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Review Article

Medicinal uses & pharmacological activity of *Tamarindus indica*

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ABSTRACT

Tamarindus indica Linn is belonging to the family *Fabaceae*, commonly known as tamarind. It is indigenous to tropical Africa and exotic to Asia and Central America. India and Thailand are the major tamarind world producers and generating 300,000 and 140,000 tons annually, respectively. There are two main types of tamarind: sour (the most common) and sweet (mostly comes from Thailand). Tamarind can be eaten fresh (ripe or unripe) and it can be consumed processed into different products. It grows as a large tree and is found in all medicinal system for a number of diseases, these includes its usefulness in jaundice, in liver, complains, as an acid refrigerant, as a gentle laxative, in yellow fever, as a blood tonic, and as a skin cleanser. It contains invert sugar, citric acid, oleic acid, linoleic acid, volatile oils (geraniol, limonene), pipecolic acid, lupeol, orientin, vitamin B3, vitamin C, vitexin, phenylalanine, leucine, potassium, Campesterol, β-amyrin, β-sitosterol, Tannins, saponins, glycosides. It has various pharmacological activity like hypolipidemic, weight reducing, antimicrobial, hepatoprotective, anthelmintic, antioxidant, analgesic & anti-inflammatory etc. This will be helpful to create interest towards Tamarind and in developing new formulations with more therapeutic and economical value.

Keywords: Drug interaction, Pharmacological activity, Phytoconstituents, Tamarind, Uses.

INTRODUCTION

Tamarind is leguminous trees of genus Tamarindus which is monotypic with only species indicum [1]. Tamarindus indica having family Fabaceae and sub-family Caesalpinaceae is a tropical evergreen tree native to Africa and Southern Asia [2]. Its various parts such as seeds, root, leaves, bark and fruits have been extremely used in traditional India and African medication [3]. Tamarind mostly used as two different varieties they are sweet and sour. Sweet tamarind is harvested ripe and directly consumed other side sour tamarind is processed into a range of value-added product [4]. India is the world 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 the ancient times. It has been known to be useful for treating constipation and liver problems among others [6]. For years, tamarind has proven to be particularly useful for treating liver and gall disorders and has been studied severally on the role it plays in treating bile problems. Tamarind is particularly useful for managing pain and inflammation on joints. It has been seen that leaves and pulp crushed and applied on swollen joints provides great relief and reduces inflammation. Tamarind used for treating sore throat. It is either gargled or drunk as tamarind juice to help relief pain and discomfort of sore throats. [7-8]. In Northern Nigeria, the fresh stem bark and leaves are used as decoction variegated with potash for the treatment of stomach disorder, general body pain, jaundice, yellow fever and as a blood tonic and skin cleanser [9]. Various parts have been expansively studied in terms of the pharmacological activity potent antibacterial, antifungal, hypoglycaemic, cholesterolemic [10], hypolipidemic, antioxidant [11], antihepatotoxic, anti-inflammatory [12], and antidiabetic [13] properties. The phytochemicals study in the human system due to their therapeutic properties cure many ailments which cannot be cured by the modern drugs [14]. This may help to advance safer antimicrobial drugs [10]. this work was aimed to explore the antimicrobial activity of stem bark of the plant against some clinical isolates. [1] flowers are in bunches, yellow in color and boat-shaped [15], seeds are reddish brown, thick [16], bark of the trunk is scaly; leaves are paripinnate and 15 cm in length [17].

