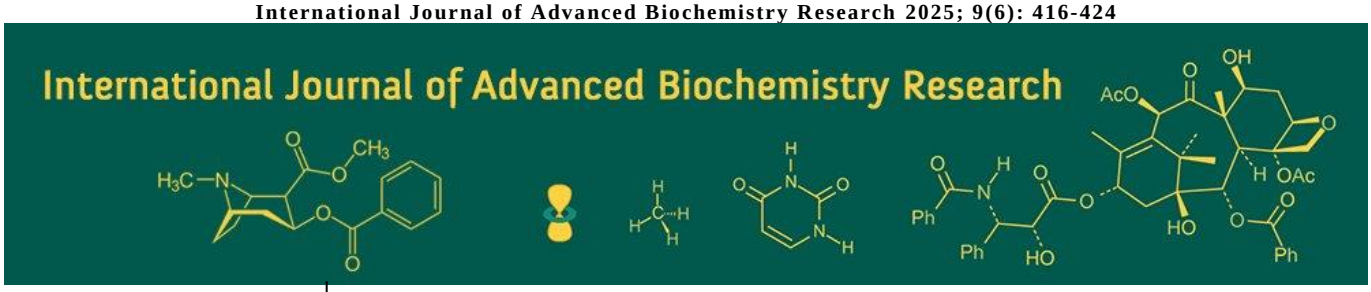

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Physical and biological characteristics of *Tamarindus indica*: A review

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Abstract
The tamarind tree (*Tamarindus indica*) is a valuable perennial legume of significant economic, health, and nutritional importance, deeply rooted in Indian and African heritage. This review examines its systematics, botanical description, chemical composition, and applications. The tamarind fruit is notable for its pulp, rich in tartaric acid, carbohydrates, vitamins, and essential minerals. The pulp of a mature fruit comprises 30% to 50%, whereas the seeds constitute approximately 25% to 40% of the fruit. This balance supports its conventional medicinal application in the treatment of wounds, abdominal pain, diarrhoea, and fever. Additional medicinal research has demonstrated tamarind's therapeutic efficacy, revealing its anti-diabetic, cholesterol-lowering, oxidative damage-inhibiting, antimicrobial, and anti-inflammatory properties. Extracts from leaves, fruit, and seeds have demonstrated potential in the treatment of diabetes, cardiovascular diseases, and microbial infections. Tamarind possesses numerous applications beyond its therapeutic qualities. It comprises wood suitable for building or furniture manufacturing, as well as tamarind kernel powder, which serves as an additive in certain foods and as an adhesive in some sectors. In summary, the tamarind tree, or *Tamarindus indica*, is valued for its extensive benefits in nutrition, medicine, and several other sectors. Significant discoveries remain to be made on its potential for fostering sustainable innovations in conjunction with natural therapies.

Keywords: Chemical components, morphology, medical use, antioxidant property & wood

1. Introduction
The tamarind plant (*Tamarindus indica*) belongs to the leguminous family (Diallo *et al*., 2007) [22]. The tamarind tree is indigenous to tropical Africa and Madagascar. Tamarind is a versatile tree fruit utilized mostly for its pulp. A standard tamarind pod comprises 55% pulp, 34% seeds, and 11% shell and fiber. Each tamarind pod contains 1 to 10 irregularly shaped seeds, each including a testa (seed coat) and a kernel (endosperm). The pulp of tamarind fruit possesses a sweet and acidic flavor resulting from elevated levels of tartaric acid and reducing sugars (Caluwe *et al*, 2010) [20]. The pulp has 30-40% reducing sugars, tartaric acid, and trace minerals like phosphorus, calcium, and potassium (Noraphaiphipaksa *et al*., 2016) [65].

