde (20 mg/kg) inrespective groups of diabetic animals administered for 28 days reduced the

blood glucose level from312 mg/dl to 118 mg/dl on the 29th day. Significant increase in body weight, liver glycogen content, plasma insulin leveland a decrease in the blood glucose, glycosylated hemoglobin, and total plasma cholesterol in test groups as compared to control group was also noted **[18]**.

Anti-diabetic activity of Bark extract

In another study, the antidiabetic activity of methanol and successive water extract of bark of *Cinnamomum tamala* was screened by using α-amylase inhibition assay. The percentage of inhibition and IC_{50} values of methanol and successive water extract of bark of the *Cinnamomum tamala* were found 97.49% and 93.78% & 1.80 and 5.53respectively. Methanolic extract of *Cinnamomum tamala* showed high potent activity than successive water extracts **[22]**.

Hypolipidemic activity

In a study conducted on streptozocin-induced diabetic rats, it was found that on the administration of oil at a dose of 200 mg/kg body weight significant increase the level of HDL-cholesterol from 36.4 mg/dl to 52mg/dl and a significant decrease in the levelsof total cholesterol and triglycerides from 222mg/dl to 100mg/dl and 40 mg/dl to 20 mg/dl respectively was observed **[18]**.

In a different experiment, the hypolipidemic effect of aqueous and ethanolic extracts of *Cinnamomum tamala* leaves was investigated in high-cholesteroldiet-induced hyperlipidemic male albino rats. Aqueous and ethanolic extracts of leaves of *Cinnamomum tamala* Nees. were administered in doses of 400mg/kg /day p.o. each for 10 days. Results showed that simultaneous administration of extracts significantly ($p<0.001$) prevent the rise in serum levels of total cholesterol, triglyceride, LDL, VLDL, and Atherogenic index whereas significant ($p<0.01$) increases in the level of HDL **[25]**.

Antidiarrheal activity

In an experimental trial, the antidiarrheal potential of 50% ethanolic extract of *Cinnamomum tamala* leaf was investigated on experimentally induced castor oil diarrhea in rats. Results showed that *C. tamala* significantly reduced the lipid peroxidation ($P<0.001$) and increased the catalase ($P<0.01$) activity in comparison to the castor oil-induced groups. *C. tamala* leaf extract did notshow any significant effect at a higher dose (15 mg/ml) on mast cell degranulation. However, the extract in the dose of 5 and 10 mg/ml conferred significant mast cell protective action ($P<0.001$). The resultindicates the Indian spice *C. tamala* is useful for diarrhea **[26]**.

Anthelmintic activity

In an *in-vitro* study on earthworms, the anthelmintic activity of the extract of leaf of *C. tamala* in a concentration of 20, 40, 60, and 80 mg/ml was evaluated. The extract showed very potent anthelmintic activity while compared with the standard albendazole, the methanolic extract of *C. tamala* demonstrated paralysis as well as death of worms in fewer times with the gradual increase of the sample concentration **[13]**.

Cytotoxic activity

Jamiuddin *et al* conducted a brine shrimp lethality bioassay to investigate the cytotoxic activity of leaf extract of *C. tamala*. Results showed significant activity when compared with the standard vincristine sulfate i.e. LC50 value 1.007 and 0.839µg/ml respectively **[13]**. In another study, the cytotoxic potential of the Leaves of *Cinnamomum tamala* extract was measured by using *in vitro* brine shrimp lethality assay. The extract showed lethality against the brine shrimp nauplii. LC50 and LC90 were found to be 40 µg/mL and 60 µg/mL respectively **[27]**.

Anti-inflammatory Activity

Thamizhselvam N *et al* investigated the anti-inflammatory activity of the methanolic extract of *Cinnamomum tamala* in carrageenan-induced paw edema in Wistar albino rats. The percentage of inhibition of edema formation was 66.75% and 73.71% at 250 and 500 mg/kg b.wt dosage respectively. Results showed that the efficacy of the extract was dose-dependent **[27]**.

In another in vitro study, the anti-inflammatory effect of the Cinnamaldehyde (CM) compound isolated from *Cinnamomum tamala* was evaluated against the denaturation of protein. Results showed concentration-dependent inhibition of protein (albumin) denaturation by the test compound at varyingconcentration ranges of 2.5 to 40 µg/ml **[28]**.

