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Review Article

A Pharmacognostical & Phyto Pharmacological Review of *Terminalia Catappa*: An Updated Retrospective Study

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ABSTRACT

Terminalia catappa (commonly known as Indian almond, tropical almond.) is an extensive found tropical tree, which has garnered much attention worldwide due to its great ethnopharmacological, nutritional importance. This study is a review of various research papers on the taxonomy, morphology, phytochemistry, cultivation and pharmacological activities of *T. catappa*. It is a storehouse of phenolic compounds, flavonoids, triterpenoids, vitamins and essential fatty acids which imparts a multitude of biological activities. Pharmacological actions Antimicrobial activity. The phytochemical work of *catappa* has been demonstrated with the discovery of anti-oxidative, anti-inflammatory, anti-tumor, anti-diabetic, hepatoprotective activities and anti-HIV. Its multiple therapeutic effects in in vitro and in vivo models have been proven across different organ systems like heart, metabolism, brain, immune systems. This review confirms the valuable multi-mechanistic action points of *T. catappa* and further highlights the importance of more extensive pharmacokinetic/toxicological/clinical evaluation for the effective utilization of *T. catappa* in evidence-based modern medicine.

INTRODUCTION

The Ayurvedic herb *Terminalia catappa* is famous for its many names, including "deshi badam," tropical almond, Indian almond, Malabar almond, and Indian almond [1]. Originally from Madagascar, Asia, & Pacific, *Terminalia catappa* Linn is a Combretaceae family member [2]. Genus name comes with Latin word terminus, which is

"very end of the branch". This is because the leaves are located at very end of the branch. *Terminalia catappa* is a coastal plant that thrives in tropical and subtropical climates [4]. As a food and medicine, medicinal almonds having long history of usage in treating and prevention of many metabolic and neurological disorders. In traditional medicine, almonds have a role in

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promoting health ^[5]. Most often, fallen leaf of *Terminalia catappa* Linn are boiled or made into beverage called tea. ^[6]



Figure 1. *Terminalia catappa*

Taxonomic classification of *terminalia catappa*:
^[7]

Kingdom : Plantae
Division : Angiosperm
Class : Cotyledons
Order : Myrtles
Family : Combretaceae
Genus : *Terminalia*
Species : *catappa*

Branches: Branches are separated in tiers and lean slightly upward; as they age, they lengthen & droop at ends.

Bark: Greyish-brown, rougher as per aging.

Leaves: Alternate, obovate, spirally grouped at branch ends, 15–36cm in length, 8–24cm broad, dark green top and lighter below, leathery & lustrous; sheds in crimson, scarlet, purple, or yellow when ripe.

Flowers: Flowers are tiny, greenish-white, and somewhat stinky. They don't have any petals but ten or twelve noticeable stamens. They grow in narrow spikes (15–25 cm long) in spaces between leaves. From February to May, blooms are usually male, although there are a few that are hermaphroditic.

Fruit: A drupe that is hard, spherical, flattened, and shaped like an egg (up to 7 cm long) with 2

Morphological Characteristics: ^[8]

Size & Structure: Standing 15–25 meters tall, this deciduous tree typically has a trunk diameter of 1–1.5 meters and is commonly buttressed at base.



ridges and no wings; when mature, it changes colour to yellow or reddish.

Seed: Shaped like a cylindrical prism, it has an inside fleshy pericarp and a tough, fibrous husk that contains oil.

Vernacular Names:

Common name: Indian Almond Marathi & Hindi: Jangle badam, Vadumai, Nattuvadumai, and Ketapa in Malayalam Tapasataruvu in Telugu. Kannada: Tavasa, Naatibaadaami, Kaadubaadaami, and Naadubaadaami, Bengali: Badam, Oriya: Desiyobadamo, Gujarati: Badamalili, Sanskrit: Inguda, Ingudee, Taapasataru ^[9]

Habit:

The overall growth form and structure of *Terminalia catappa* are referred to as its habit. It's massive deciduous tree which grows till 15 to 25 meters in height. When young, the tree has a characteristic pagoda-like look due to its upright, straight trunk, which is frequently buttressed at the base, and its horizontally tiering branches. The branches droop more at the tips as it gets older. As it ages, the greyish-brown bark becomes rougher. The tree has a dense canopy because of the huge, leathery leaves that are spirally huddled at the terminals of the branches. ^[10]