India has a prominent role in the global production and export of tamarind. The five southern states of India-Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, and Telangana-are the main producers of the crop and in the 2023 agricultural year, the country's estimated tamarind production stood at roughly 162.15 thousand metric tons (Agricultural and Processed Food Products Export Development Authority [APEDA], n.d.). Karnataka is the largest contributor, accounting for approximately 28% of the total production (APEDA, n.d.). According to Zauba Corp (2024) [94], the country's export volume is also on the rise, with 9,519 shipments exported between March 2023 and February 2024. India's key markets for purchasing tamarind include the USA, Australia, and the United Arab Emirates (Zauba Corp, 2024) [95]. DGFT (n.d.) reports that India, Vietnam, and Thailand are the biggest exporters of tamarind in the world, claiming that India exports the most due to the various global markets needing raw and processed tamarind goods.

In 2023, the nation yielded over 162,000 metric tons of tamarind. In India, tamarind cultivation occurs throughout several states, with varying production levels among them.

The five leading Indian states in tamarind production are Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, and Telangana. The majority of tamarind produced in Chhattisgarh comes from the Bastar region, accounting for approximately 50% of the state's total tamarind yield. Annually, this amounts to around 400,000 quintals of tamarind produced, with approximately eighteen minor forest products commercially traded in Chhattisgarh. In the state, 139 primary processing centers have been designated to support all minor forest products. In 2020, amidst the lockdown, around 51,000 quintals of tamarind, valued at Rs 15.80 crore, were procured (Verma *et al*., 2016) [91].

Tamarind is a perennial, slow-growing, substantial tree that attains a height of 24-30 meters (80 to 100 feet) under optimal conditions. In many locations, the reddish-fleshed kind is regarded as superior in quality, distinct from the typical brown-fleshed variant. Two varieties of tamarind exhibit a sweeter flavor profile. The Makhamwaan of Thailand and the Manila Sweet, managed by the United States Department of Agriculture's Subtropical Horticulture Research Unit in Miami, are two examples (Naeem *et al*., 2017) [64].

2. Taxonomy

T. indica is a member of the Fabaceae family and the Caesalpinioideae subfamily. It comprises 58 tribes based on its morphology. It is a diploid dicotyledonous species, constituting the third biggest family of flowering plants, comprising 727 genera and 19,327 species. Possessing a chromosomal number of 2n = 24 (Purseglove, 1987) [72]. The scientific classification of this species is as follows (Sources: Wikipedia and Scientific Classification of Fruits):

Domain-Eukarya
Kingdom-Plantae
Subkingdom-Tracheobionta
Division-Magnoliophyta
Class-Liliopsida
Subclass-Rosidae
Order-Fabales
Family-Fabaceae
Subfamily-Caesalpiniodeae
Genus-Tamarindus
Species-*Tamarindus indica* (Md. Salim Azad, 1998) [79]

2.1 Habitat and Plant Description

The *Tamarindus indica*, an evergreen tree, may reach heights of 30 meters and features a wide, spreading crown with a circumference of up to 12 meters (Orwa *et al*., 2009) [69]. The tree may temporarily shed its leaves in arid regions; its abundant, delicate foliage provides ample shade (Huxley, 1992) [35]. The bark is often greyish-brown (Orwa *et al*., 2009) [69], characterized by fissures and a rough texture. The compound leaves, consisting of several small leaflets arranged in pairs along a central axis, measure between 6 and 15 cm in length and typically fold at night (Asian Agri-History, 2014) [15]. Emerging in pendulous clusters, its 2.5 cm diameter, pale yellow or pinkish flowers have reddish streaks (Orwa *et al*., 2009) [69]. The fruit typically measures 4 to 20 cm in length and is characterized by a distinctive, indehiscent pod featuring a scurfy brown exterior and a soft, acidic pulp that surrounds multiple firm, dark brown seeds (Asian Agri-History, 2014) [15].