Analgesic Activity

The anti-inflammatory activity of the methanolic extract of *Cinnamomum tamala* was evaluated in mice by using the hot plate method, acetic acid-induced writhing movement, and tail flick test. Results showed significant ($p<0.05$) analgesic activity and dose-dependent prolongation of response latency inthe hot plate test. Acetic acid-induced writhing assay showed a decreased number of stretching episodes in the treated groups **[27]**.

Antipyretic Activity

Methanolic extract of *Cinnamomum tamala* was evaluated in Brewer's yeast-induced pyrexia in ce by observing the rectal temperature. Temperature decreasing pattern was observed significantly ($p<0.01$) when compared with the control **[27]**.

Diuretic Activity

The diuretic activity of the ethanolic extract of *C. tamala* leaves was investigated in Swiss albino mice. The effect on the urination of mice was observed for 5 h which revealed that the extract has a mild diuretic effect in the test animals. This was comparable to that of the standard drug Furosemide and diuretic agent urea. Electrolyte loss showed a similar ratio (Na+/K + excretion ratio was 1.46 and 1.59 at the doses of 200 and 400 mg/kg respectively) asthat of the loop diuretic furosemide (1.40) **[14]**.

Thrombolytic Activity

The thrombolytic activity of the ethanolic extract of *C. tamala* leaves was investigated. The study revealed that the percentage (%) of clot lysis was statistically significant ($P < 0.001$) when compared with the control group. The plant extract showed moderate activity with 22.33 ± 1.23%, 24.75 ± 1.27% and 21.78 ± 1.74% colt lysis of samples from volunteers 1, 2 and 3, respectively; whereas, standard streptokinase produced 48.22 ± 2.98% clot lysis **[14]**.

Cardio protective Activity

The cardioprotective potential of ethanolic extract (EECT) of dried leaves of *Cinnamomum tamala* was evaluated against doxorubicin-induced myocardial infarction in Wistar albino rats. Levels of marker enzymes-Creatinine Phospho Kinase (CPK), Lactate Dehydrogenase (LDH), Alanine Amino Transferase (ALT) and Aspartate Amino Transferase (AST) were estimated in both the serum and heart tissues; antioxidant parameters viz., catalase (CAT) and malondialdehyde (MDA) were assayed in heart homogenate. EECT elicited asignificant cardio protective activity by lowering the levels of serum marker enzymes and lipid peroxidation and elevated the levels of catalase **[29]**.

Nephro-protective Activity

Nephro-protective property of *Cinnamomum tamala* leaf extract was evaluated against gentamicin-induced nephrotoxicity in rabbits. Body weight, blood urea nitrogen, serum creatinine, creatinine clearance, serum uric acid, urinary volume, and urinary protein excretion were measured followed by histological examination. Gentamicin-treated animals showed significant renal damage as indicated by rise in blood urea nitrogen (54.18 ± 2.60 mg/dl), serum creatinine (4.02 ± 0.14 mg/dl), serum uric acid (2.34 ± 0.12 mg/dl), urinary proteins (3.86 ± 0.32 mg/dl) and decrease in creatinine clearance (0.76 ± 0.09ml/min), urinary volume (126.00 ± 9.09 ml) and body weight (10.80 ± 1.09 %). However, animals treated with gentamicin and *C. tamala* significantly decreased blood

urea nitrogen (16.75±2.5812 mg/dl), serum creatinine (1.21±0.09mg/dl), serum uric acid (1.56±0.13mg/dl) and increased creatinine clearance (3.53±0.43ml/min) **[30]**.

Gastroprotective Activity

In a study gastroprotective effect of *Cinnamomum tamala* leaves was evaluated in Sprague–Dawley rats and Swiss albino mice. Leaves extract (CTE; 50,100 and 200 mg/kg body weight) was administered orally, twice daily for 5 days for prevention from ethanol (EtOH)-, cold-restraint stress (CRS)- and pylorusligation (PL)-induced ulcers. Estimation of H+K+ATPase activity and gastric wall mucous was performedin the EtOH-induced ulcer model, antioxidant enzyme activities were carried out in the CRS-induced ulcer model, and various gastric secretion parameters like the volume of gastric juice, acid output, and pH value were estimated in PL-induced ulcer model. A significant reduction in lesion index as well as a decrease occurred in the level of H+K+ATPase, volume of gastric juice, and acid output. Results showed that *Cinnamomum tamala* possesses significant gastroprotective activity, probably due to its free radical scavenging activity **[31]**.

