



## Phytopharmacological Properties of *Tamarindus indica*: An Overview

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### ABSTRACT

*Tamarindus* is a monotypic genus and belongs to the family Fabaceae. It is commonly known as Tamarind tree. It is indigenous to tropical Africa and exotic to Asia and Central America. Traditionally it is used for Inflammation, tumours, ring worm, diseases of blood, small pox, eye disease, ear ache, snake bite, urinary discharges, bad odour in perspiration, astringent, appetizing, laxative, anthelmintics, heals wounds and fractures, biliousness, bile disorders, heals ulcer, liver, Ankylostomiasis (hookworm). Every part of the plant (leaves, stem, seed, root, bark and fruit) is therapeutically effective in treating various human diseases. The aim of the present review is to describe its nutritional values, geographical conditions, collection and cultivation, chemical constituents, pharmacological activities of various plant parts of *Tamarindus indica*.

**Keywords:** *Tamarindus indica*, Fabaceae, Inflammation, Astringent, Laxative, Ankylostomiasis, Anthelmintics.

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### INTRODUCTION

Plants are the basic elements of traditional medicine and are used in larger amount. *Tamarindus indica* (*T. indica*) is multi-stemmed, it needs dry climate for its growth, It reaches 24 m height and 7 m girth and it has pale yellow and pink flowers. Every single part of *T. indica* (fruit, leaves, stem, root, body) has its own nutritional value and extensive usage in the area of medicine. In traditional medicine, it is used in wound healing, abdominal pain, diarrhea, dysentery, parasitic infestation, fever, malaria and respiratory problems. It is also frequently used in tropical countries because of its laxative and aphrodisiac properties. The plant lives for 80-100 years produces fruits more than 50 years. The seeds of *T. indica* has an available protein source, mainly in the countries where the protein deficiency as a common problem. Based on the phytochemical analysis, *T. indica* contains the phenolic compounds like catenin, procyanidin B2, epicatechin, tartaric acid, mucilage, pectin, arabinose, xylose, galactose, glucose, uronic acid and triterpen.<sup>1</sup> Kernel composed of D-glucose, D-xylose, D-galactose and L-arabinose. The leaves alone contains flavone C-glycosides orientin, vitexin, isoorientin and isovitexin. The leaves and in combination with fruits contains tartaric acid and malic acid. The fruit pulp yields tamarindienal (bitter)

and certain amino acids include serine, beta-alanine, proline, pipercolinic acid, phenylalanine and leucine.<sup>2</sup>

Table 1: Scientific Classification<sup>3</sup>

Domain	Eukaryota
Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Dicotyledonae
Order	Fabales
Family	Fabaceae
Subfamily	Faboideae
Genus	<i>Tamarindus</i>
Species	<i>T.indica</i>

**Binomial Name:** *Tamarindus indica*. L

**Synonyms<sup>4</sup>:**

*Tamarindus umbrosa* Salisb.

*Tamarindus officinalis* Hook.

*Tamarindus occidentalis* Gaertn.

### Nutritional value of Tamarind ( *T. indica* )

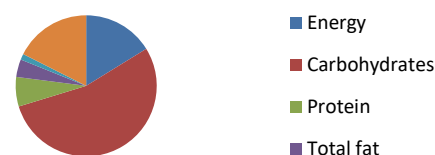


Figure 1: The nutritional values of *Tamarindus indica* raw fruit<sup>1</sup>



**Table 2:** Nutritional value per 100 g of Tamarind (*T. indica*)

(Source: USDA National Nutrient data base).

