

Phytopharmacological overview of *Terminalia chebula* Retz.

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ABSTRACT

Phytotherapy is the traditional method used to cure many diseases. Various medicinal plants found in many parts of India are well known for their various medicinal values. The *Terminalia chebula* Retz. a native plant of Asia is found to have various properties like anti-oxidant and free radical scavenging activity, anti-carcinogenic activity, anti-mutagenic activity, anti-bacterial activity, anti-fungal activity, anti-viral activity, anti-diabetic, renoprotective activity, cardio-protective activity, anti-inflammatory and anti-arthritis activity. These properties of *T. chebula* discussed in this review are mainly due to the presence of various types of phytoconstituents.

Key words: *Terminalia chebula*, Anti-oxidant, Phytoconstituents, Free radical, Anti-fungal, Anti-carcinogenic, Renoprotective, Anti-arthritis, Anti-inflammatory.

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INTRODUCTION

The Siddha and Ayurveda treatments use plants to cure various diseases;¹ they are the traditional method adopted in India before 5000 years. The use of plants in various treatments has drawn attention in recent years due to their accuracy in treatment and their reduced or absence of side effects. Treatments involving the use of chemically synthesized compounds have more severe side effects to patients other than curing the disease effectively. *Terminalia chebula* Retz. is one of the many traditional medicinal trees used to treat many diseased conditions. *T. chebula* under the family Combretaceae, a native plant in India and Southeast Asia, is widely cultivated in Taiwan. Its dried ripe fruit, also called as medicinal Terminalia fruit, has traditionally been used as a way to treat various ailments in Asia.² *T. chebula* possesses a large number of different types of phytoconstituents which exhibits a number of medicinal activities. The fruit of the tree provides diverse health benefits and is a traditional medicine for household remedy against various human ailments over decades.³ *T. chebula* has been widely used in Ayurveda, Unani and Homoeopathic medicine and has become an important part of modern medicine. The presence of the various phytochemicals like polyphenols, terpenes, anthocyanins, flavonoids, alkaloids and glycosides makes them a potent anti-oxidant, anti-fungal, anti-bacterial, anti-viral agents.

BOTANICAL DESCRIPTION

T. chebula is a native plant of Asia, found predominantly in Srilanka, Bangladesh, Egypt, Turkey, Tibet, Pakistan and various parts of India. This is a deciduous tree that grows up to 30 m in height with a crown shaped like a broad disk.⁴ This tree grows at the height of 1500-2000 m. They have sub-opposite or alternate leaves elliptic blades of 7-18×4.4-10 cm. They have veins which are lateral and they occur as 6-12 pairs. *T. chebula* have monoecious flowers with unpleasant smell and are pale yellow in color. The unripen fruit is green in color and the ripe fruit is yellowish grey in color with the size of 1-2 inches. May to June is the time the flowers appear and July to December the fruits appear.

ANTI-OXIDANT AND FREE RADICAL SCAVENGING ACTIVITY

Compounds that can scavenge excessive free radicals in the body can hinder the process of carcinogenesis. The leaves, bark and fruit of

T. chebula possessed high anti-oxidant activity due to the presence of phenolics which is responsible for this activity.⁵ Aqueous form of the extract of *T. chebula* inhibited xanthine/xanthine oxidase activity and was also a scavenger of DPPH radicals.⁵ The poly-herbal formulation of *T. chebula* (Aller-7/ NR-A2) is found to inhibit the hemolysis and makes the lipopolysaccharide to release nitric oxide in an inhibited form.⁶ Acetone extract has stronger anti-oxidant activity than alpha-tocopherol and HPLC analysis with diode array detection indicated the presence of phenolic compounds such as hydroxybenzoic acid derivatives, hydroxyl cinnamic acid derivatives, flavonol aglycones and their glycosides.⁷

ANTI-CARCINOGENIC ACTIVITY

A group of researchers have reported the phenolics of *T. chebula* fruit have inhibitory action on cancer cell growth and found that tannic acid, ellagic acid and chebulinic were the growth inhibitory phenolics of *T. chebula*.⁸ Ethanol extract of *T. chebula* fruit inhibited cell proliferation and induce the death of the cell in a dose dependent manner in many malignant cell lines including breast cancer cell line of mouse (S115) and human (MCF-7), human osteosarcoma cell line (HOS-1), a non-tumorigenic immortalized human prostate cell line (PNT1A) and human prostate cancer cell (PC-3).⁹ Besides, acetone extract of bark and fruit powder of *T. chebula* have constituents with promising anti-carcinogenic activity.⁹

ANTI-MUTAGENIC ACTIVITY

Anti-mutagenic activity of aqueous extract and hydrolyzable tannins from *T. chebula* in *Salmonella typhimurium* has been well documented.¹⁰ The aqueous extract of *T. chebula* inhibits gamma radiation induced strand breaks formation in plasmid PBR322 DNA.¹¹ The administration of aqueous extract of *T. chebula* prior to whole body irradiation of mice resulted in a reduction of peroxidation of membrane lipids in the mice liver and a decrease in radiation induced errors to DNA. It also protected the human lymphocytes from the harmful gamma radiation-induced damage to DNA exposed *in vitro*.¹² *T. chebula* showed chemo preventive effects on toxicity, nickel chloride -induced renal oxidative stress, and cell proliferation response in male Wistar rat.