2.2 Plant Description and Morphology

Tamarindus indica is a moderately large, evergreen tree, reaching heights of up to 24 meters and girths of 7 meters. Recent morphological and molecular analysis, along with ongoing research, will elucidate the precise placement of Tamarindus in respect to its purportedly related genera. It is a substantial evergreen tree characterized by an incredibly attractive spreading crown, planted across nearly the entire country, excluding the Himalayas and arid western parts. Leaves are alternately arranged, compound, consisting of 10-18 pairs of opposing leaflets; leaflets are narrowly oblong, measuring 12-32×3-11 mm, with a finely hairy petiole and rachis, and the midrib and net venation are somewhat prominent on both surfaces. Flowers are appealing pale yellow or pink, arranged in tiny, loose spikes approximately 2.5 cm wide. Flower buds entirely encased by two bracteoles, which abscise prematurely; sepals numbering four, petals five, with the upper three well-developed and the lowest two diminutive. The fruit is a pod, indehiscent, subcylindrical, about 10-18 × 4 cm, either straight or curved, with a velvety, rusty-brown exterior; the pod's shell is fragile, and the seeds are encased in a sticky, delicious pulp. Seeds are 3-10 mm in length, approximately 1.6 cm, exhibit uneven shapes, and possess a firm, lustrous, and smooth testa. (Md. Salim Azad-1998) [79].

Table 1: Different Local Name of *Tamarindus indica* in different part of India is given bellow

S. No.	Country/Language	Local Name
1	Assamese	Tamar, Tenteli
2	Bengali	Tetula, Nuli, Tintil, Tinturi
3	English	Indian date, Tamarind tree
4	Gujrati	Amali, Ambali
5	Hindi	Amli, Imli
6	Marathi	Ambali, Amli, Chinch
7	Malayalam	Puli, Valampuli, Kolpuli
8	Odisa	Tentuli
9	Panjabi	Imli
10	Sanskrit	Amlika, Chincha, Tinthidi, Chukra
11	Telugu	Chinta, Chintachettu, Chintapandu
12	Tamil	Amilam, Puli, Puliamavam

Source: (Md. Salim Azad-1998) [79]

3. Chemical Composition

Each component of *T.* The *indica* plant (root, body, fruit, leaves) possesses significant nutritional value and extensive applications in medical, as well as industrial and economic relevance. Tamarind can exhibit the highest levels of acidity and sweetness according on its growing season (Caluw *et al*., 2010) [20]. In numerous African nations, it is a widely consumed beverage (Ghoneim *et al*., 2012) [29]. In traditional medicine, it is utilized for wound healing, abdominal pain, diarrhea, dysentery, parasite infections, fever, malaria, and respiratory issues (Bhadoriya *et al*., 2011) [9]. It is frequently utilized in tropical nations due to its laxative and aphrodisiac attributes (Havinga *et al*., 2010) [32]. The detail of Chemical constituent of *Tamarindus indica* shows in Table 3.

They play a significant impact in human nutrition, particularly in underdeveloped nations (Mohamed & Rangappa, 1992) [62]. The predominant concentration of essential oil is found in leaves. Thirteen components were found in the leaf oil of tamarind, with limonene at 24.4% and benzyl benzoate at 40.6% being the most abundant (Pino *et al*., 2002) [71]. The tamarind fruit is the most prevalent and valuable component utilized from the

tamarind tree. The pulp comprises 30 to 50% of the mature fruit (Caluwe *et al*., 2010) [20]. The shell and fiber constitute 11 to 30%, while the seed comprises approximately 25 to 40% (Caluwe *et al*., 2010) [20]. Distribution of metabolites classes in percentage in tamarind fruit pulp in show in Figure 2. The commercially available dried tamarind pulp has 8 to 18% tartaric acid (2, 3-dihydroxybutanedioic acid-C4H6O6, a dihydroxy carboxylic acid) and 25 to 45% reducing sugars, with glucose constituting 70% and fructose 30% (EI-Siddig, 2006) [25]. Tamarind pulp contains significant mineral content, including potassium (62 to 570 mg per 100 g), calcium (81 to 466 mg per 100 g), phosphorus (86 to 190 mg per 100 g), and iron (1.3 to 10.9 mg per 100 g). Some scientists indicate that magnesium content ranges from 25.6 to 30.2 mg per 100 g, while sodium ranges from 23.8 to 28.9 mg per 100 g; in contrast, copper (0.8 to 1.2 mg per 100 g) and zinc (0.8 to 0.9 mg per 100 g) are present in modest quantities (Parvez *et al*., 2003) [81]. It is rich in riboflavin and a substantial source of niacin and thiamin, while containing modest levels of vitamin C and vitamin A (Caluwe *et al*., 2010) [20]. The detail of Food value of *Tamarindus indica*shows in Table 2 and there graph is shows in Figure 1.

