

A Review on Health-Related Effects & Pharmacological Activity of Tamarindus Indica

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ABSTRACT

Tamarindus indica L. (Tamarind) is a widely utilized tropical plant in traditional medicine across Africa and Asia, with almost every part (pulp, seeds, leaves, bark) having recognized culinary and therapeutic value. This review summarizes the current scientific literature concerning the health-related effects and pharmacological activities of *T. indica* and its bioactive constituents. Phytochemical analysis has revealed that *T. indica* is a rich source of essential amino acids, vitamins, minerals, and diverse bioactive compounds, including polyphenols, flavonoids, tannins, and tartaric acid. These constituents are responsible for a broad spectrum of pharmacological properties demonstrated through in vitro and in vivo studies.

Keywords: *Tamarindus indica*, Pharmacological Activity, Phytochemicals, Antioxidant, Anti inflammatory, Bioactive compounds

INTRODUCTION

Tamarind is a leguminous tree of the genus *Tamarindus*, which is monotypic with only the species *indicum* [1]. *Tamarindus indica*, having the family Fabaceae and subfamily Caesalpinaceae, is a tropical evergreen tree native to Africa and Southern Asia [2]. Traditional medicine, in contrast to pharmacotherapy, can be easily accessible and ready to use, especially in tropical countries, so it has an important role in the first-line approach. For example, in Burkina Faso, 90% of people prefer to use traditional medicine [3]. Plants are the basic elements of traditional medicine and are preferred as a treatment choice in an increasing amount [4]. India is the world's largest producer of tamarind; it is estimated that 300,000 tons are produced annually [5]. One of the most known health benefits of tamarind is its use as medicine since ancient times. It has been known to be useful for treating constipation and liver problems, among others [6]. Its seeds share comparable qualities, making them a valuable and easily available source of protein, particularly in nations where protein deficiency is a prevalent issue. According to phytochemical analysis results, *T. indica* contains phenolic compounds like catechin, procyanidin B2, epicatechin, tartaric acid, mucilage,

pectin, arabinose, xylose, galactose, glucose, uronic acid, and triterpenes [7]



Figure 1: Fruit of *Tamarindus indica*

Scientific Classification [8]

Table.1: Taxonomical classification

Taxonomic Rank	Classification
Kingdom	Plantae
Subkingdom	Tracheobionta
Super Division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Superorder	Rosanae
Order	Fabales
Family	Fabaceae
Subfamily	Caesalpinaceae

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Tribe	Detarieae
Genus	<i>Tamarindus</i>
Species	<i>Tamarindus indicus</i>

Vernacular Name:

Marathi: Chinch

Hindi: Imli, Titar

English: Sweet Tamarind

Arabic: Aradeib

Greek: Tamarin

Japanese: Tamarindo

Philippines: Sampaloc

Danish: Tamarind

Estonian: Tamarindipuu

Srilanka: Sinhala [9]

Plant Distribution by Geography:

Tamarind grows natively throughout Asia, from Burma to Afghanistan, at elevations of roughly 500 meters. It is widely dispersed over the southern and central parts of the Indian subcontinent, which share the same wet and semi-arid climatic traits as tropical regions [10]. It can also be found in isolated areas in northern India. *T. indica* is a common forest plant in Africa that thrives in arid and semi-arid environments. Essentially a tropical tree, it can withstand temperatures of up to 47°C but is extremely vulnerable to frost [11].

Phytochemistry:**Table.2: Chemical constituents of different part of *Tamarindus indica***

Parts	Chemical Constituents
Leaves	Pulps contains invert sugar, citric acid, pipercolic acid nicotinic acid, 1-malic acid, volatile (geraniol, limonene) [12] pipercolic acid, lupanone, lupeol, [13] benzyl benzoate (40.6%), cinnamates, serine, pectin, beta alanine, proline, phenylalanine, leucine, potassium, 1-malic acid, tannin, glycosides [14]
Fruits	Furan derivatives and carboxylic acid [15]. Phlorotannins, apple acid, grape acid [16]
Seed	Campesterol, β -amyrin, β -sitosterol, palmitic acid, oleic acid, linoleic acid and eicosanoic acid. The Mucilage, arabinose, xylose, galactose pectin, glucose and uronic acid was also Found [17].
Steam bark	Tannins, saponins, glycosides, peroxidase and lipids [18].
Root bark	The n-hexacosane, eicosanoic acid, β -sitosterol, (+)-pinitol, octacosanyl ferulate, 21- oxobehenic acid [19, 20].

Pharmacological Activity:

1. Antioxidant activity: According to research by udjaroen et al., *Tamarindus indica* seeds and pericarps contain phenolic antioxidant compounds [21]. When compared to artificial antioxidants such as butylated hydroxyl ascorbic acid and anisole, all of the extracts demonstrated strong antioxidant activity against the linoleic acid emulsion system [22]. Martinelli found that in hypercholesterolemic hamsters, fruit pulp ethanolic extract exhibited strong antioxidant and hypolipidemic effects [23]. Using ascorbic acid as a reference, the DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method was also used to evaluate the antioxidant activity of the ethanolic extract of seed coat. The extract's

capacity to scavenge free radicals may be the cause of this activity [24].