Immunomodulatory Activity

Jitendra *et al*., have evaluated the Immunomodulation property of hexane fraction (CTH) of leaves of *Cinnamomum tamala* in rats, using cyclophasphamide and dexamethasone as the reference drugs. CTH was orally given to rats for 10 days and delayed type of hypersensitivity (DTH), antibody production against sheep red blood cells (SRBCs), mitotic index in bone marrow cells and concanavalin A (Con A) mediated proliferation of lymphocytes was assessed. In the same study change in body weight (BW), spleen weight, thymus weight, bone marrow cellularity and hematological changes were observed for 30 days period. Results show that CTH at doses, higher than 800 mg/kg it inhibited significantly the DTH response (IC_{50}1475±57.19 mg/kg BW), antibody production, suppressed mitotic index in bone marrow cells along with the suppression of lymphocyte proliferation against Con A (IC_{50} 63.33±1.95 mg/mL). It also significantly suppressed growth rate, increase of spleen and thymus weight and low bone marrow cellularity. In the hematological examination, it inhibited total white blood cell and lymphocyte count and increased the percent of polymorphs **[32]**. Another research done by Chen *et al.* suggests that the immunosuppressive activities of cinnamon bark are in part due to procyanidin Oligomers and cinnamtannin D1 (CTD-1) may be a

potential therapeutic agent for immune-related diseases **[33]**.

Effect on Prostatic Hyperplasia

In an animal study conducted on prostatic hyperplasia-induced rats *C. tamala* showed a reduction in prostatic enlargement and improved hyperplastic changes. Its powder at a dose of (270 and 540 mg/kg) for 21 days significantly reduced the volume and weight of the prostate and improve hyperplastic changes induced by testosterone when compared to negative control. The effect was more pronounced than the positive control Finasteride (5 mg/kg). The study concludes that *C. tamala* may benefit in prostate disorder by inhibiting androgen mechanisms in the prostate and modulation of inflammatory mediators in the prostate **[34]**.

The pharmacological actions attributed to *Tejpāt* have been summarized in **Table 1**.

Unani Formulations:

There are numerous formulations mentioned in Classical Unani texts in which *Tejpāt* (*C. tamala* leaves) is used as an ingredient in the formula. Some of the important formulations mentioned in the Govt. official book (National Formulary of Unani Medicine) are summarized in **Table 2**.

Chemical composition of essential oil

GC of the essential oil of *C. tamala* leaves showed the presence of 54 identified components, comprising 95.2% of the total oil. The main constituent present in the *C. tamala* oil was eugenol (58.2%), followed by β-pinene (3.5%), caryophyllene (2.6%), ϒ-elemene (2.6%), spathulenol (2.6 %) and acetyl eugenol (2.5 %). Other constituents which are present in more than 1% were p-cymene,1,8-cineol, alloaromadendrene, ledene, and aromadendrene epoxide **[17]**.

Table 1: Summary of various pharmacological activity of *Tejpāt*

S. No.	Pharmacological Action	Part Used	Form	Reference
1	Antibacterial Activity	Leaf	Extract	[10], [11], [12], [13]
		Leaf	Essential Oil	[10]
		Stem-bark	extracts	[15]
2	Anti-Fungal Activity	Leaf	Oil	[16]
3	Antioxidant potential	Leaf	Extract	[16]
		Leaf	Extract	[19]
		Leaf	Oil	[17], [18]
4	Anti-diabetic Activity	Leaf	Extract	[20], [21], [23], [24]
		Leaf	Oil	[18]
		Bark	Extract	[22]
5	Hypolipidemic Activity	Leaf	Oil	[18]
		Leaf	Extract	[25]
6	Anti-diarrheal Activity	Leaf	Extract	[26]
7	Anti-helminthic Activity	Leaf	Extract	[13]
8	Cytotoxic Activity	Leaf	Extract	[13]
		Leaf	Extract	[14]
9	Anti-inflammatory Activity	Bark	Cinnamaldehyde	[28]
		Leaf	Extract	[27]

