



A Brief Review on Pharmacological Potential of *Tamarindus indica*

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ABSTRACT

Tamarindus indica is a leguminous monotypic genus plant belonging to the subfamily Caesalpinioideae of the family Fabaceae commonly known as the Tamarind tree. It is a long-lived evergreen tree native to southern Asian and African continents. These trees are slowly growing, massive tree. They can grow under varied climatic conditions and environmental modifications. The tree can attain a maximum of 24m height and 7m girth, it bears pale yellow and pink flowers. *Tamarindus indica* is extensively used as traditional medicine in India, Pakistan, Bangladesh, Nigeria, and in most of the tropical countries. Almost every part *Tamarindus indica* plant consists numerous nutritional and medicinal value. Tamarind possesses various essential amino acids and phytochemical constituents which exhibit pharmacological activities such as antimicrobial, anti-inflammatory, antiemetic, antioxidant, anti-diabetic, anti-nephrotoxic and hepatoprotective activity. Tamarind has been used for centuries as a traditional medicinal plant which has often been reported as curative in several ethnomedical applications.

Keywords: Botanical description, Chemical constituents, Distribution, Pharmacological activities, Tamarind, *Tamarindus indica*.

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INTRODUCTION

Tamarindus indica commonly known as tamarind tree, is a monotypic genus and belongs to the subfamily Caesalpinioideae of the family Leguminosae (Fabaceae) is one of the fruit tree species that is used as traditional medicine. Tamarind tree is found especially in the Indian subcontinent, Africa, Pakistan, Bangladesh, Nigeria and most of the tropical countries.^{1,2} Tamarind tree is commonly found in moist waste ground, lawns and open plantation. It is cultivated throughout India, self-sown in waste places, forest lands and also planted along roadsides throughout India.³ Tamarind fruit was at first thought to be produced by an Indian palm, as the name tamarind comes from a Persian word "Tamar-I-hind", meaning date of India. Its name "Amlika" in Sanskrit indicates its ancient presence in the country.⁴

The tamarind tree has ability to grow in poor soils because of their nitrogen fixing capability and ability to withstanding long periods of droughts make them ideal for low input with high yielding. The outstanding characteristic of the tamarind fruit is that it is the most acidic of all fruits, with a total acidity range varying from 12-24% as tartaric acid and has a high total sugar content varying from 21-31%. The overall aroma of tamarind is characterized by its warm, citrus-like notes and some roasted undertones.⁵

Traditional medicine (TM) is important in tropical countries in contrary to pharmaceuticals, as it is often freely and readily available. The tamarind tree has been used widely due to its good potential to contribute to affordable local health care based on traditional medicine. In addition, medicinal plants with a long history of safe and effective use are likely to have a pharmaceutical effect.^{6,7}

Vernacular Names⁸

Table 1: Vernacular names of *Tamarindus indica*

English	Tamarind
Sanskrit	Jambula, mahanila
Kannada	Hunase mara, unsi, Hunase huli
Malayalam	Amlam
Telugu	Amlika, chinta, sinja, sinta
Bengal	Ambli, tentul, tinturi, nuli
Tamil	Ambilam, amilam

Taxonomical Classification^{4,9}

Table 2: Taxonomical classification of *Tamarindus indica*

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae
Subfamily	Caesalpinioideae
Tribe	Detarieae
Genus	Tamarindus
Species	indica



Habitat

Tamarind tree grows well in both humid monsoon and semi-arid climates. These trees can grow on a wide range of soil types like loam, sandy, clay soil but well drained slightly acidic soil is best for its growth. Tamarind tree can tolerate temperatures up to 47°C. It is mainly grown in areas with 500-1500 mm rain/ year but cannot tolerate continuous frost. In the wet tropics with over 4000 mm rain, flowering and fruit setting is significantly reduced and in India it is not grown in areas receiving more than 1900 mm rain/year. Regardless of total annual rainfall, it produces more fruit when subjected to a fairly long dry period.^{8,9}