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SCIENTIFIC CLASSIFICATION

Kingdom : *Plantae*
Subkingdom : *Tracheobionta*
Superdivision : *Spermatophyta*
Division : *Magnoliophyta*
Class : *Magnoliopsida*
Subclass : *Rosidae*
Superorder : *Rosanae*
Order : *Fabales*
Family : *Fabaceae*
Subfamily : *Caesalpiniaceae*
Tribe : *Detarieae*
Genus : *Tamarindus*
Species : *Tamarindus Indica* [18]

Vernacular name

Hindi : *Ambli, Imlii*
English : *Indian date, Sweet tamarind*
Afrikaans : *Tamarindo*
Arabic : *Aradeib, Tamar el hindi*.
Burmese : *Ma gyi, Ma jee pen*.
Chinese : *Da ma lin, Luo huang zi.*
Danish : *Tamarind*
Philippines : *Sampaloc*
Estonian : *Tamarindipuu*.
Greek : *Tamarin*
Japanese : *Tamarindo*
Srilinka : *Sinhala* [19].

Geographical Distribution of Plant

Tamarind grows naturally all over Asia up to an altitude of about 500 m that is from Burma to Afghanistan. In the In Indian subcontinent, it is distributed continuously in southern and central regions (which have similar wet and semi-arid climatic characteristics of tropical regions [21]. It also occurs in sparse patches up in northern India. In Africa, *T. indica* is commonly found in woodlands and is well adapted to the arid and semi-arid zones. Essentially a tree of the tropics, it tolerates temperatures up to 47°C but is very sensitive to frost [22].

Habitat

It grows well in both semi-arid and humid monsoon climates and can grow on a wide range of soil types. It is a tree of the tropics; it can tolerate temperatures up to 47°C but is very sensitive to frost. It is mainly grown in areas with 500-1500 mm rain/ year but tolerates down to 350 mm if irrigated at the time of establishment. 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 [23].

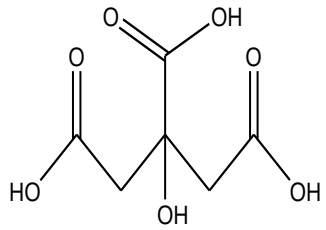
Fig 1. (A) Fruits, (B) Leaves, (C) Flowers, (D) Stem bark of *T. indica*

PHYTOCHEMISTRY

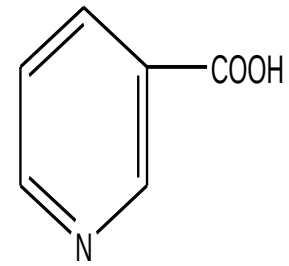
Table No. 1: Chemical constituents of different parts of *Tamarindus indica*

Parts	Chemical constituents
Leaves	Pulps contains invert sugar, citric acid, pipecolic acid nicotinic acid, 1-malic acid, volatile oils (geraniol, limonene) [24], pipecolic acid, lupanone , lupeol ,[25] orientin , isoorientin [26], vitamin B3, vitamin C , vitexin, isovitexin [27], benzyl benzoate (40.6%), cinnamates, serine, pectin, beta alanine, proline, phenylalanine, leucine, potassium, 1-malic acid, tannin, glycosides[28].
Fruits	Furan derivatives and carboxylic acid [29]. Phlorotannins, apple acid, grape acid [30], succinic acid, citric acid, tartaric acid, pectin, invert sugar [31,32].
Seeds	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 [33]. A new bufadienolide (Scilliroside 3-O-β-D glucopyranosyl - (1-2)-L rhamnopyranoside) and a cardenolide (uzarigenin-3-O-β-Dxylopyranosyl (1-2)-α-L rhamnopyranoside) were identified from the seed extract [34,35]. Cellulose, albuminoid. amyloids, phytohemagglutinins, chitinase [36].
Stem bark	Tannins, saponins, glycosides, peroxidase and lipids [37].
Root bark	The n-hexacosane, eicosanoic acid, β-sinosterol, (+)-pinitol, octacosanyl ferulate, 21-oxobehenic acid [38, 39].