10	**Analgesic Activity**	**Leaf**	**Extract**	**[27]**
11	**Antipyretic Activity**	**Leaf**	**Extract**	**[27]**
12	**Diuretic Activity**	**Leaf**	**Extract**	**[14]**
13	**Nephroprotective Activity**	**Leaf**	**Extract**	**[30]**
14	**Cardio protective Activity**	**Leaf**	**Extract**	**[29]**
15	**Gastroprotective Activity**	**Leaf**	**Extract**	**[31]**
16	**Immunomodulatory Activity**	**Leaf**	**Hexane Fraction**	**[33]**

Table 2: Unani Formulations in which Tejpat is an ingredient

S. No.	Formulation	Uses/ Indication	Reference
1	***Kuḥal Roshnai***	***Ḍu'f Baṣarat*** **(Asthenopia),** ***Ẓufra*** **(Pterygium)**	**[35]**
2	***Kuḥal-i-Bāsaliqūn Kabīr***	***Ẓulmat-i-Chashm*** **(blindness),** ***Nuzūl al-Mā'*** **(cataract),** ***Jarab*** **(trachoma),** ***Sabal*** **(pannus),** ***Ẓufra*** **(pterygium),** ***Sharnāq*** **(lipoma of upper lid).** ***Sha'r Munqalib*** **(trichiasis)**	**[36]**
3	***Kuḥal-i -Māmīrān***	***Dama*** **(epiphora),** ***Sulāq*** **(blepharitis),** ***Kharish-i-Chashm*** **(itchy eyes),** ***Ḍu'f-i-Baṣar*** **(Asthenopia)**	**[36]**
4	***Kuḥal-i-Jawāhar***	***Ḍu'f-i-Baṣar*** **(Asthenopia)**	**[39]**
5	***Barūd-i-Aswad***	***Dama*** **(epiphora),** ***Bayāze Qarniya*** **(corneal opacity)**	**[38]**
6	***Barūd-i-Banafshajī***	***Ḍu'f-i-Baṣar*** **(Asthenopia),** ***Kharish-i-Chashm*** **(itchy eyes),** ***Dama*** **(epiphora)**	**[38]**
7	***Surmā-i-Zahiri***	***Nuzūl al-Mā'*** **(Cataract),** ***Sozish-i-Chashm*** **(burning of eyes),** ***Ramad*** **(conjunctivitis),** ***Inteshar-i-Sha'r-i-Palak*** **(madarosis)**	**[40]**
8	***Jawārish Nārmushk***	***Ḍu'f-i-Kabid*** **(hepatic insufficiency),** ***Ḍu'f-i-Am'ā'*** **(enteric insufficiency),** ***Ḥummā 'Ufūniyya*** **(infectious fever)**	**[35]**
9	***Jawārish Shaheryārān***	***Ḍu'f-i-Kabid*** **(hepatic insufficiency),** ***Ḍu'f-i-Mi'da*** **(gastric insufficiency),** ***Qabḍ*** **(constipation),** ***Qūlanj*** **(colic)**	**[35]**
10	***Jawārish Tamarhindi***	***Qai*** **(vomiting),** ***Ḍu'f-i-Mi'da*** **(gastric insufficiency),** ***Karb*** **(anxiety),** ***Khafqān*** **(palpitation)**	**[35]**
11	***Jawārish Zarishk***	***Ḍu'f-i-Ishtihā'*** **(anorexia),** ***Ḍu'f-i-Haḍm*** **(delayed digestion),** ***Qai*** **(vomiting)**	**[35]**