Principle	Nutrient value	Percentage of RDA
Energy	239.00 Kcal	12%
Carbohydrates	62.50 g	40%
Protein	2.80 g	5%
Total tat	0.60 g	3%
Cholesterol	0 mg	0%
Dietary fiber	5.10 g	13%

**Table 3:** Nutritional value for Vitamins

Vitamins		
Names	Nutrient value	Percentage of RDA
Vitamin A	30.00 IU	1.0%
Vitamin C	3.500 mg	6.0%
Vitamin E	0.100 mg	0.8%
Vitamin K	2.800 µg	2.0%
Vitamin B1	0.428 mg	36.0%
Vitamin B3	1.938 mg	12.0%
Vitamin B5	0.143mg	3.0%
Vitamin B6	0.066 mg	5.0%
Vitamin B9	14.00 µg	3.5%

**Vernacular Names<sup>5</sup>**

- Arabic : Daralsida
- Assam : Tamar, Teteli
- Bengal : Tetula, Nuli, Tintil, Tinturi

- Brazil : Jubay, Tamarindo
- Coorg : Pulinje
- Dutch : Tamrinden boom
- English : Tamarind tree
- French : Tamarindien
- German : Tamarindenbaum
- Gujarat : Amlī, Ambli
- Hindi : Amlī, Imli
- Italian : Tamarindo
- Kannada : Hunise, imli.
- Malayalam : Puli, valampuli, kolpuli.
- Marati : Ambali, Amlī
- Mysore : Asam, Hunese
- Nepal : Titri
- Persian : Ambalah
- Portugese : Tamarindo
- Punjab : Imbli
- Sanskrit : Amlīka, Chinchā, Tinthīdi, Chukra
- Sind : Amri, Gīdamri
- Telugu : Amlīka, sinja, Tinthrini
- Urdu : Imli
- Uriya : Tentuli





Figure 2: *Tamarindus indica*

### Description Of Plant Parts<sup>3</sup>

#### Leaves

The leaves are green, even, oblong, unequal, alternate, pinnate and 8-15 cm long with 10-20 pairs and 5-6 mm wide. The rachis is 7–15 cm long with opposite leaflets. The leaves close at night and may open during the day time. Leaves having a feathery appearance in combination with open branch structure.

#### Flowers

Flowers (5-13 cm in length and 2-2.5 cm in diameter) that emerges on the new branches. The buds are pink in colour. The flowers may be bisexual and the development of flower-bud takes about 20 days from the starting period of time.

**Fruit:** The fruit (7-20 cm in length and 1.5-3.0 cm in width) having irregular curves. The outer part is brown in colour, scaly and small constrictions between the seeds. As the pod ripens it becomes brittle and can be easily broken. The pod loses its water content during drying.

### Biology And Ecology

#### Climate

The tamarind grows best in semi-arid tropical and subtropical conditions tolerating temperature is upto 47°C. The annual temperature range between 29-36°C (maximum), with a minimum of 10-18°C. In many humid conditions, plant provides a dry season that allows for ripening of fruit, and is well-adapted to arid regions. A dry climate is very important to increase the yield of flowers and fruits. The plant requires the annual rainfall of 500-1500 mm for its growth. In areas of wet tropics, tamarind does not produce flowers and also production of fruit is decreased over 4000 mm of rainfall

#### Soil

Tamarind can grow in all types of soil, such as alluvial, deep, loam, sandy, clay, rocky and silt. The plant production is little or no cultivation in poor and rocky soils, and tolerates saline soils, although yields are not as high. Preferably soils should be slightly acid in nature. It flourishes best in loamy, deep, alluvial soils which benefit the development of a long taproot. It also allows slightly alkaline or saline soils.<sup>3</sup>

#### Propagation

Plant can be propagated easily from cuttings or by shield-budding, side-veneer grafting, or air-layering.

#### Season

Most of the studies reveals that the fruits starts to dehydrate after 203 days of fruit-set, losing half of the moisture at the state of full ripeness, about 245 days from the fruit-set. The flowers appear in summer, the green fruits are found in December and January and ripening of fruits takes place from April through June.

#### Harvesting

Harvesting is done with the help of fruits and are often by pulling the pod from the stalk in which fibers gets attached. In India, harvesting taking place by shaking the branches to cause mature fruits to fall and they leave the remainder to fall naturally when they ripe.