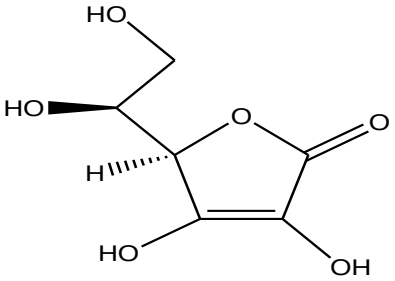
Figures: 2. Chemical structure of various phytoconstituents from *Tamarindus indica*



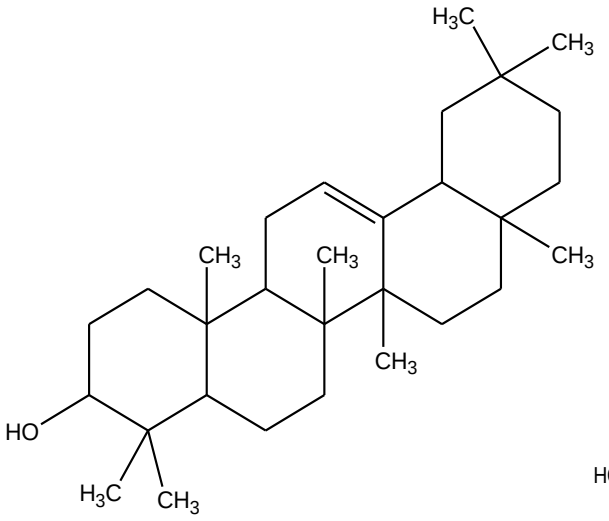
Citric acid



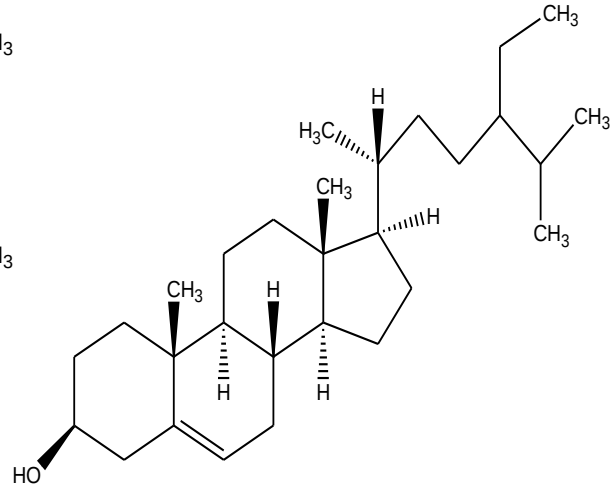
Niacin



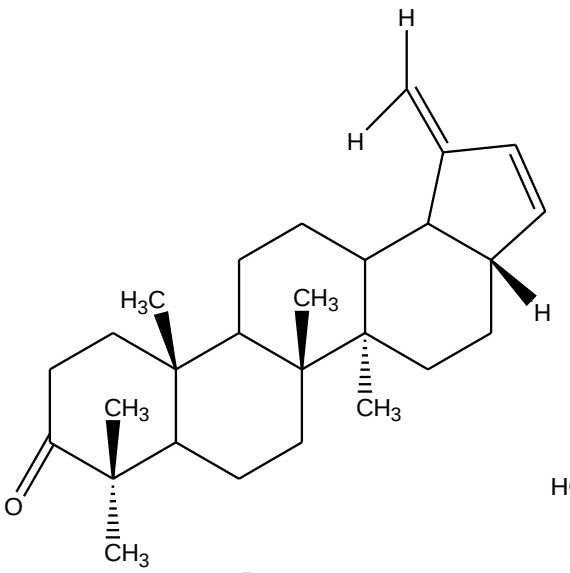
L-ascorbic acid



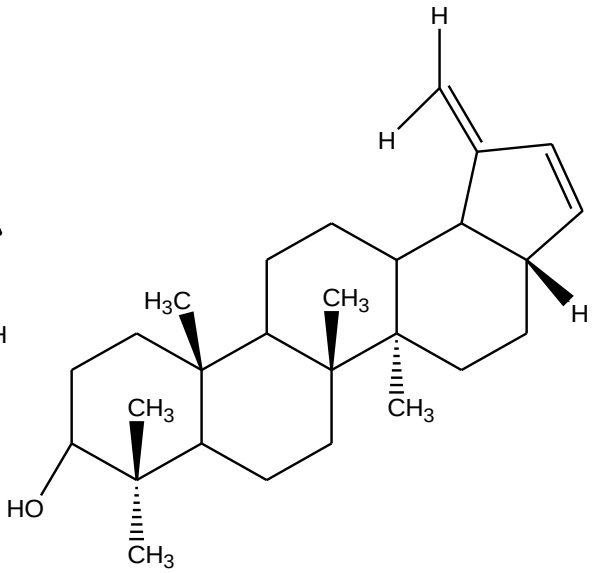
ß-amyrin



ß-sitosterol



Lupanone



Lupeol

PHARMACOLOGICAL ACTIVITY

Antioxidant activity:
Sudjaroen et al., studied that the seed and pericarp of *Tamarindus indica* contain phenolic antioxidant compound [40]. All the extracts exhibited good antioxidant activity against the linoleic acid emulsion system compared to synthetic antioxidants like butylated hydroxyl ascorbic acid and anisole [41]. Martinelli studied that the ethanolic extract of fruit pulp showed significant antioxidant and hypolipidemic activity in hypercholesterolemic hamsters [42]. Antioxidant activity of ethanolic extract of seed coat was also assessed by DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging method using ascorbic acid as a standard. This activity of extract may be attributed to its free radical-scavenging ability [43].

Antimicrobial activity: Muthu et al., studied that the methanolic leaf extract for antibacterial activity against *Burkholderia pseudo mallei* and it's *in vitro* inhibitory potential suggests further animal studies to understand the role of *T. indica* in treating melioidosis [44]. The antimicrobial activity of the concentrated extracts (aqueous, ethanolic, acetone) was evaluated by determination of the diameter of the zone of inhibition against both gram-positive and gram-negative bacteria and fungi using the paper disk diffusion method. These reported possessing potent antimicrobial activity against *Salmonella paratyphoi*d, *Bacillus subtilis*, *Salmonella typhi*, and *Staphylococcus aureus* [45]. Vaghasiya et al., studied that the Methanol and acetone extracts have shown significant antimicrobial activity against *Klebsiella pneumonia* by agar disk diffusion method [46].