12	***Jawārish-i-Kāfūr***	***Sū-i-Haḍm*** **(indigestion),** ***Tukhma*** **(cholera),** ***Nafakh-e-Shikam*** **(flatulence)**	**[36]**
13	***Jawārish Muqawwī-i-Mi'da***	***Ḍu'f-i-Mi'da*** **(gastric insufficiency),** ***Ḍu'f-i- Am'ā'*** **(bowel insufficiency),** ***Ḍu'f-i- Ishtihā*** **(anorexia)**	**[40]**
14	***Khamīra Ābresham Arshadwāla***	***Ḍu'f-i-A'ḍā' Ra'īsa*** **(vital organ's insufficiency),** ***Ḍu'f-i-'Umūmī*** **(general weakness),** ***Khafqān*** **(palpitation)**	**[35]**
15	***Khamīra Ābresham Hakīm Arshadwāla***	***Khafqān*** **(palpitation) and** ***Ḍu'f-i-Badan*** **(asthenia)**	**[39]**
16	***Khamīra Marwārīd Banuskha Kalān***	***Khafqān*** **(palpitation),** ***Ghabrāhat*** **(anxiety),** ***Ḍu'f-i-Qalb*** **(cardiac insufficiency),** ***Ḍu'f-i-'Ām Basabab-i-Moti Jharā, Khasrā and Chechak*** **(post eruptive fevers weakness)**	**[39]**
17	***Ma'jūn Junṭiyāna***	***Waja' al-Mi'da*** **(gastralgia),** ***Ṣalābat kabid wa ṭihāl*** **(hepatic and splenic stiffness),** ***Kāla azār*** **(visceral leishmaniasis)**	**[35]**
18	***Ma'jūn Kalkalānaj***	***Istisqā*** **(ascites),** ***Ḥummā*** **(fever),** ***Zīqun Nafas*** **(Asthma)**	**[35]**
19	***Ma'jūn Khadar***	***Khadar*** **(hyposthesia/ numbness),** ***Ḍu'f-i-A'ṣāb*** **(neurasthenia),** ***Ḍu'f-i-Dimāgh*** **(cerebral insufficiency),** ***Waram-i-A'ṣāb*** **(neuritis)**	**[35]**
20	***Ma'jūn Muqil***	***Qabḍ*** **(constipation),** ***Waram-i-Qūlūn*** **(colitis),** ***Bawāsīr*** **(haemorrhoids)**	**[35]**
21	***Ma'jūn Suhāg Sonth***	***Sayalān al-Raḥim*** **(leucorrhoea),** ***Waram-i-Raḥim*** **(metritis),** ***Ḍu'f-i-Raḥim*** **(uterine insufficiency)**	**[35]**
22	***Ma'jūn Mujarrab***	***Mālikhūliyā*** **(melancholia)**	**[36]**
23	***Ma'jūn Regmāhī***	***Ḍu'f-i-Bāh*** **(sexual debility),** ***Riqqat-i-Manī*** **(thin semen)**	**[36]**
24	***Ma'jūn Pīpal Pāk***	***Ḍu'f-i-Bāh*** **(sexual debility)**	**[38]**
25	***Ma'jūn Muqawwī Raḥim***	***Ḍu'f-i-Raḥim*** **(uterine insufficiency)**	**[39]**
26	***Ma'jūn Zanjabīl***	***Ḍu'f-i-Mi'da*** **(gastric insufficiency),** ***Sayalān al-Raḥim*** **(leucorrhoea),** ***Kathrat-i- Ṭamth*** **(mennorhagia) and** ***Waram-Raḥim*** **(metritis)**	**[39]**