Table 2: Food value of tamarind fruit (per 100 g of edible portion)

Nutrient	Min Value	Max Value
Water	17.8	35.8
Protein	2	3
Fat	0.6	0.6
Carbohydrates	41.1	61.4
Fiber	2.9	2.9
Ash	2.6	3.9
Calcium (mg)	34	94
Phosphorus (mg)	34	78
Iron (mg)	0.2	0.9

Source: Coronel (1991) [17].

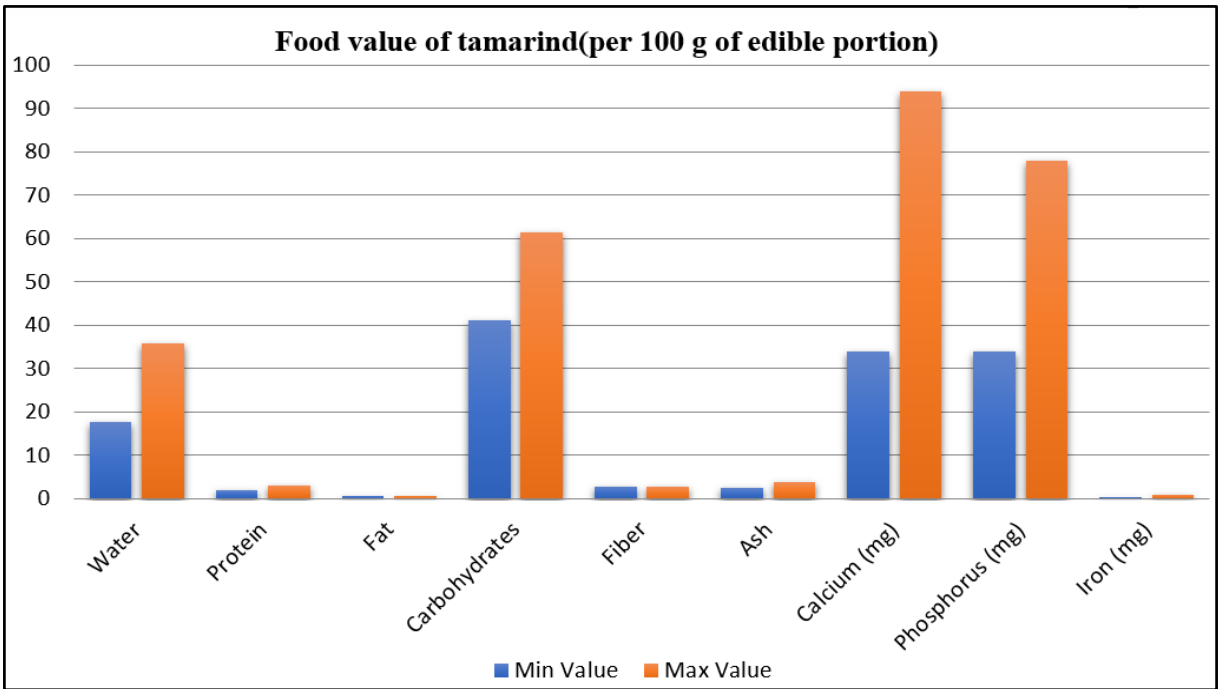

Fig 1: Food value of tamarind fruit (per 100 g of edible portion)

