Int. J. Sci. R. Tech., 2025 2(11)
A Multidisciplinary peer-reviewed Journal
www.ijsrtjournal.com [ISSN: 2394-7063]

Original Article

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

Nikhil Dond, Vishal Madankar*, Anil Panchal

Delight College of Pharmacy, Koregaon Bhima, Pune, Maharashtra, India-412216

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	Caesalpiniaceae

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Tribe	Detarieae
Genus	*Tamarindus*
Species	*Tamarindus indicus*

Vernacular Name:

Marathi: Chinch
Hindi: Imli, Titar
English: Sweet Tamarind
Arabic: Aradeib
Greek: Tamarin
Japanese: Tamarindo
Philippines: Sampaloc
Danish: Tamarind
Estonin: Tamarindipuu
Srilinka: 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, pipecolic acid nicotinic acid, 1-malic acid, volatile (geraniol, limonene) [12] pipecolic 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 eicosanoicacid. 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-sinosterol, (+)-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. (Caesalpiniaceae). 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 proantocyanidins, 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±2°C, and with a relative humidity of 50±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.

REFERENCE

1. Bentley R, Trimen H. Medicinal Plants. Vol. 1. New Delhi: Asiatic Publishing House; 2004.
2. Kirtikar KR, Basu BD. Indian Medicinal Plants. 3rd ed. Vol. 2. Dehradun: International Book Distributors; 1987;887–891.
3. Havinga RM, Hartl A, Putscher J, Prehsler S, Buchmann C, Vogl CR. Tamarindus indica L. (Fabaceae): patterns of use in traditional African medicine. J Ethnopharmacol. 2010;127(3):573–588.
4. Bhadoriya SS, Ganeshpurkar A, Narwaria J, Rai G, Jain AP. Tamarindus indica: extent of explored potential. Pharmacogn Rev. 2011;5(9):73–81.
5. El-Siddig K, Gunasena HPM, Prasad BA, Pushpakumara DKNG, Ramana KV, Vijayanand P, et al. Tamarind (Tamarindus indica L.). Fruits for the future, revised. Southampton: International Centre for Underutilized Crops; 2006;188.
6. Aida P, Rosa V, Blamea F, Tomas A, Salvador C. Paraguayan plants used in traditional medicine. J Ethnopharmacol. 2001; 16:93–98.
7. Bhadoriya SS, Mishra V, Raut S, Ganeshpurkar A, Jain SK. Anti-inflammatory and antinociceptive activities of a hydroethanolic extract of Tamarindus indica leaves. Sci Pharm. 2012;80(3):685–700.
8. Wagh AS, Bhagure BL. A pharmacological review on Tamarindus indica Linn. (Caesalpiniaceae). Int J Universal Pharm Life Sci. 2012;2(1):2249–6793.
9. Milind P, Isha D. Imli: A crazy lovely. Int Res J Pharm. 2012;3(8):2230–8407.
10. Dash KD, Meher B, Roy A. A review on phytochemistry, pharmacology and traditional uses of Tamarindus indica. World J Pharm Pharm Sci. 2014;10(3):229–240.
11. Coronel RE. Tamarindus indica L. In: Verheij EWM, Coronel RE, editors. Plant Resources of South-East Asia No.2: Edible Fruits and Nuts. Wageningen: Pudoc/Prosea Foundation; 1991;298–301.
12. Pino JA, Escalera JC, Licea P. Leaf oil of Tamarindus indica L. J Essent Oil Res. 2002;14(3):187–188.
13. Iman S, Azhar I, Hasan MM, Ahmed SW. Two triterpenes, lupinone and lupeol, isolated and identified from Tamarindus indica Linn. Pak J Pharm Sci. 2007;20(2):125–127.
14. Evans WC. Trease and Evans Pharmacognosy. 15th ed. New York: Saunders; 2002;182–183.