27	***Mufarriḥ Mu'tadil***	***Nafakhe Shikam*** **(flatulence),** ***Ḍu'f-i-Qalb*** **(cardiac insufficiency)**	**[35]**
28	***Mufarriḥ Āzam***	***Ḍu'f-i-Qalb*** **(cardiac insufficiency),** ***Khafqān*** **(palpitation)**	**[37]**
29	***'Ambari***	***Ḍu'f-i-Badan*** **(Asthenia),** ***Ḍu'f-i-A'ḍā' Ra'īsa*** **(vital organ insufficiency),** ***Ghashī*** **(fainting)**	**[40]**
30	***'Arq-i-'Ambar***	***Ḍu'f-i-A'ḍā' Ra'īsa*** **(vital organ insufficiency),** ***Ḍu'f-i-'Umūmī*** **(general weakness),** ***Naqāhat*** **(lethargy)**	**[35]**
31	***'Arq-i-'Ambar***	***Ḍu'f-i-Qalb*** **(cardiac insufficiency),** ***Ḍu'f-i-Dimāgh*** **(cerebral insufficiency),** ***Ḍu'f-i-Jigar*** **(hepatic insufficiency),** ***Ghashī*** **(fainting) and** ***Naqāhat*** **(lethargy)**	**[39]**
32	***'Arq-i-Juzām***	***Juẓām*** **(leprosy),** ***Barṣ*** **(vitiligo),** ***Qurūḥ*** **(ulcers),** ***Jarab*** **(scabies)**	**[35]**
33	***'Arq-i-Hāzim***	***Ḍu'f-i-Mi'da*** **(gastric insufficiency),** ***Ḍu'f-i-Haḍm*** **(indigestion)**	**[40]**
34	***Mā' al-Laḥm Khās***	***Ḍu'f-i-Bāh*** **(sexual debility),** ***Ḍu'f-i-'Āam*** **(general weakness).**	**[40]**
35	***Sharbat Nānkhwāh***	***Ḍu'f-i-Ishtihā*** **(anorexia) and** ***Kathrat-i-Riyāḥ*** **(flatulence)**	**[39]**
36	***Sharbat Salājīt***	***Jiryān*** **(semonorrhoea)**	**[39]**
37	***Roghan Benazīr***	***Ḍu'f-i-Dimāgh*** **(cerebral insufficiency),** ***Inteshār-i-Sha'r*** **(hair fall),** ***Ḍu'f-i-Baṣārat*** **(eyesight weakness)**	**[40]**
38	***Iyārij Loghāẓia***	***Ṣara'*** **(epilepsy),** ***Fālij*** **(paralysis),** ***Laqwā*** **(facial palsy)**	**[35]**
39	***Iṭrīfal Muqawwī-i-Baṣar***	***Nafkh-i-Shikam*** **(flatulence),** ***Waja'-i-Mi'da*** **(gastralgia),** ***Tukhmā*** **(cholera)**	**[36]**
40	***Iṭrīfal Hāmān***	***Bahaq*** **(pityriasis)**	**[38]**
41	***Ḥalwa-i-Supāri Pāk***	***Jiryān*** **(semenorrhoea),** ***Sur'at-i-Inzāl*** **(premature ejaculation),** ***Ḍu'f-i-Bāh*** **(sexual debility)**	**[36]**
42	***Ḥalwa-i-Supāri Pāk***	***Jiryān*** **(semenorrhoea),** ***Sur'at-i-Inzāl*** **(premature ejaculation) and** ***Sayalān al-Raḥim*** **(leucorrhoea)**	**[39]**
43	***Safūf Hāzim Mushtahī***	***Sū -i-Haḍm*** **(indigestion),** ***Ḍu'f-i-Ishtihā*** **(anorexia),** ***Nafkh-i-Shikam*** **(flatulence)**	**[40]**
44	***Bazarjali***	***Fasāde Dam*** **(blood disorder)**	**[38]**
45	***Yashabī***	***Amrāz-i-Raḥim*** **(uterine diseases),** ***Ḍu'f-i- Mi'da*** **(gastric insufficiency),** ***Ḍu'f-i-Kabid*** **(hepatic insufficiency),** ***Ḍu'f-i-Kulya*** **(renal insufficiency),** ***Ḍu'f-i-Masāna*** **(urinary bladder insufficiency)**	**[40]**