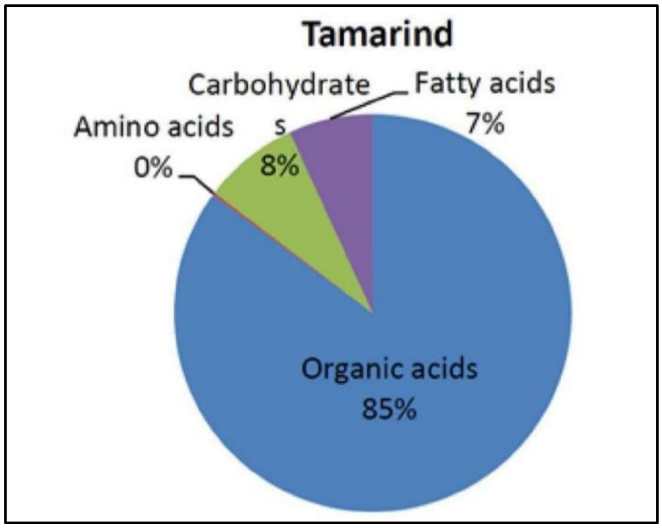

Fig 2: Distribution of metabolites classes in percentage in tamarind fruit pulp (Adapted from Bekzol *et al*., 2016)

Table 3: Chemical constituent of *Tamarindus indica*

S. No.	Plant Part	Chemical Constituent	Uses of various parts of *Tamarindus indica*
1	Leaves	Pulps contain invert sugar, citric acid, pipecolic acid, nicotinic acid, malic acid, volatile oils (geraniol, limonene) (Pino *et al*., 2002) [71], lupanone, lupeol (Iman *et al*., 2007), orientin, isoorientin (Koeppen *et al*., 1965) [49], vitamin B3, vitamin C, vitexin, isovitexin (Bhatiya *et al*., 1966) [10], benzyl benzoate (40.6%), cinnamates, serine, pectin, beta-alanine, proline, phenylalanine, leucine, potassium, tannin, and glycosides (Evans *et al*., 2002) [27].	The leaves, flowers, and immature pods of Tamarind are also edible. The leaves and flowers are used to make curries, salads, stews, and soups in many countries, especially in times of scarcity (Benthall *et al*., 1933) [8]. These are used in some Thai food recipes because of their sourness and specific aroma (Coronel *et al*., 1991) [17]. Children in Gambia mix the acid leaves with gum from fig trees to make a chewing gum. The leaves and flowers are also useful as a mordant in dyeing. A yellow dye derived from the leaves colour wool red and turns indigo dyed silk to green (Anonymus *et al*., 1976) [4]. Mature leaves are used as a bleaching agent in the preparation of young leaves of "buri" (Coryphaalata) for hat making in the Philippines (Brown *et al*., 1950) [12].
2	Fruit	Furan derivatives and carboxylic acids (Wong *et al*., 1998) [92]. Phlorotannins, malic acid, tartaric acid (Shankaracharya *et al*., 1998) [82], succinic acid, citric acid, pectin, and invert sugar (Kesehatan *et al*., 1985; Dalimartha *et al*., 2006) [21, 18].	The most valuable and commonly used part of the tamarind tree is the fruit. The pulp constitutes 30-50% of the ripe fruit (Purseglove, 1987; Shankaracharya, 1998) [72, 82], the shell and fibre account for 11-30% and the seed about 25-40% (Shankaracharya, 1998) [82]. The large range is associated with heterozygosity since many cultivated forms have been seed propagated.
3	Seed	Campesterol, β-amyrin, β-sitosterol, palmitic acid, oleic acid, linoleic acid, and eicosanoic acid. Mucilage, arabinose, xylose, galactose, pectin, glucose, and uronic acid were also identified. A novel bufadienolide (Scilliroside 3-O-β-D-glucopyranosyl-(1-2)-L-rhamnopyranoside) and a cardenolide (uzarigenin-3-O-β-D-xylopyranosyl-(1-2)-α-L-rhamnopyranoside) were isolated from the seed extract (Yadara *et al*., 1999) [93]. Cellulose, albuminoid. amyloids, phytohemagglutinins, chitinase.	Tamarind seed is a by-product of the commercial utilization of the fruit, the seed comprises the seed coat or Testa (20-30%) and the kernel or endosperm (70-75%) (Coronel *et al*., 1991) [17] & (Shankaracharya *et al*., 1998) [82]. However, it has several uses. It is commercially available as a food additive for improving the viscosity and texture of processed foods (Sone *et al*., 1994) [85]. The name "jellose" has been suggested for the seed polysaccharide as it describes both its jelly forming properties and the carbohydrate character (Rao *et al*., 1948) [76]. It has been recommended for use as a stabilizer in ice-cream, mayonnaise, and cheese and as an ingredient or agent in a number of pharmaceutical products, and the seed oil is said to be palatable and of culinary quality (Morton *et al*., 1987) [63]. The oil is used for making varnish to paint idols, and light lamps (Lewis *et al*., 1964) [51] & (Salim *et al*., 1998, Levis *et al*., 1964) [79, 51].
4	Seed Testa and Bark	Tannins, saponins, glycosides, peroxidase, and lipids.	The seed Testa contains 23% tannin, in leather tanning tests, Tamarind tannin gives harsh and highly coloured leather, which could be used for heavy soles, suitcases, and others. The seed husk has also been found to be an effective fish poison (Roy *et al*., 1987) [78]. Bark tannins are used in the preparation of ink and for fixing dyes (Storrs *et al*., 1995) [87].
5	Root Bark	n-Hexacosane, eicosanoic acid, β-sitosterol, (+)-pinitol, octacosanylferulate, and 21-oxobehenic acid (Pino *et al*., 2002; Jain *et al*., 2007) [71, 39].	
6	Wood		Tamarind wood has many uses, including 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 so on (Coates-Palgrave *et al*., 1988) [16]. In North America, Tamarind wood has been traded under the name of "Madeira mahogany" (NAS tropical Legumes). It is valued for making gunpowder. The ash is used to remove hair from animal hides (Dalziel *et al*., 1937, Salim *et al*., 1998, Irvine *et al*., 1961) [19, 79, 37] and can be mixed with fruit pulp for cleansing and brightening brass and copper vessels.