Antidiabetic activity: Maiti et al., studied on aqueous extract of seeds of *T.indica* in STZ induced diabetic male rats and found that a potent antidiabetic activity.The extract was given to mild diabetic and severe diabetic rats, and hyperglycemia was significantly reduced, measured by fasting blood glucose levels [47]. Similarly, hyperlipidemia was found to be reduced, measured by different contents of cholesterol. This rat model may shed some light on the basis of ancient herbal therapy in India [48].

Anthelmintic Activity: V Mute et al., reported the Anthelmintic effect of the juice of *Tamarindus indica* against *Pheretia Posthuma as* a test worm. Various conc. (100%, 50%, 20%) of *Tamarindus indica* leaves juice were tested in the assay, which involved determination of paralysis (P) and death (D) of worms. It shows shorter time of paralysis (P=23.5min) and death (D=62 min) in100% concentration, while the time of paralysis and death will increases in 50% conc.(P=26 min and D=65 min.) and in 20% conc. (P=30 min. and D=72 min.) respectively as compared to piperazine citrate (10mg/ml) used as a standard reference (P=23 min.and D=60 min.) and distilled water as a control. Juice of *Tamarindus indica* leaves showed significant Anthelmintic activity [49].

Anti-inflammatory activity: Aqueous ethanol and chloroform extracts from *T. indica* were evaluated for anti-inflammatory properties in mice (ear oedema induced by arachidonic acid) and rats(subplantar oedema induced by carrageenan) after topical or i.p. administration,respectively.

Results showed that the plant exhibit anti-inflammatory activity [50].