15. Wong KL, Tan CP, Chow CH, et al. Volatile constituents of the fruit of Tamarindus indica L. J Essent Oil Res. 1998;10(2):219–221.
16. Shankaracharya NB. Tamarind—chemistry, technology and uses: a critical appraisal. J Food Sci Technol. 1998;35(3):193–208.
17. Ibrahim E, Abbas SAE. Chemical and biological evaluation of Tamarindus indica L. growing in Sudan. Acta Hort. 1995; 390:51–57.
18. Agarwal SS, Paridhavi M. Herbal Drug Technology. 1st ed. Hyderabad: Universities Press; 2007;104.
19. Pino JA, Escalora JC, Licea P. Leaf oil of Tamarindus indica L. J Essent Oil Res. 2002;14:187–188.
20. Jain R, Jain S, Sharma A, Hideyuki I, Hatano T. Isolation of (+)-pinitol and other constituents from the root bark of Tamarindus indica L. J Nat Med. 2007;61:355–356.
21. Sudjaroen Y, Haubner R, Wurtele G, et al. Isolation and structure elucidation of phenolic antioxidants from tamarind (Tamarindus indica L.) seeds and pericarp. Food Chem Toxicol. 2005; 43:1673–1682.
22. Siddhuraju P. Antioxidant activity of polyphenolic compounds extracted from defatted raw and dry-heated Tamarindus indica seed coat. LWT Food Sci Technol. 2007; 40:982–990.
23. Martinello F, Soares SM, Franco JJ, et al. Hypolipemic and antioxidant activities from Tamarindus indica fruit pulp extract in hypercholesterolemic hamsters. Food Chem Toxicol. 2006; 44:810–818.
24. Vyas N, Gavatia NP, Gupta B, Tailing M. Antioxidant potential of Tamarindus indica seed coat. J Pharm Res. 2009; 2:1705–1706.
25. Muthu SE, Nandakumar S, Rao UA. The effect of methanolic extract of Tamarindus indica on the growth of clinical isolates of Burkholderia pseudomallei. Indian J Med Res. 2005; 122:525–528.
26. Doughari JH. Antimicrobial activity of Tamarindus indica Linn. Trop J Pharm Res. 2006; 5:597–603.
27. Singh S, Bani S, Singh GB, et al. Anti-inflammatory activity of lupeol. Fitoterapia. 1997; 68:9–16.
28. Kerharo J, Bouquet A. Plantes Médicinales et Toxiques de la Côte d'Ivoire et Haute-Volta. Paris: Vigot Frères; 1950.
29. Khan RA, Siddiqui SA, Azhar I, Ahmed SP. Preliminary screening of methanol and butanol extracts of Tamarindus indica for antiemetic activity. J Basic Appl Sci. 2005; 1:51–54.
30. Tayade PM, Ghaisas MM, Jagtap SA, Dongre SH. Anti-asthmatic activity of methanolic extract of leaves of Tamarindus indica Linn. J Pharm Res. 2009; 2:944–947.
31. Pimple BP, Kadam PV, Badgujar NS, Bafna AR, Patil MJ. Protective effect of Tamarindus indica Linn. against paracetamol-induced hepatotoxicity in rats. Indian J Pharm Sci. 2007; 69:827–831.
32. Maiti R, Jana D, Das UK, Ghosh D. Antidiabetic effect of aqueous extract of seed of Tamarindus indica in streptozotocin-induced diabetic rats. J Ethnopharmacol. 2004; 92:85–91.
33. Maiti R, Das UK, Ghosh D. Attenuation of hyperglycemia and hyperlipidemia in streptozotocin-induced diabetic rats by aqueous extract of seeds of Tamarindus indica. Biol Pharm Bull. 2005; 28:1172–1176.
34. Doughari JH. Antimicrobial activity of Tamarindus indica Linn. Trop J Pharm Res. 2006;5(2):597–603.
35. Kalra P, Sharma S, Suman, Kumar S. Antiulcer effect of the methanolic extract of Tamarindus indica seeds in different experimental models. J Pharm Bioallied Sci. 2011;3(2):236–241.
36. Vargas-Olvera CY, Sanchez-Gonzalez DJ, Solano JD, Aguilar-Alonso FA, Montalvo-Munoz F, Martinez-Martinez CM, et al. Characterization of N-diethylnitrosamine-initiated and ferric nitrilotriacetate-promoted renal cell carcinoma model and effect of tamarind seed extract. Mol Cell Biochem. 2012;369(1-2):105–117.
37. Ali N, Shah S. Spasmolytic activity of fruits of Tamarindus indica L. J Young Pharm. 2010;2(3):261–264.
38. Kulkarni RS, Gangaprasad S, Swamy GS. Tamarindus indica: economically an important minor forest product. Minor Forest Prod News.1993;3:6.
39. Coronel RE. Tamarindus indica L. In: Verheij EW, Coronel RE, editors. Plant Resources of South-East Asia No.2: Edible Fruits and Nuts.

Bogor, Indonesia: PROSEA Foundation; 1991;298–301.
40. Benthall AP. The Trees of Calcutta and Its Neighbourhood. Dehradun: Thacker Spink & Co; 1933;513.
41. Sozolnoki TW. Food and Fruit Trees of Gambia. Hamburg: Stiftung Walderhaltung in Africa; 1985.
42. Coates-Palgrave K. Trees of Southern Africa: Tamarindus indica. Cape Town: LCS Struik Publishers; 1988.
43. Troup RS. The Silviculture of Indian Trees: Leguminosae to Verbenaceae. Vol. II. London: Oxford Clarendon Press; 1921;231–235.
44. Roy RN, Maiti SS, Mondal CR. Tamarind seed husk as an effective fish poison. Environ Ecol. 1987; 5:467–471.
45. Jena S. Preliminary observations on the effect of tamarind seed husk on fish. J Inland Fish Soc India. 1991; 18:1–3.
46. Mathur NK, Mathur V. Industrial polysaccharides–9: tamarind seed polysaccharide and tamarind kernel powder. Chem Wkly. 2001; 46:143–150.
47. Reddy SG, Rao JS, Achyutaramayya D, Azeemoddin G, Rao TS. Extraction, characteristics and fatty acid composition of tamarind kernel oil. J Oil Technol Assoc India. 1979; 11:91–93.
48. OECD. Guideline for the Testing of Chemicals: Acute Oral Toxicity – Acute Toxic Class Method. Paris: OECD; 2001;423.

HOW TO CITE: Nikhil Dond, Vishal Madankar*, Anil Panchal, A Review on Health-Related Effects & Pharmacological Activity of Tamarindus Indica, Int. J. Sci. R. Tech., 2025, 2 (11), 438-444. https://doi.org/10.5281/zenodo.17627634