#### Yield

A fully developed tree may annually produce (150-220 kg) of fruits, of which the pulp may constitute 30-55%, the shells and fiber 11-30 %, and the seeds, 33-40%.<sup>7</sup>

Table 5: Traditional uses of *Tamarindus indica*<sup>7</sup>

Plant part	Uses
Leaves	Reduce Inflammation, tumours, ring worm, diseases of blood, small pox, and other eye disease, ear ache, snake bite
Flower	Appetizing, urinary discharges, bad odour in perspiration
Fruit pulp (unripe)	Astringent, to the bowel and cure "vata"
Fruitpulp(ripe)	Appetizing, laxative, anthelmintics, heals wounds and fractures, biliousness and bile disorders
Bark	Astringent, heals ulcer, liver complaints
Root	Treat Ankylostomiasis (hookworm)

**Medicinal Uses of *Tamarindus indica*<sup>8</sup>:****Leaves**

Leaves are grounded in the form of a paste in order to prevent the inflammation. A decoction of leaves act as foaming agent on abscesses and reduces pain. The leaves can be used as purgative, diaphoretic, emollient and also for treating stomach disorders. The powdered form can be used in treatment of wounds.

**Bark**

The bark is used as an astringent for treating diarrhoea and the decoction is used as a lotion to wash ulcers and wounds.

**Seed**

The seed testa is mixed with lime juice or vinegar, helps in reducing the formation of pimples. The powdered form of seed is used for treating dysentery. The oil extracted from the seed is used for hair.

**Fruit pulp**

The fruit pulp is for laxative, fever, as a liniment for rheumatism, in treating inflammation, as an astringent and also used in treating scurvy which is having a common ingredient in blood sugar-reducing and also in cardiac medicines. The ripe fruit is used as a refrigerant, digestive, carminative and laxative.

**Flowers**

The flowers are used internally for treating jaundice and applied on eyes externally for reducing conjunctivitis.

**Therapeutic Uses<sup>7</sup>**

- Antioxidant
- Anti-diabetic
- Anti-microbial
- Anthelmintic
- Anti-inflammatory
- Analgesic
- Antivenom
- Hypolipidemic and weight reducing
- Immunomodulatory
- Anti diarrhoeal and Anti dysentery
- Wound healing
- Anti-emetic
- Hepatoprotective
- Antihistaminic
- Anti-pyretic
- Anti-malarial

- Cytotoxic
- Laxative
- Acaricidal

**Uses of Various Parts of *Tamarindus indica*****Fruit pulp**

The pulp has a wide range of domestic and industrial purposes. The acidic pulp is used as an important ingredient for culinary preparations, such as curries, chutneys, sauces, ice cream, and sherbet. Tamarind pulp is used as a raw material for manufacturing of industrial products, such as Tamarind Juice Concentrate, Tamarind Pulp Powder, tartaric acid, pectin, tartarates, and alcohol.

**Seed**

The seed comprises of seed coat or testa (20-30%) and the kernel or endosperm (70-75%). It is commercially available as a food additive for improving the viscosity and texture. The name "jellose" used for the seed polysaccharide as it describes both its jell forming properties and the carbohydrate character. The jell form is used as a stabilizing agent in ice-cream, mayonnaise, and cheese, the seed oil is used for making varnish to paint idols, light lamps.

**Flowers and leaves**

The leaves and flowers are also useful as a mordant in dyeing. Used to make curries, salads, stews, soups, and in times of scarcity. These are used in Thai recipes because of their sourness and aroma. Mature leaves are used as a bleaching agent A yellow dye can be obtained from the leaves.

**Wood**

The wood is used for making furniture, wheels, mallets, rice pounders, mortars, pestles, ploughs, well construction, tent pegs, canoes, side planks for boats, cart shafts and axles, and naves of wheels, toys, oil presses, sugar presses, printing blocks, tools and tool handles, turnery, and soon. Used for making gunpowder. The ash is used for removing of hair from the animal hides and it can also be mixed with fruit pulp for cleansing and brightening brass and copper vessels.

**Seed testa & bark**

The seed testa and bark contains tannin, used for making leathers, heavy soles, suitcases and also used in the preparation of ink. The seed husk has been found to be effective on fish poison.<sup>10</sup>

**Tamarind kernel powder**

Tamarind Kernel Powder (TKP) obtained from the seeds used as a source of carbohydrates, the binding agent in paper and textile sizing, weaving and in making jute products, as well as textile printing.