Analgesic activity: Various extracts of *T. indica* bark was screened for analgesic activity by using suitable models as hot plate test and acetic acid-induced writhing test. The petroleum ether extract showed significant result at 50 mg/kg, i.p. as compared to standard drug pentazocine (10mg/kg, i.p.). Preliminary phytochemical tests showed the presence of sterols and triterpenes in petroleum ether extract. Some sterols and triterpenes are responsible for anti-inflammatory and analgesic activity [51]. So from this study we conclude that analgesic activity observed by sterols and triterpenes of *T. indica* bark [52].

Antivenom activity: In Indian traditional medicine, various plants have been used widely as a remedy for treating snake bites. Stuied that the effect of *T. indica* seed extract on the pharmacological as well as the enzymatic effects induced by *V. russelli* venom. Tamarind seed extract inhibited the PLA (2), protease, hyaluronidase, l-amino acid oxidase and 5'-nucleotidase enzyme activities of venom in a dose-dependent manner. These are the major hydrolytic enzymes responsible for the early effects of envenomation, such as local tissue damage, inflammation, and hypotension. Furthermore, the extract neutralized the degradation of the beta chain of human fibrinogen and indirect hemolysis caused by venom. On the other hand, animals that received extract 10 min after the injection of venom were protected from venom-induced toxicity. Since it inhibits hydrolytic enzymes and pharmacological effects, it may be used as an alternative treatment to serum therapy and, in addition, as a rich source of potential inhibitors of PLA(2), metalloproteinases, serine proteases, hyaluronidases and 5-nucleotidases, the enzymes involved in several physiopathological human and animal diseases [53].

Hepatoprotective Activity: The study was done by intoxicating rats with paracetamol (1 g/kg p.o.) for seven days. The aqueous extract of various parts of Tamarindus indica such as fruits, leaves (350 mg/kg p.o.), unroasted seeds (700 mg/kg p.o.) were administered for 9 days after the third dose of paracetamol. Biochemical estimation such as aspartate transaminase, alanine transaminase, alkaline phosphate, bilirubin and total protein were recorded on 4^{th} and 13^{th} day. Liver weight variation, thiopentone-induced sleeping time and histopathology were studied on the 13^{th} day. Silymarin (100 mg/kg p.o.) was used as a standard. A significant hepato- generative effect was observed for the aqueous extracts of tamarind leaves, fruits and unroasted seeds ($p< 0.05$) as judged from the parameters studied [54].

Hypolipidemic and weight reducing Activity: Rajender Kumar et al. , reported the hypolipidemic and weight reducing effect of fruit pulp of *Tamarindus indica*. Cafeteria diet and sulpiride-induced obese rats. Cafeteria diet alone significantly increased body weight serum cholesterol, triglycerides and decreased HDL cholesterol in male rats as compared to control.Sulpiride increases the level of glucose, triglycerides, cholesterol and no significant effect on HDL cholesterol in female rats as compared to control.Ethanolic extract (50 mg/kg) showed significant decreased in body weight, serum cholesterol and triglycerides and increased HDL cholesterol in cafeteria diet and Sulpirideinduced obese rats as compared to their respective control group[55].

Immunomodulatory activity: Sreelekha T et al., isolate A polysaccharide and purified from *Tamarindus indica*, shows immunomodulatory activities such as phagocytic enhancement, inhibition of cell proliferation and leukocyte migration inhibition [56].

Anti-diarrheal & Anti- dysentery activity: Tamarind is also used for treating diarrhea and dysentery. The Tamarind pulp with lemon is used to treat diarrhea (anti-diarrheal activity), and the root is used to treat dysentery (Anti-dysentery activity). Dysentery is a type of diarrhea containing mucus or blood, usually caused by an infection of the intestine. When diarrhea is not treated properly, the patient has risks of dehydration and death [57].