Figure 1: Cinnamomum tamala (leaf)

CONCLUSION:

The leaf of *Cinnamomum tamala* has been used by humans for centuries. Other than the use of its leaf and bark in crude form, oil extracted from its leaf and bark is also being used in different traditional systems. The

renowned scholar Avicenna, also described the characteristics of this plant in his famous book "The Cannon of Medicine", and wrote stomachic and diuretic as its pharmacological actions. In Classical Unani literature, it is indicated in various cardiac, neurological, gastrointestinal, and ophthalmic disorders. Recent scientific pharmacological studies also proved the classical claims and showed its nephro-protective, gastro-protective, and immunomodulatory potential. Similarly, some other studies revealed that the plant has anti-bacterial, anti-fungal, anti-diabetic etc. properties as well. The present review exhibited that *Cinnamomum tamala* is a wonder plant and more scientific studies are required to explore its potential to the full extent.

Conflict of interest statement

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REFERENCES:

[1] Lamichhane and Karna. Harvesting methods of Cinnamomum tamala leaves in private land: A case study from Udayapur district, Nepal Banko Janakari, Vol. 19, No. 2, 2009. P-20-24.

[2] Anonymous. Unani Pharmacopoeia of India, part I, vol I, Govt. of India, Ministry of Health & Family Welfare 2007 Page -78

[3] Rais S. Al-Qanoon Fit Tibb. vol2, Aijaz Publishing House, New Delhi, p-160

[4] Kirtikar K.R, Basu B.D. Indian Medicinal Plants. 2nd edition, Vol III, International Books Distributors, P-2146

[5] Retrieved (August 15th, 2023) from the Integrated Taxonomic Information System online database http://www.itis.gov. Taxonomic Serial No.:506207.

[6] Kabiruddin M. Makhzanul Mufradat. Aijaz Publishing House, Delhi, P-207

[7] Ibn Baitar. Aljame Almufradat Aladvia wa Alaghzia, vol. III, Urdu translation, CCRUM, P-19-20

[8] Azam K. Muheete Azam, vol. 3rd, Central Council for Research in Unani Medicine, New Delhi, P-15.

[9] Ghani N. Khazainul Advia. Idara Kitabus Shifa, New Delhi, P-532

[10] Mishra AK, Singh BK, and Pandey AK. *In vitro*-antibacterial activity and phytochemical profiles of *Cinnamomum tamala* (Tejpat) leaf

extracts and oil. Reviews in Infection, vol. 1(3), 2010, P-134-139

[11] Parekh J and Chanda S. In vitro screening of antibacterial activity of aqueous and alcoholic extracts of various Indian plant species against selected pathogens from Enterobacteriaceae. African Journal of Microbiology Research Vol. 1 (6), 2007, P-092-099

[12] Hassan W, Kazmi S, Noreen H, Riaz A and Zaman B. Antimicrobial Activity of *Cinnamomum tamala*Leaves. Journal of Nutritional Disorders & Therapy. Volume 6Issue 2, 2016, P-1-5

[13] Ahmed J, Sultana N, Dewan S, Amin M, Naimuddin S. Determination of Chemical Groups and Investigation of Anthelmintic, Cytotoxic, and Antibacterial Activities of Leaves of Cinnamomum Tamala (Family: Lauracea). International Journal of Pharmamedix India, 1(2), 2013, P-222-232

[14] Rahman M, Khatun A, Islam MM, Akter MN, Chowdhury SA, Ali Khan MA, *et al*. Evaluation of antimicrobial, cytotoxic, thrombolytic, diuretic properties and total phenolic content of Cinnamomum tamala. Int J Green Pharm, vol7, 2013, P-236-43.

[15] Goyal P, Chauhan A, Kaushik P. Laboratory Evaluation of Crude Extracts of Cinnamomum tamala for Potential Antibacterial Activity. Electronic Journal of Biology, Vol. 5(4), 2009, P-75-79

[16] Pandey AK, Mishra AK, and Mishra A. Antifungal and antioxidative potential of oil and extracts derived from leaves of Indian spice plant Cinnamomum tamala. Cell. Mol. Biol. 58 (1), 2012, p-142-147.

[17] Amma KP, Rani MP, Sasidharan I, and Sreekumar MM. Comparative chemical composition and in vitro antioxidant activities of essential oil isolated from the leaves of Cinnamomum tamala and Pimenta dioica. *Natural Product Research*, Vol. 27, No. 3, 2013, P-290–294

[18] Kumar S, Vasudeva N and Sharma S. GC-MS analysis and screening of antidiabetic, antioxidant and hypolipidemic potential of Cinnamomum tamala oil in streptozotocin induced diabetes mellitus in rats. Cardiovascular Diabetology, 11:95, 2012,P-2-11

[19] Smerq J, Sharma M. Possible Mechanism of Murrayakoenigii and Cinnamomum tamala With Reference to Antioxidants Activity International Journal of Pharmaceutical Sciences and Drug Research, 3(3), 201, P-260-264

[20] Bisht S, Sisodia SS. Assessment of antidiabetic potential of Cinnamomum tamala leaves extract in streptozotocin induced diabetic rats. Indian Journal of Pharmacology, Vol 43, Issue 5, 2011,P-582-85

[21] Chakraborty U and Das H. Antidiabetic and Antioxidant Activities of Cinnamomum tamala Leaf Extracts in Stz-Treated Diabetic Rats. Global Journal of Biotechnology & Biochemistry 5 (1), 2010, P-12-18

[22] Kumanan R, Manimaran S, Saleemulla K, Dhanabal SP, Nanjan MJ. Screening of bark of Cinnamomum tamala (Lauraceae) by using α-amylase inhibition assay for anti-diabetic activity. *Inernational Journal of Pharmaceutical and Biomedical Research*, *1*(2), 2010, P-69-72