2. Antimicrobial Activity: The methanolic leaf extract's antibacterial activity against *Burkholderia pseudomallei* and its in vitro inhibitory potential were investigated by Muthu et al. [25]. This advises that more animal research be done to fully comprehend *T. indica*'s involvement in treating melioidosis. By utilizing the paper disk diffusion method to measure the diameter of the zone of inhibition against gram-positive and gram-negative bacteria and fungi, the antibacterial activity of the concentrated extracts (aqueous, ethanolic, and acetone) was assessed. *Staphylococcus aureus*, *Salmonella typhi*, *Bacillus subtilis*, and *Salmonella paratyphi* were all found to be susceptible to their strong antibacterial action [26].

3. **Analgesic activity:** The analgesic effectiveness of several *T. indica* bark extracts was evaluated using appropriate models, such as the acetic acid-induced writhing test and the hot plate test. In comparison to pentazocine (10 mg/kg, i.p.), a common medication, the petroleum ether extract had a noteworthy effect at 50 mg/kg. Initial phytochemical analyses revealed that petroleum ether extract contained triterpenes and sterols. Some sterols and triterpenes have analgesic and anti-inflammatory properties [27].
4. **Anti-diarrheal & Anti-dysentery activity:** Tamarind is also used to treat dysentery and diarrhea. The root of the tamarind is utilized to cure dysentery (anti-dysentery activity), while the pulp with lemon is used to treat diarrhea (anti-diarrheal activity). Dysentery is a form of bloody or mucus-containing diarrhea that is typically brought on by an intestinal infection. Patients who have diarrhea run the danger of becoming dehydrated and dying [28].
5. **Anti-emetic activity:** *Tamarindus indica* leaf extracts in methanol and butanol showed anti-emetic properties similar to those of the commercial drug that contains chlorpromazine [29].
6. **Hepatoprotective and antiasthmatic activity:** Some experimental studies have predicted that *T. indica* shows antiasthmatic and hepatoprotective effect. In experimental mice, the methanolic extract of *T. indica* Linn. Leaves demonstrated strong antihistaminic, adaptogenic, and mast cell stabilizing properties. [30] Rats were injected with paracetamol to test the protective effect of *T. indica* Linn. (Caesalpinaceae). A substantial regeneration effect was noted for the aqueous extracts of Tamarind leaves, fruits, and unroasted seeds based on the parameters examined. Aqueous extracts of various parts of *T. indica*, including fruits, leaves (350 mg/kg p.o.), and unsweetened seeds (700 mg/kg p.o.), were given as treatment. [31]
7. **Antidiabetic activity:** Male rats with diabetes caused by streptozotocin showed strong antidiabetic effects from an aqueous extract of *T. indica* seeds. When rats with mild and severe

diabetes were administered *T. indica* seed aqueous extract, their fasting blood glucose levels showed a significant decrease in hyperglycemia. [32] Likewise, a decrease in hyperlipidemia was observed based on varying cholesterol levels. The foundation of traditional Indian herbal medicine may be clarified by this rat model. [33]

8. **Acaricidal activity:** The strongest acute acaricidal activity was demonstrated by oxalic acid at concentrations of 0.5% and 1%. The greatest delayed acaricidal action was observed at 1% tartaric acid solution. The acaricidal activity of a mixture of 0.5% oxalic acid and 0.5% malic, succinic, citric, and tartaric acids at a concentration of 1:1 V/V was evaluated. These acid combinations' acaricidal action was not more potent than that of any one acid alone. After plunging for 15 minutes, the ticks' skin developed a patchy hemorrhagic swelling due to both the crude extract of tamarind fruits and their organic acids. This suggests that tamarind fruit crude extract diluted with water or 10% ethanol may be applied practically to manage the tropical cattle tick. Their organic acids, particularly the tartaric and oxalic acids, are the active ingredients [34].

Health related effects of *T. indica*:

Gastrointestinal system and related disorders:

1. Peptic ulcer:

Peptic ulcers, which cause painful gastrointestinal damage to the stomach and duodenum, are defined as mucosal damage that extends deeper than 0.5 centimeters. *T. indica* seed extract has been demonstrated to have a dose-dependent protective effect on ulcer models brought on by pylorus ligation, alcohol, and ibuprofen. It may be a novel therapy for ulcers. [35] Procyanidin, epicatechin, and polymeric tannins are the primary polyphenolic chemicals in *T. indica* seeds that give them their protective properties. These substances defend against free radicals and have antioxidant properties. By generating vasoconstriction and protein buildup, tannins also stop ulcers from developing [35].