Wound healing activity: Fabiyi JP et al., studied on a decoction of *T. indica* leaves and resulted, it is one of the most important agents to clean wounds caused by Guinea worm infections[59]. *Tamarindus indica* is frequently cited in the literature regarding the treatment of cuts, wounds, and abscesses. *T. indica*, bark or leaves are most commonly used, is applied externally on the spot, either as a decoction or as a powder or poultice, alone or in combination with other species.[60] Tamarind bark is mostly sold for wound healing purposes,[61] sporadically other Tamarind plant parts are found in wound healing medicine, such as the fruit,[62] the pod husks or the gum [63].

Anti-emetic activity: Methanolic and butanolic extracts of *Tamarindus indica* leaves exhibited anti-emetic activity comparable to that of marketed medicine viz. Chlorpromazine [64].

Antihistaminic activity: Tayade identified the antihistaminic potential of the leaves of *Tamarindus indica* Linn. In isolated goat tracheal chain preparation and guinea pig ileum, this is found to be beneficial in asthma [65].

Anti-pyretic activity: Tamarind also possess antipyretic activity. A polysaccharide obtained from *Tamarindus indica* pulp had been shown to possess antipyretic activity against yeast induced pyretic rats and lipopolysaccharide (E.coli) induced pyrexia in mice [66].

Anti-malarial activity: The Fruits of *T.indica* are known as a febrifuge in Madagascar [67], whereas; in Ghana, Tamarind leaves are used for the treatment of malaria [68].

Ophthalmological activity: Tamarindus indica showed significant activity as ophthalmic preparation. The seed polysaccharide of *T.indica* used as eye drops give result of relieving important problems of eyes such as dry eye syndrome, ocular burning ,trouble blinking, and sensation of having something in one's eye [69].

Cytotoxic activity: Al-Fatemi et al., reported that methanolic extracts of *Tamarindus indica* showed remarkable cytotoxic activity against FL-cells, a human amniotic epithelial cell line, with IC50 values below [70]. Sano M et al., was examined the carcinogenic potential of tamarind seed polysaccharide in both sexes of B6C3F1 mice. The results demonstrated that its polysaccharide is not carcinogenic in B6C3F1 mice of either sex. Bioassay-guided fractionation of methanolic extract of tamarind seeds led to the isolation of L-di-n-butyl maleate which is having pronounced cytotoxic activity against sea urchin embryo cells [71]. In order to study structure-activity relationships of its analogs, L-di-n-pentyl maleate was the most effective inhibitor to the development of the fertilized sea urchin eggs, and significant inhibitory activity was not in the esters of D-isomer [72].

Acaricidal activity: The oxalic acid of 0.5% and 1% concentration exhibited the highest acute acaricidal activity. The tartaric acid 1% concentration showed the highest delayed acaricidal activity. The mixture of 0.5% of oxalic acid with 0.5% of malic, succinic, citric and tartaric acids by the concentration of 1:1 V/V were tested the acaricidal activity. The acaricidal activity of these acid mixtures was not stronger than those of each individual acid. Both of crude extract of tamarind fruits and their organic acids caused the patchy hemorrhagic swelling on the skin of ticks after dipping at 15 min. This indicates that the crude extract of tamarind fruits by water or 10% ethanol is possibly used in practical for controlling the tropical cattle tick. The active substances are their organic acids, especially oxalic and tartaric acids [73].

Laxative properties: The fruit is used traditionally as a laxative, due to the presence of high amounts of malic and tartaric acids and potassium acid [74]. Children in Madagascar are given whole Tamarind fruits for breakfast to overcome constipation. The laxative can be taken in the form of a sweetmeat, called Bengal by the Wolof people of Senegal, prepared from the unripe fruit of Tamarind and sometimes mixed with lime juice or honey [75]. Abdominal pain is not a specific disorder but a complaint, which refers to a painful abdomen and which may have a wide variety of causes, including constipation or diarrhea. Soaked fruits are also eaten by rural Fulani in Nigeria, to relieve constipation [76]. Roots, prepared as an extract, are used in the treatment of stomach ache or painful abdomen, mainly in East Africa [77].