[23] Kar A, Choudhary BK, Bandyopadhyay NG. Comparative evaluation of hypoglycaemic activity of some Indian medicinal plants in alloxan diabetic rats. Journal of Ethnopharmacology 84, 2003, P-105-108

[24] Shibly AZ, Suborna LA, Adhikari J, Islam MS. Evaluation of antihyperglycemic activities of Bangladeshi medicinal plant Cinnamomum tamala Leaf extracts in alloxan treated Albino Rats. Int J Basic Clin Pharmacol,7, 2018, P-11-5

[25] Dhulasavant V, Shinde S, Pawar M, Naikwade NS. Antihyperlipidemic Activity of Cinnamomum tamala Nees. on High Cholesterol Diet Induced Hyperlipidemia. International Journal of PharmTech Research, 2(4), 2010, P-2517-2521

[26] Rao CV, Vijayakumar M, Kumar S.Antidiarrhoeal activity of the standardised extract of Cinnamomum tamala in experimental rats. J Nat Med., 62, 2008, P-396–402

[27] Thamizhselvam N, Soumya S, Sanjayakumar YR, Salinichandran K, Venugopalan TN, Jaya N. Anti-

Inflammatory, Analgesic and Antipyretic Activity of Methanolic Extract of Cinnamomum Tamala (Nees) In Experimental Animal Models. *International Journal of Bioassays.* Volume 01, Number 09, 2012. P-26-9

[28] Akila M, Dayana J, Parameswari CS. Evaluation of Anti-Inflammatory Effect of Cinnamaldehyde – an in vitro Study. International Journal for Pharmaceutical Research Scholars (IJPRS) V-3, I-4, 2014, P-79-82

[29] Nagaraju B, Vidhyadhara S, Kumar A,Vikas S, and Raju DS. Evaluation of cardioprotective activity of Ethanolic extract of dried leaves of Cinnamomum tamala in rats. International Journal of Biomedical and Advance Research, 7(4), 2016, P-181-186.

[30] Naveedullah, Khan MA, Khan T, and Ahmad W. Protective Effect of Cinnamomum tamala Extract on Gentamicin-Induced Nephrotic Damage in Rabbits. Tropical Journal of Pharmaceutical Research, 12 (2), 2013, P-215-219

[31] Eswaran MB, Surendran S, Vijayakumar M, Ojha SK, Rawat AKS, Rao CV. Gastroprotective activity of Cinnamomum tamala leaves on experimental gastric ulcers in rats. Journal of Ethnopharmacology 128, 2010, P-537–540

[32] Chaurasia JK, Mishra A, and Tripathi YB. Immunomodulation property of hexane fraction of leaves of Cinnamomum tamala Linn. in rats. Cell Biochemistry and Function, 28, 2010, P-454–460

[33] Chen L, Yang Y, Yuan P, Yang Y, Chen K, Jia Q, and Li Y. Immunosuppressive Effects of A-Type Procyanidin from Cinnamomum tamala. Evidence-Based Complementary and Alternative Medicine, Volume 2014, Article ID 365258, P-1-9

[34] Dumbre RK, Kamble MB, and Patil VR. Inhibitory effects by ayurvedic plants on prostate enlargement induced in rats. Pharmacognosy Res., 6(2), 2014, P-127–132.

[35] Anonymous, National Formulary of Unani Medicine. Part -I Govt. of India, Ministry of Health & Family Welfare. 2006.

[36] Anonymous, National Formulary of Unani Medicine. Part -II, Volume -

IGovt. of India, Ministry of Health & Family Welfare. 2007.

[37] Anonymous, National Formulary of Unani Medicine. Part -III, First edition,Govt. of India, Ministry of Health & Family Welfare. 2001.

[38] Anonymous, National Formulary of Unani Medicine. Part -IV, First edition, Govt. of India, Ministry of Health & Family Welfare. 2006.

[39] Anonymous, National Formulary of Unani Medicine. Part -V, Govt. of India, Ministry of Health & Family Welfare. 2008

[40] Anonymous, National Formulary of Unani Medicine. Part -VI, Govt. of India, Ministry of Health & Family Welfare. 2011.