The botanical morphology of the main features of *Tamarindus indica*. (a) *Tamarindus indica* tree growing in Eastern Uganda. (b) Greyish stem bark of *T. indica*. (c) Alternate, compound, opposite leaflets leaf of *T. indica*. (d) *T. indica* flowers. (e) *T. indica* fruits. (f) Rusty-brown pulp of *T. indica*. (g) Irregularly shaped, shiny, and smooth seeds of *T. indica* with very hard testa. Pictures of *Tamarindus indica* shows in Figure 3.

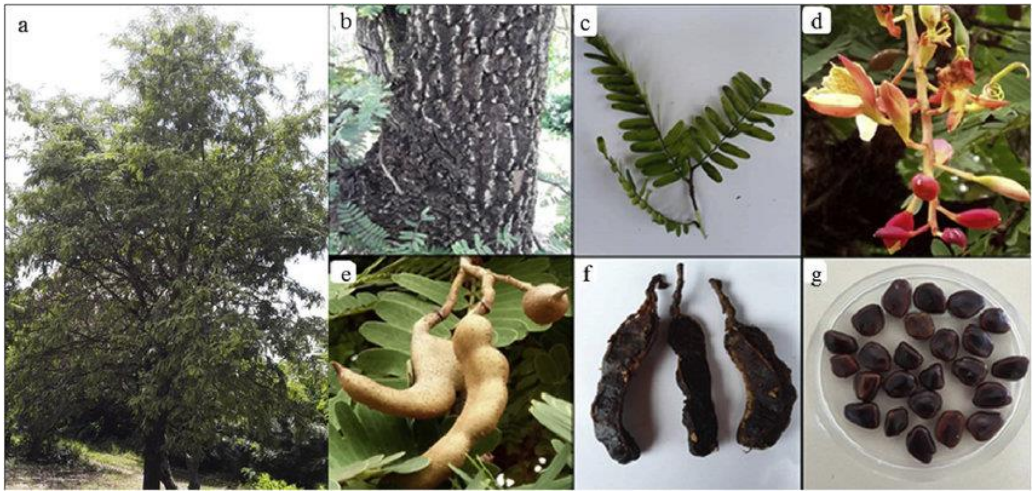

Fig: 3 Different plant parts used for medicinal purpose of *Tremendous indicia*.
(**Source:** R. Komakech *et al*., 2019)