Effect on enzyme: Proteinase inhibitors with high inhibitory activity against human *neutrophil elastase* were found in seeds. A *serine proteinase* inhibitor denoted PG50 was purified using ammonium sulfate and acetone precipitation activity, showed that PG50 preferentially affected *elastase* release by platelet activating factor stimuli and this may indicate selective inhibition on platelet activating factor (PAF) receptors [78]. *Neuraminidase* from *Clostridium chauvoei* (jakari strain) was reduced in its activity in a dose dependent manner by a partially purified methanolic extract [79].

Effect on cardiovascular system and blood: In hypercholesterolemic hamsters, the effect of the crude extract from the pulp was investigated on lipid serum levels and atherosclerotic lesions. Tamarind extract has a high potential in diminishing the risk of atherosclerosis in humans [80]. In Bangladesh, fruits were evaluated for their effects on the lipid profile, systolic and diastolic blood pressure, and the body weight of humans [81]. Another experimental study on hamsters has shown that the hydroalcoholic extract of Tamarind pulp influenced the mediator system of inflammation [82].

Effect on cellular system: The L-(-)-Di-n-butyl maleate was isolated from the methonolic extract of fruit and it exhibited a pronounced cytotoxicity against sea urchin embryo cells. In comparing structure-activity experiments, this toxicity is connected with the special structure of the chemical. Only L-(-)-Di-n-pentyl maleate was a

stronger inhibitor [83]. In the descending colon of Swiss albino mice, the fruit pulp caused a greater rate of cell proliferations than in the ascending part, when they were fed a diet of the pulp, compared with the negative controls [84]. Phenolic flavonoids from the seed coat extract showed inhibitory effect on nitric oxide production. In a murine macrophage-like cell line RAW 264.7 and in mouse peritoneal macrophages the extract significantly attenuated the nitric oxide production, in a concentration-dependent manner [85].

MEDICINAL USES

Table No. 2: Medicinal uses of *Tamarindus indica*

Disorder category	Medicinal uses	Plant part	Preparation
Unspecified	Fortifiant	Bark and leaf	Decoction of fresh plant parts with potash used as blood tonic [86].
	Jaundice	Bark and leaf	Decoction of fresh plant parts with potash [86].
Circulatory	Heart disease	Fruit (unripe)	Chew with onion and swallow to treat palpitations [87].
	Hypotension	Leaf	Infusion taken 3 times a day [88].
Digestive System	Abdominal pain	Bark	Well the fresh bark of young twigs in water for 24 h and drink as purgative and to treat abdominal pain [87].
	Diarrhoea	Bark	Decoction, used as astringent [89].
	Dysentery	Seed	Powdered seeds administered Orally [90].
	Laxative	Bark	The fresh bark of young twigs is soaked in water for 24 h and drunk as purgative and to treat abdominal pain [87].
	Vomiting	Fruit	In leprosy treatment to enhance the emetico-cathartic properties of Trichilia America; A mixture of Cantharides-powder and tamarind pulp is taken by the patient before the syphilis treatment starts [91].
Endocrine System	Diabetes	Leaf	Not specified [92].
Genitourinary System	Aphrodisiac	Bark	Mash and add to porridge to treat impotence [87].
	Contraceptive	Not specified	Large quantity of 'tamarind' infusion drunk by the woman before sexual intercourse; Mixture of 'tamarind' with pepper and honey in water, called Konkori Badji [93].
	Diuretic	Unspecified/ bark	In the treatment of gonorrhea: food prepared of millet with tamarind and ground seeds of Jatropha curcas or with Trichilia emetic, Medicine prepared bark of tamarind and that of Prosopis africana (Toucouleur) [91].
	Infertility	All aerial parts	Crush all parts and soak in water; give orally to the cattle [94].
Infections/ Infestations	Cold	Fruit pulp	Mix with water and add sugar for taste, then drink [87].
	Fever	Fruit	Fruit pulp used in the treatment of fever for refreshment followed by rubbing [91].