Distribution

Tamarindus indica has a wide geographical distribution in the subtropics and semi-arid tropics where it is cultivated. Tamarind grows naturally all over Asia up to an altitude of about 500m that is from Burma to Afghanistan. In the Indian subcontinent, it is distributed continuously in southern and central regions which have similar wet and semi-arid climatic characteristics of tropical regions. It also occurs in sparse patches up in northern India.^{8,9,10}

Botanical Description

Tamarind is a long lived, medium to large in size, evergreen or semievergreen trees. Tamarind trees are about 20-30m tall and 7m girth. The trunk forks about 1m above ground and multi-stemmed with branches widely spreading, drooping at the ends forming a beautifully spreading round crown.^{8,11}

Bark

The bark is rough, scaly and brownish-grey in colour.¹¹

Leaves

Leaves are elliptical ovular, alternate, pinnate with reticulate venation and is a mass of bright green, dense foliage with a feathery appearance. Leaves are paripinnate up to 15cm long. Leaflets: Subsessile, 10-20 pairs, tolerably closely set on the rachis. At the leaf base is a pulvinus and two small stipules 0.5-1.0 cm long which are caducous, stipules are falcate, acuminate and pubescent.^{8,10}

Flowers

Flowers are inconspicuous, inch wide, five-petaled bore in small lax racemes and are yellow with red or orange streaks. Flowers are irregular 1.5 cm long and 2-2.5 cm in diameter each with a pedicel about (5-)6(-10) mm long, nodose and jointed at the apex. The calyx is (8-)10(-15) mm long with a narrow tube (turbinate) and 4 sepals, unequal, ovate, imbricate, membranous and coloured cream, pale yellow or pink. The flower buds are markedly pink due to the outer colour of 4 sepals which shed when the flower opens.^{8,10}

Fruit

Fruit is a pod, indehiscent, subcylindrical, curved or straight, velvety, rusty brown, 5-15 cm long and 1cm thick. Fruit pulp are reddish-brown, moist, sticky mass which consist of yellowish-brown fibres. Odour is pleasant, taste is sweetish and acidic. The pod has outer epicarp which is rusty brown and scaly. The shell is light greenish or scruffy brown and minutely scaly, often irregularly constricted between seeds, brittle, and easily broken, if pressed. It is filled with firm soft pulp surrounding the seed cavities.^{1,4}

Seeds

Pods contain 1–10 seeds, irregularly shaped, flattened, rhomboid, with the centre of each flat side of the seed marked with a large central depression. The seeds are very hard, shiny, reddish, or purplish brown.^{4,8}

Chemical Constituents

Phytochemical investigation carried out on *Tamarindus indica* revealed the presence of various phytoconstituents such as flavonoids, alkaloids, tannins, phenols, triterpenoids, fatty acids, saponins, amino acids, steroids, cardiac glycosides, tartaric acid, mucilage, pectin, fatty acids and essential elements like As, Ca, Cu, Fe, Mn.^{10,11,12} Phenolic compounds like catenin, procyanidin B2, epicatechin, tartaric acid, mucilage, pectin, arabinose, xylose, galactose, glucose, uronic acid and triterpene were also observed.^{13,14} *Tamarindus indica* root bark exhibited presence of phytoconstituents such as β -sitosterol, eicosanoic acid, n-hexacosane, 21-oxobehenic acid, octacosanyl ferulate and (+)-pinitol.¹⁵

Pharmacological Activities**Anti-microbial activity**

Tamarindus indica has a broad spectrum anti-microbial activity. Hydroalcoholic and aqueous extracts of *T. indica* leaves have shown to possess effective antimicrobial activity against some gram positive and negative bacteria like *S. aureus*, *B. subtilis*, *E. coli* and *P. aeruginosa*.¹⁶ Methanol and acetone extracts of *T. indica* have also showed significant antimicrobial activity against *Klebsiella pneumoniae* which was demonstrated by agar disk diffusion method.¹⁷ Methanolic leaf extract of *Tamarindus indica* have revealed its antibacterial potential against *Burkholderia pseudomallei*.¹⁸