4. General uses

4.1 Wood

The imli tree (*Tamarindus indica*) is esteemed for its robustness and resistance to decay and pests, with its resilient hardwood typically exhibiting a reddish-brown hue interspersed with darker streaks (Exotic Wood Zone, 2023; The Wood Database, n.d.). Frequently subjected to a meticulous polish, it is utilized for furniture, carvings, and turned objects; yet, its hardness and interconnecting grain might complicate the working process at times (The Wood Database, n.d.). In certain regions, it is utilized in construction and for generating resilient and sturdy timber (ECHOcommunity.org, n.d.; Kinaree.de, n.d.). Its durability renders it suitable for butcher blocks and cutting boards (Chef Bae, n.d.; Choppingboards.in, n.d.).

4.2 Tamarind Kernel Powder

Tamarind Kernel Powder (TKP) produced from the seeds is another commercial product and is often reported in commercial digests (Mathur *et al*., 2001) [57]. The TKP will become rancid and brown if stored inadequately and the storage ability and colour will be better if it is defatted (Reddy *et al*., 1979) [84]. In India, TKP is used as a source of carbohydrate as the adhesive or binding agent in paper and textile sizing, and weaving and making jute products (Shankaracharya *et al*. 1998, Anonymus *et al*., 1976) [82, 4], as well as textile printing (Khoja *et al*., 2001) [47]. Wound healing, Anti-microbial activity, laxative properties, Antioxidant activity, Antivenom Activity, Abdominal Pain, Anti diabetic activity, Fever and Malaria, Effect on blood and cardiovascular system.

4.3 Antioxidant Properties of *Tamarindus indica*

Antioxidants, even in minimal amounts, are molecules that inhibit the harmful process of oxidation in other chemicals, so serving as the body's natural defense against harmful free radicals. These molecules can be broadly categorized as either synthetic or natural. Recent research indicate potential adverse effects associated with synthetic antioxidants, implying that their widespread use may pose future health risks (Kaur and Kapoor, 2001) [43]. There is a growing preference among individuals for natural antioxidants rather than synthetic ones. Polyphenols, which are natural antioxidants, are prevalent in nearly all plant components, including barks, fruits, leaves, nuts, roots, and seeds. Flavonoids, a significant subclass of polyphenols, are the second most abundant type of natural antioxidants (Lu *et al*., 2011) [53]. Notable vitamins such as vitamin C (ascorbic acid) and vitamin E (tocopherol), together with carotenoids, exhibit antioxidant properties. *Tamarindus indica* is recognized for its potent antioxidant properties. Natural supplies of these beneficial compounds are plentiful in several parts of the tamarind plant, including fruit pulp, pericarp, seeds, and leaves, thereby providing a natural alternative to manufactured antioxidants.

4.4 Pharmacological Activity of *Tamarindus indica*

4.4.1 Antidiabetic, Hypolipidemic and antioxidant

Hydroalcoholic and aqueous extracts of T. seed.Indica demonstrates considerable antidiabetic properties (Ramchander *et al*., 2012 & Maiti *et al*., 2004) [75, 55]. The findings of antioxidant activity distinctly demonstrate the antioxidant properties of the ethanolic extract of *T. indica* in Streptozotocin-induced diabetic rats (Bhutkar *et al*., 2011) [11]. The pulp and fruit extract of *T. indica* exhibits hypolipidemic and antioxidant properties in rats subjected to a cholesterol-rich diet. The methanol extract and aqueous acetone extract exhibit the best antioxidant activity (Siddhuraju *et al*., 2007) [83]. Ethanolic extract of *T. indica* fruit pulp demonstrated hypolipidemic and weight-reducing effects in cafeteria diet and sulpiride-induced obese rats (Jindal *et al*., 2011) [41]. Hydroalcoholic and aqueous extracts of *T. indica* leaves exhibit antioxidant activity, including Fe + 3 reducing potential and the scavenging potential for NO·, OH·, and DPPH· radicals (Meher *et al*., 2013) [58, 59]. Hydroalcoholic and aqueous extracts of *T. indica* seeds exhibit hepatoprotective and antioxidant properties. Markedly reduced liver function test markers such as SGOT, SGPT, ALP, and serum bilirubin, while considerably elevating antioxidant enzymes including GSH, CAT, and SOD, and substantially decreasing lipid peroxidation (Meher *et al*., 2013) [58, 59].