	Malaria	Bark	Decoction with Mangifera indica (part used of the latter species unclear) [95].
	Helminth infections (parasiticworms)	Bark	Macerate used in the treatment of vesical schistosomiasis [96-97].
	Hepatitis A	Leaf	Not specified [98].
	Leprosy	Bark/ root	Drink root and bark extract together with root and bark extract of Stereospermum kunthianum [99].
	Measles	Pods/ leaves	Burnt to symbolize the disease egress through the skin [100].
	Microbial infections	Fruit	Soaked fruit, oral administration to treat infectious diseases including STD's [101].
Inflammation	Bronchitis	Leaf	Leaf juice with ginger in the treatment of bronchitis [102].
Injuries	Wounds	Bark	Not specified [103].
Mental	Sleep	Fruit pulp	Mix with water and add pepper, then drink [87].
	Sorcery	Leaf/ bark	Several preparations in the domain of sorcery, fear and talismans [87]
Nervous System	Epilepsy	Root	One cup of root decoction taken twice a day [104].
Nutritional	Appetite	Leaf	Cooled down decoction, to drink for appetite [87].
Pain	Scurvy	Fruit pulp	Not specified [105].
	Dysuria	Bark	Add to the soup a tablespoon of a sugared decoction of ground tamarind stem bark and Capsicum frutescens fruit pericarps [106-107].
	Pain	Bark and leaf	Decoction of fresh plant parts with potash used to treat body pains [86]
Poisoning	Antidote	Leaf	Decoction of the leaves is used as wash on snake and insect bites [108].
Pregnancy, birth, puerperium	Birth	Leaf	Cooled down decoction is given to drink to sheep and goats to treat complications with delivery [87].
	Lactation	Fruit	To increase lactation, eat Kunu (a kind of porridge) prepared with fruit of tamarind and Ximenia americana or drink a macerate of tamarind fruits in water [109].
	Pregnancy	Fruit	Drink macerate of fruits in water to relieve pain upon labor [109].
Respiratory System	Respiratory	Bark	Macerate of the bark taken for coughs [96].
Sensory System	Earache	Leaf	Pounded, applied to ear [110].
	Eye	Leaf/ bud	Decoction used as wash [17].
	Vertigo	Fruit pulp	Mix with water and add sugar for taste, then drink [87].
Skin	Skin	Bark and leaf	Decoction of fresh plant parts with potash used as skin cleanser [86].

DRUG INTERACTIONS

Table No. 3: Drug interactions of *T. indica* [111]

Drug interactions of *Tamarindus indica* Drug	**Effects**
Anticoagulant (Warfarin or Heparin) antiplatelet (Clopidogrel), Aspirin, NSAIDS (ibuprofen or naproxen) and *Ginkgo biloba*	Increased risk of bleeding
Hypoglycemic drug in diabetic patients	Hypoglycemia
Topical ophthalmic antibiotic	Synergistic effect

CONCLUSION

This review gives a broad information about the bioactive constituents and ethnopharmacology along with the scientifically claimed medicinal uses. *T. indica* possess large range of medicinal application in human health care it also possesses a large amount of vitamin B and C which is responsible for the enhancement of immune system. Several, carbohydrates, fat, proteins and tannins, acids, minerals have been reported to be present in different parts of *T indica*. The plant shows various types of activities such as antidiabetic, hypolipidemic, antioxidant, hepatoprotective, antimicrobial, anti-snake venom analgesic and anti-inflammatory properties which may be due to the presence of the investigated active chemical constituents. It also uses as a flavoring agent to impart flavor to various dishes and beverage a impart flavor to the pharmacological studies so far have been performed in both vitro and in vivo. Therefore, there is a need for investigation and quantification of different phytoconstituents present and its pharmacological profile.

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