Habitat:

Terminalia catappa inhabits tropical and subtropical environments, mostly along the shore. It grows well in lowland tropical forests, which are frequently found close to water bodies like lagoons and estuaries; urban and cultivated landscapes, including parks, roadsides, and gardens, because of its shade-providing canopy; sandy beaches, riverbanks, and coastal plains, where it can withstand salt spray and saline soils; and tropical

climates with warm temperatures and 1,000–3,500 mm of annual rainfall. ^[11]

Cultivation:

Terminalia catappa, or tropical almond, is tropical tree cultivated for shade, edible seeds, and medicinal uses. It thrives in warm, coastal climates with well-drained, acidic to neutral soils and full sun. Seeds are the primary method of propagation; soaking in hot water at 70°C for five minutes increases germination to 80% in eighteen days. Plant 3–5 meters apart during the wet season, water regularly for the first 1–2 years, and apply balanced fertilizer annually. Prune to shape the canopy and monitor for fungal diseases. Fruits ripen in 1–3 years, with seeds harvested in March–April for high oil content (up to 56.38%). The tree tolerates drought and salt but may require clean up due to falling leaves and fruits, and its spread should be managed in sensitive areas. ^[12]

Phyto Chemical Constituents:

Chemical nature:

An assortment of phenols, including terflavins A and B, tergalagin, and catappanin etc, are found. Quercetin, rutin, and isovitexin are all chemicals that are classified as flavonoids. This group includes compounds such as ursolic acid, squalene, asiatic acid, 2 & 23-trihydroxyurs-12-en-28-oic acid (DHUA). Vitamins C and E, along with carotenoids like β -carotene, are essential.

The part from which they originate:

➤ Bark : In addition to catappanin, there are two phenol carboxylic acids, two phenolic glycoside gallates, seven ellagic tannins, and four flavan-3-ols [7,21,25]. Glycoside, volatile oils, saponin, steroids, arjunolic acid, two triterpenes, two triterpenoid saponins, and



sitosterol 3-O-β-D-glucopyranoside are all present.

- Seed: Proteins, ash, fat, carbohydrates, water etc, and a variety of acids.
- Leaves: β-tocopherol, punicalagin and its derivatives, p-coumaric acid, gallic acid, saponins, phytosterols, ash, protein, glucose, moisture, oil painting oil, carbohydrates, and oil painting oil.
- Fruit: β- carotene, cyanidin-3-glucoside, ellagic acid, brevifolin carboxylic acid, pentosans, glucose, and tannin. [13, 14]

Pharmacological Uses:

Terminalia catappa is widely studied in pre-clinical research and possesses a wide variety of pharmacological activities. Such bioactive chemicals as flavonoids, tannins, triterpenoids and others are present in large quantities in its leaves, bark, seeds and fruits conferring medicinal properties. The plant's anti-oxidant, anti-inflammatory, anti-bacterial, and anti-microbial properties make it a good remedy for a diverse assortment of ailments and health conditions having swelling as the underlying factor. By pathways of enzyme inhibition, free radical scavenging, and gene expression regulation, it also exerts anti-aging, anti-diabetic, anti-cancer activities. Additional research related to *T. catappa* has involved anti-atherosclerotic, anti-parasitic, anti-hepatoprotectant, wound-healing, anti-HIV, and cardioprotectant aspects. Its immune regulatory and erythropoietic modulating activity also support its therapeutical flexibility. *Terminalia catappa* is considered as a natural source of compound for the prevention and treatment of various chronic as well as infectious diseases owing to their various pharmacological activity. [15]

Research Findings

Anti – bacterial activity:

Researchers have looked at the antimicrobial capabilities of ethanoic and water-based extracts of *Terminalia catappa* bark and leaves against a small number of harmful bacteria. Tests against four different bacteria - *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus*, and *Enterobacter aerogenes*—were conducted to determine antibacterial properties of ethanoic and aqueous extracts of *Terminalia catappa* bark and leaves. To assess the antibacterial activity, the agar disc diffusion technique was used. Comparing the extracts' activities to those of the commonly used antibiotic Ciprofloxacin, inhibition zone technique was used to evaluate their efficacy. The results showed that out of the three concentrations tested (100, 200, and 300 μg/ml), 300 μg/ml had the best impact. [16, 17, 18]