**Lac**

The tree is an anchor for the lac insect named *Kerriallacca*, that deposits a resin on the twigs, it can be harvested and is sold as stick-lac which is used for the production of lacquers.

**Twigs and barks**

Tamarind twigs are usually called as "chewsticks", bark (6-7% tannin) is used in dyeing, and is burned to make an ink. A low-quality fiber is obtained from young bark used for twine and string. Galls present on the young branches are used in tanning.<sup>11</sup>

**Table 6:** Research work done on *Tamarindus indica*

S. No	Plant part used	Pharmacological activity
1.	Leaves	Analgesic Activity <sup>9</sup>
		Anti-inflammatory Activity <sup>11</sup>
		Anti-bacterial Activity <sup>12</sup>
		Astringent Activity <sup>9</sup>
		Anthelmintic Activity <sup>7</sup>
		Antiemetic Activity <sup>7</sup>
		Anti-microbial Activity <sup>13</sup>
		Antidiabetic Activity <sup>14</sup>
		Antiasthmatic Activity <sup>15</sup>
		Laxative Activity <sup>16</sup>
		Adaptogenic Activity <sup>15</sup>
		Hepato-protective activity <sup>7</sup>
		Wound healing Activity <sup>17</sup>
		Anti malarial Activity <sup>18</sup>
2	Fruit	Hypolipidemic Activity <sup>19</sup>
		Spasmolytic Activity <sup>20</sup>
		Antidiabetic Activity <sup>21</sup>
		Laxative Activity <sup>9</sup>
		Wound healing Activity <sup>7</sup>
		Antibacterial Activity <sup>22</sup>
3	Seed	Antioxidant Activity <sup>23</sup>
		Constipation Activity <sup>24</sup>
		Antihypertensive Activity <sup>25</sup>
		Antidiabetic Activity <sup>26</sup>
		Neurotoxicity Activity <sup>27</sup>
		Hyperglycemia Activity <sup>26</sup>
		Hyper-lipidemia Activity <sup>26</sup>
		Antiulcer Activity <sup>28</sup>
		Anti-carcinogenic Activity <sup>29</sup>
		Anti-inflammatory Activity <sup>30</sup>
Antioxidant Activity <sup>31</sup>		
Ameliorative effect on metabolic syndrome <sup>32</sup>		

4.	Bark	Wound healing Activity <sup>33</sup>
		Nerve regeneration Activity <sup>1</sup>
		Anti-venom Activity <sup>34</sup>
		Insecticidal Activity <sup>35</sup>
		Fish Poison <sup>36</sup>
		Protease inhibitor Activity <sup>37</sup>
		Antibacterial Activity <sup>38</sup>
		Goitrogenic effect <sup>39</sup>
		Purgative Activity <sup>40</sup>
5.	Root	Wound healing Activity <sup>41</sup>
		Antimicrobial Activity <sup>42</sup>
		Analgesic Activity <sup>43</sup>
		Neuramidase Activity <sup>44</sup>
		Antiasthmatic Activity <sup>45</sup>
		Anthelmintic Activity <sup>46</sup>
6.	Stem	Amenorrhoea Activity <sup>45</sup>
		Antidiabetic Activity <sup>47</sup>
		Antimicrobial activity <sup>48</sup>
		Antidysentery Activity <sup>7</sup>
		Anti-inflammatory Activity <sup>48</sup>
6.	Stem	Analgesic Activity <sup>49</sup>
		Anti-inflammatory Activity <sup>49</sup>
		Conjunctivities <sup>5</sup>
		Antiseptic <sup>50</sup>
6.	Stem	Hepatoprotective Activity <sup>50</sup>

**CONCLUSION**

*Tamarindus indica* has a rich nutritional value containing vitamins, minerals, electrolytes. It is well known with its usage in traditional medicine purpose having various therapeutic and pharmacological activities

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