2. Cancer

T. indica seed extract has been demonstrated to have an ameliorative effect on renal cell cancer and chemically induced acute nephrotoxicity. The antioxidant effect explains this effect. Despite the strong correlation between oxidative damage and cancer, the polyphenol compounds found in *T. indica* seed extract, including 2-hydroxy-dihydroxyacetophenone, methyl 3,4-dihydroxybenzoate, 3,4-dihydroxyphenylacetate, (-)-epicatechin, tannin, anthocyanidine, and oligomeric proanthocyanidins, have the ability to induce antioxidant enzymes and block cancer-related signal pathways [36].

3. Spasmolytic effect

The presence of tamarind fruit relaxes smooth muscles by blocking of calcium channels. It also describes how to use *T. Indica* for the treatment of diarrhea [37].

Uses of various part of *Tamarindus indica*:

- 1. Fruit Pulp-** Tamarinds are prized primarily for their fruit, particularly its pulp, which finds extensive usage in both residential and industrial settings. [38]
- 2. Seed-** These are used in some Thai food recipes because of their sourness and specific aroma. [39]
- 3. Leaves and flowers-** Tamarind leaves, blossoms, and immature pods can all be eaten. In many nations, especially during times of famine, the leaves and blossoms are used to prepare soups, stews, salads, and spices. [40] These are utilized in several Thai cuisines due to their distinct aroma and sourness. [39] To manufacture chewing gum, children in the Guinea combine gum harvested from fig trees with the acid leaves. [41]
- 4. Wood-** Toys, oil presses, sugar presses, manufacturing blocks, tools and tool handles, turning machinery, well constructing, tent pegs, canoes, side planks for boats, cart tines and axles, furniture, wheels, mallets, rice pounders, mortars, pestles, ploughs, and more can all be made from tamarind wood. [42, 43]
- 5. Seed testa and bark-** In leather tanning tests, tamarind tannin produces rough, highly colored

leather that can be utilized for heavy soles, luggage, and other items. The seed testa contains 23% tannin. It has also been discovered that the seed husk works well as a fish poison. [44, 45]

- 6. Powdered tamarind kernels-** Another commercial product that is frequently mentioned in commercial digests is Tamarind Kernel Powder (TKP), which is made from the seeds. [46] If the TKP is not stored properly, it will turn brown and rotten; defatting it will improve its color and storage capacity. [47]



Figure 2: Seeds of *Tamarindus indica*

MATERIAL AND METHODS:

- 1. Plants collection and authenticity-** *Tamarindus indica* (TI) seeds were gathered from locations in the Pune area. The "Botanical Survey of India" in Pune identified and verified the *Tamarindus indica* (TI) seeds. (Specimen number on voucher: KIROT AM-2).
- 2. Extract preparation -** The seeds were dried in a shed for ten days before being coarsely ground with a mixer. A 40-mesh sieve was used to filter the powder. The maceration process was used to make the extract. For 72 hours, 3500 ml of methanol (1:7) was used to extract roughly 500 g of the seeds' dried powder. After concentration and drying, the extract yielded 8% w/w. throughout the investigation, the desiccator's airtight container containing the dried methanolic extract was utilized.
- 3. Test animals -** For one week prior to the trials, Wistar albino rats weighing 150–200 g were kept in conventional cages with a light/dark cycle of 10/12 hours, at a room temperature of $22 \pm 2^\circ\text{C}$, and with a relative humidity of $50 \pm 5\%$. The animals were fed a typical mouse pellet diet (Amrut, India) and had

unlimited access to water. The animals had unrestricted access to drinking water but were denied meals for a full day prior to the experiment. Every experiment was carried out in the morning. Our Institutional Ethics Committee authorized experimental protocols that adhere to international INSA (Indian National Science Academy) standards and the CPCSEA's (Committee for the Purpose of Control and Supervision of Experiments on Animals) requirements.

4. Acute oral toxicity analysis and dosage selection-

The Organization of Economic Co-Operation and Development (OECD) guideline no. 423 (Acute toxic class technique) was followed in determining the acute toxicity of *Tamarindus indica* (TI) seed methanolic extract. The Ethanolic extract and its fractions were shown to be non-toxic even at a level of 2000 mg/kg. Therefore, for this investigation, 1/10th (200 mg/kg) of this dosage was used. [48]

RESULT:

The review revealed that *Tamarindus indica* exhibits significant health benefits with antioxidant, antimicrobial, antidiabetic. Its bioactive compounds contribute to various therapeutic effects supporting its medicinal importance.

CONCLUSION:

Tamarindus indica is a popular plant used for nutrition and medicine that has a lot of therapeutic potential. Packed with bioactive substances like polyphenols, flavonoids, organic acids, and vital minerals, it has a wide range of pharmacological properties, such as hepatoprotective, cardioprotective, antibacterial, anti-inflammatory, and antioxidant actions. Due to its wide range of therapeutic uses and safety profile, tamarind—which has long been prized in Ayurvedic, Unani, and African traditional medicine—continues to be a significant component of contemporary study. To prove its therapeutic value and better incorporate it into evidence-based medicine, future research must concentrate on standardization, dosage optimization, and clinical trials.

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