Anti – aging activity:

For this study, researchers used a hydrophilic *T. catappa* extract, which protects erythrocytes against 2,2'-Azobis AAPH-induced haemolysis and demonstrates DPPH-free radical scavenging activity. Activities of elastase is not decreased by *T.catappa*, while collagenase activity is inhibited in a dose-dependent manner (ranging from 82.3% to 101.0%). In addition, at concentrations of 25μg/mL and 50μg/mL, *T.catappa* inhibits the production of MMP-1, MMP-9, and MMP-3 proteins, respectively. Furthermore, *T. catappa* promotes the synthesis of type I procollagen. In order to decrease MMP-1, -3, and -9 production, *T.catappa* inhibited phosphorylation of ERK, JNK, and p38. This means it may slow down the ageing process. [19]

Hypoglycemic Activity:

Main aim of research was to ascertain if *Terminalia catappa* L. leaves had any anti-diabetic



benefits on rats given streptozotocin (STZ). Blood samples were analysed for biochemical labels after diabetic rats were given two different tablets of *T.catappa* leaf extract (300 and 500 mg/kg) in an ethanoic form. The issues of herbal remedies were varied with those of glibenclamide, a common drug. Anti-diabetic effects of the ethanol extract (500 mg/kg) were observed through alterations in glucose 6-phosphatase, fructose 1,6-bisphosphatase, urea, uric acid, and creatinine levels, as well as an increase in insulin levels. Hence, results of present research suggest that patients with diabetes might profit from using *T.catappa* leaves as supplement in order to alleviate some of symptoms associated with their condition. [20, 21, 22]

Anti-Microbial Activity:

Two nutraceutical plants, *Terminalia catappa* L. and *Colocasia esculenta* L. were studied for their antimicrobial, antioxidant, and synergistic qualities. Methanolic extract of *T. catappa* shown good antibacterial action in the current study both on its own and when combined with conventional antibiotics, it demonstrated good synergistic activity. [23, 24, 25, 26]

Anti-Helmintic Activity:

A study evaluating the anthelmintic potential of *Terminalia catappa* leaf extract used an in vitro bioassay with L₃ larvae of *T. colubriformis*, *C. curticei*, and *H. contortus*. Larvae were incubated with the extract at 20°C for 3 and 5 hours, and motility was assessed using an inverted microscope. After 3 hours, the reduction in motility was 70%, 63%, and 73% respectively, increasing to 77%, 67%, and 80% after 5 hours. Controls using PBS (Phosphate buffer solution) and distilled water showed no significant reduction. These findings suggest *T. catappa*

leaves possess promising anthelmintic properties. [27]

Anti-Tumor Activity:

There are 354.02 mg/g of phenolic and 51.67mg/g of flavonoid content in the ethanoic extract of *T. catappa*. Both the peritoneal cell count and the life duration are increased by *T. catappa* extract at 2 different doses, 50mg/kg and 200mg/kg. At 200mg/kg, it also considerably reduces the solid tumour mass compared to mice with EAC tumours. Mice treated with the extract show normal levels of RBC, WBC, haemoglobin, and protein. In contrast to its negative effects on lipid peroxidation and lowered glutathione levels, *T.catappa* has a dramatic effect on SOD & CAT levels. The presence of phenolic and flavonoid components may explain *T.catappa's* antioxidant defence and its anticancer action, which is shown by changes in LPO levels. [28-37]

Chemopreventive Effect:

A study examined the chemo preventive effects of *Terminalia catappa* (TC) on AOM-induced colon carcinogenesis in 36 male F344 rats. Five groups of rats were created: AOM alone was given to Group 1, AOM + 0.02% or 0.1% TC was given to Groups 2 and 3, 0.1% TC was given to Group 4 without AOM, and Group 5 was left untreated. For two weeks, AOM was given at a rate of 20 mg/kg each week, and *T.catappa* feeding started one week earlier. Following five weeks, in comparison to the AOM-only group, *T.catappa* at both dosages considerably reduced PCNA labelling index, ACF, and BCACs in colon. It seems that *T.catappa* inhibits the formation of ACF and BCAC, which would explain its strong short-term chemo preventive action against biomarkers of colon cancer. [38]