ANTI-BACTERIAL ACTIVITY

T. chebula showed anti-bacterial activity against both Gram-positive and Gram-negative human pathogenic bacteria.^{13,14} Ethanedioc acid and

ellagic acid isolated from *T. Chebula* fruit extract had strong anti-bacterial activity against intestinal bacteria, *Clostridium perfringens* and *Escherichia coli*.¹⁵ It is effective against *Helicobacter pylori* by inhibiting the urease activity, and ubiquitous bacterium which cause stomach cancer, ulcers and gastritis.¹⁴ The methicillin-resistant *Staphylococcus aureus* when treated with the extract of *T. chebula* showed decreased growth and activity thereby confirming the anti-bacterial activity. The ripe seeds of *T. chebula* also have strong anti-bacterial activity against *S. aureus*. The aqueous extract of *T. chebula* strongly inhibited the growth of *Streptococcus* mutants, salivary bacteria.¹⁶

ANTI-FUNGAL ACTIVITY

An aqueous extract of *T. chebula* showed anti-fungal activity against a number of dermatophytes and yeasts. Its activity is effective against the pathogenic yeast *Candida albicans* and dermatophytes *Epidermophyton floccosum*, *Microsporungy pseum* and *Trichophyton rubrum*.¹⁷ Methanol extract of *T. chebula* have anti-candidal activity which acts against clotrimazole resistant *Candida albicans*. Anti-fungal activity against *Trichophyton glabrata* exhibited by seed extracts.¹⁸

ANTI-VIRAL ACTIVITY

T. chebula fruits used for four immunodeficiency virus HIV-1 (type 1) integrase inhibitors, GA (I) and three galloyl glucoses (II-IV). Their galloyl moiety plays an important role for inhibition of 3'-processing of HIV-1 integrase of the compounds.¹⁹ *T. chebula* also exhibit retroviral reverse transcriptase inhibitory activity.²⁰ It protects epithelial cells against influenza a virus; supporting its use for aiding in treatment of acute respiratory infections.²¹ It also showed the therapeutic activity against herpes simplex virus both *in vitro* and *in vivo* tests.²² These findings encouraged a team of Japanese researchers to investigate *T. chebula* effect on human cytomegalovirus (CMV). The replication of human cyto-magalo virus in AIDS is found to be inhibited by the extract of *T. chebula* and also in preventing CMV disease.

ANTI-DIABETIC AND RENOPROTECTIVE ACTIVITY

In streptozotocin induced diabetic rats *T. chebula* fruit and seeds showed dose dependent reduction in blood glucose both in short term and long term study and also had renoprotective activity. The high blood sugar level is reduced to normal by using the extract of *T. chebula*.^{23,24}

CARDIOPROTECTIVE ACTIVITY

Pretreatment with the extract of *T. chebula* was found to ameliorate the consequence of isoproterenol on the formation of lipid peroxide and also retained the activities of the diagnostic marker enzymes in isoproterenol induced myocardial damage in rats.²⁵ Its pericarp has been reported to have cardioprotective activity which is showed in isolated frog heart model.

ANTI-INFLAMMATORY AND ANTI-ARTHRITIC ACTIVITY

Aqueous extract of dried fruit of *T. chebula* demonstrated inhibition of inducible nitric oxide synthesis which shows anti-inflammatory activity.²⁶ Chebulagic acid obtained from immature seeds of *T. chebula* significantly suppressed the onset and progression of collagen induced arthritis in mice.²⁷ Polyherbal formulation (Aller-7) containing *T. chebula* exhibited a dose dependent anti-inflammatory activity against Freund's adjuvant induced arthritis in rats.²⁸

CONCLUSION

Among all the rapidly healing chemical medicines available, a large number of populations in the whole world are still using plants to cure disease. The *T. chebula* with its numerous pharmacological activities found its rightful place in traditional medicine. More biochemical tests are yet to be conducted to find more uses and potential value of *T. chebula*. This can lead to a rapid emergence of the use of plant extracts to cure many diseases without causing any harm to the patient thereby leading to a healthy environment.

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CONFLICT OF INTEREST

No funding source and there is no conflict of interest.

ABBREVIATION USED

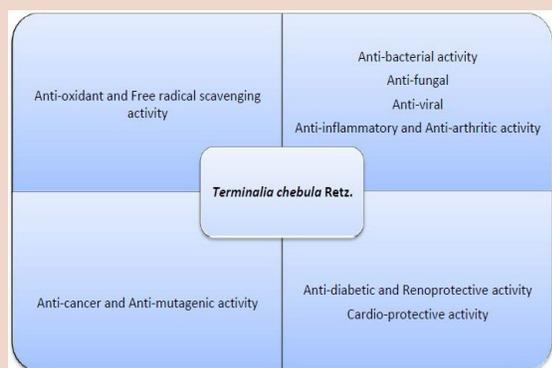
DPPH: 1,1-Diphenyl-2-picryl-hydrazyl; **HPLC:** High Performance Liquid Chromatography; **AIDS:** Acquired Immune Deficiency Syndrome.

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PICTORIAL ABSTRACT



SUMMARY

- This review confirmed the ability of *Terminalia chebula* Retz.
- *Terminalia chebula* exhibit anti-microbial, anti-diabetic, cardio-protective, anti-oxidant and anti-cancer activities.
- Its support the traditional uses *Terminalia chebula*.

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