Anti-inflammatory activity

Various parts of *Tamarindus indica* have exhibited anti-inflammatory activity. Methanolic extract of *T. indica* seeds using in vivo rat model (carrageenan induced paw edema) demonstrated that seed extract exhibited anti-inflammatory activity.¹⁹ *Tamarindus indica* seeds were found to contain serine proteinase inhibitor. Abnormal accumulation of a serine proteinase in human neutrophil caused acute and chronic inflammation. Serine proteinase inhibitor found in tamarind seeds exhibited high inhibitory activities against human neutrophil elastase which explains anti-inflammatory properties of the tamarind



seeds.²⁰ *Tamarindus indica* has an ability to inhibit various biological pathways such as NF-B activation pathways and leukotriene biosynthesis which explains the anti-inflammatory properties it exhibits.²¹

Anti-diabetic activity

Hydroethanolic seed coat extract of *Tamarindus indica* was evaluated for its antidiabetic potential using alloxan induced rat model revealed that the extract possessed potent hypoglycaemic action.^{22,23}

Antioxidant activity

Aqueous, acetone and methanolic *Tamarindus indica* seed coat extracts were evaluated by various *in-vitro* and *in vivo* techniques that indicate the presence of compounds responsible for exhibiting antioxidant activities.²⁴ Ethanolic root and stem bark of *Tamarindus indica* has also been reported to exhibited scavenging potential.²⁵

Anti-emetic activity

Methanol and butanol leave extract of *Tamarindus indica* has been reported to exhibited significant anti-emetic potential.²⁶

Anti-obesity activity

Investigation of *Tamarindus indica* pulp aqueous extract in diet-induced obese Sprague– Dawley rats exhibited significant reduction in adipose tissue weights, as well as lowering the degree of hepatic steatosis which indicated that extract possessed an anti-obesity effect.²⁷

Anti-venom activity

The root extract of *Tamarindus indica* exerted potent inhibitory action against hydrolytic enzymes and *Vipera russelli* venom which confirmed that extract contained constituents that exhibited anti- venom activity.²⁸

Anti-ulcerogenic activity

Methanolic seed coat extract of *Tamarindus indica* exhibited a significant, dose-dependent cytoprotective action in alcohol, ibuprofen and pylorus-ligation induced ulcer models. Thus, revealing seed coat extract possesses antiulcerogenic property.²⁹

Anti-nephrotoxic activity

The nephroprotective effect of aqueous ethanolic fruit extract of *Tamarindus indica* against gentamicin-induced renal toxicity was investigated. Thus, result of the above study confirmed anti-nephrotoxic potential of fruit extract to counteract the toxic effects of gentamicin.³⁰

Hepatoprotective activity

A study of ethanolic stem bark extract of *Tamarindus indica* against hepatic damage induced by co-administration of antitubercular drugs like rifampicin and isoniazid revealed significant dose dependent restoration of liver exhibited by the stem bark extract. Hence confirming its hepatoprotective action.³¹ Aqueous extract

of various parts of *Tamarindus indica* were shown to have hepatoprotective activity against paracetamol induced hepatotoxicity.³²

CONCLUSION

Tamarindus indica belonging to family Fabaceae is widely accepted for its traditional medicinal uses and pharmacological potential. Various parts of *Tamarindus indica* have reported the presence of several phytochemicals such as carbohydrates, fats, proteins, alkaloids, flavonoids, phenols, terpenoids, tannins, tartaric acid, amino acids, minerals and other constituents. *Tamarindus indica* revealed various pharmacological activities such as anti-microbial, anti-inflammatory, anti-diabetic, anti-oxidant, antiemetic, anti-obesity, anti-venom, anti-neurotoxic, anti-ulcerogenic and hepatoprotective activity. Each and every part of tamarind tree possesses medicinal and nutritional value, with numerous other applications. Further scientific investigation on different parts of *Tamarindus indica* must to be undertaken to unveil additional pharmacological properties.

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