4.4.2 Antimicrobial

T. indica exhibits extensive antibacterial properties and is a potential source of novel antibiotic classes that may be beneficial for the treatment and management of infectious diseases (Doughari *et al*., 2006) [23]. Ethanolic extract of the leaf and stem of *T. indica* extracts exhibit antibacterial action against certain Gram-negative bacteria (Uchechukwu

et al., 2011) [67]. Hydroalcoholic and aqueous extracts of *T. indica* leaves exhibit antibacterial action against certain Gram-positive and Gram-negative bacteria, such as *S. B. aureus Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa* (Meher *et al*., 2013) [58, 59]. Hydroalcoholic and aqueous extracts of *T. indica* seeds exhibit antibacterial action against certain Gram-positive and Gram-negative bacteria, such as *S. B. aureus Bacillus subtilis*, *Escherichia coli*, and *Pseudomonas aeruginosa* (Meher *et al*., 2013) [58, 59].

4.4.3 Helminthes infections (parasitic worms)
Maceration of the *T. indica* seeds are utilized as a vermifuge (Lemordant *et al*., 1985) [5]. An extract from the leaves and root is utilized to cure ankylostomiasis (hookworm) in certain regions of Tanzania (Haerdi *et al*., 1964) [30]. It exhibits anti-nematodal action against Bursaphelenchusxylphilus.

4.4.4 Hepatoprotective
Ethanolic extracts of *T.* The *indica* flower demonstrated hepatoprotective effects in Wistar rats with hepatotoxicity induced by Isoniazid and Rifampicin (Mahesh *et al.*, 2013) [54].

4.4.5 Analgesic activity
Aqueous fruit extract of *T. indica* possess both central and peripherally acting analgesic activity (Khalid *et al.*, 2010) [45].

4.4.6 Antipyretic activity
Polysaccharide derived from *T. indica* pulp has demonstrated considerable antipyretic efficacy against bacterial pyrogen and polysaccharide-induced pyrexia (Izquierdo *et al*., 2007) [38].

4.4.7 Laxative activity
The mild laxative effect is partially ascribed to tartaric acid and malic acid salts, which facilitate bowel movements (Havinga *et al*., 2010) [32].

4.4.8 Anticancer activity
T. indica exhibits cytotoxic action against cancer cell lines with an IC_{50} value of less than 50 µg/ml (AL-Fatimi *et al*., 2007) [3].

4.4.9 Antiemetic activity
Methanolic and butanolic extracts of *T. indica* exhibits considerable antiemetic properties (Khan *et al.*, 2005) [46].

4.4.10 Bioavailability enhancer
It is having lack of toxicity and improves the bioavailability of Durgs like ibuprofen and aspirin.

5. Conclusion
The tamarind tree (*Tamarindus indica*) is economically, nutritionally, and medicinally valuable, exhibiting varied characteristics. It is a fundamental component of Indian and African cultures. This review examined subdivisions of the biological branches of tamarind. It encompassed taxonomy and morphology, subsequently addressing chemical composition and diverse applications. Tambour fruits are utilized in culinary practices and traditional medicine due to its pulp, which is a rich source of tartaric acid, vitamins, minerals, and carbohydrates, providing numerous health benefits. Investigations on the pharmacological properties of tamarind have demonstrated its efficacy in diabetes, cardiology, microbial infections, and other domains. Consequently, it is positioned as a formidable contender in the pursuit of unexploited natural therapeutic agents. The varied industrial applications of tamarind, encompassing food processing, textiles, and pharmaceuticals, underscore its economic significance and reveal the sustainable innovation potential inherent in its various components. *Tamarindus indica* ultimately demonstrates the cohabitation of nature and human existence by offering a diverse range of alternatives that extend beyond nourishment. The ongoing research and increasing recognition of its therapeutic properties, along with its industrial uses, will undoubtedly elevate the significance of this remarkable tree globally.

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