Free Radical Scavenging and Anti-Oxidant Activity:

In comparison to extracts produced by sonicating *T. catappa* leaves for 20 or 60 minutes, as well as a control, the 40-minute sonication method yielded significantly higher polyphenolic levels. After 40 minutes of sonication, the antioxidant tests show that the vitamin C equivalent values of the sonicated extract are much greater compared to previous sonication and control intervals. It is possible that the polyphenolic content is responsible for this action. Multiple assays, including DPPH, nitric oxide, reducing power, and H₂O₂ tests, have shown that *T. catappa* has dose-dependent antioxidant activity. [39-43]

Anti-Oxidant Activity:

In order to determine methanolic acid's antioxidant activity, three separate assays were conducted: DPPH radical scavenging, oxidative cell death, and linoleic acid oxidation. Plants growing near subtropical coastlines have been utilised in harvesting leaves from 39 different species. In every system tested, 2 extracts from *Terminalia catappa* and *Excoecaria agallocha* shown very high levels of activity. HPLC investigation also found same antioxidant in the extracts, & chemical called ellagic acid was isolated. [44]

Ace Inhibitory Activity:

Angiotensin converting enzyme (ACE) inhibition was utilised to evaluate potential antihypertensive efficiency of Brazilian plants in vitro. In all, forty-four plants belonging to thirty-one families were analysed. Because of their common usage as diuretics and anti-hypertensives, these herbs were chosen. There was a notable decrease in ACE activity in *Terminalia catappa*. [45]

Anti-Parasitic and Anti-Fungal Activity:

The dried leaves of the Indian almond plant were ground into powder and mixed with water. Various quantities of this solution are utilised in assessing activity against tilapia pathogens. Results showed that at 800 ppm, trichodina, a kind of fish ectoparasite, were eradicated. At a concentration of 0.5mg/ml, Indian almond leaves inhibited the development of two different *Aeromonas hydrophilia* strains. In addition, fungal infection in tilapia eggs may be reduced with this treatment. To find out if this solution is harmful to tilapia and to determine active components of Indian almond for treating fish diseases, researchers are conducting studies. [46]

Anti-Inflammatory Activity:

Ursolic acid (1), 23-trihydroxyurs-12-en-28-oic acid (2), which were extracted from the chloroform fraction and used in a bioassay-oriented fractionation technique, showed potent anti-inflammatory effects. In both acute and chronic contexts, the anti-inflammatory activity of an ethanolic extract of *Terminalia catappa* leaves was tested utilising 12-O-TPA-induced ear oedema. The anti-inflammatory action of *T. catappa* leaves is likely caused by triterpenic acids 1 and 2, according to the results. [47, 48]

Erythropoietic Enhancing Activity & Modulatory Activity:

By dramatically increasing foetal haemoglobin (HbF) production in both EPO-dependent and EPO-independent erythroid progenitor stem cells, the distilled water active fraction of TCDWF shows promising promise as a new medicinal treatment for sickle cell anaemia. A dual function in boosting erythropoiesis and regulating cell survival may be attributed to TCDWF, which enhances erythroid lineage commitment, demonstrates selective cytoprotective effects, and differently controls



caspase 3 activity. These results show that TCDWF has great potential as a drug candidate for HbF-inducing treatments. [49, 50]

Toxicology:

The crude aqueous extract of *T. catappa* (0.5 g/kg, 1.0 g/kg, and 3.0 g/kg) was found to be both primary (by lethal occurrence) and secondary harmful over 14-day treatment period. During the trial time, no fatality is seen in the rats. Additionally, the rats' dietary behaviour is normal, and no anomalies in their physiological characteristics have been found. [51]

Wound Healing:

A wound is defined as an area where the cellular and functional capability of living tissues is lost or disrupted. The advancement of synthetic antimicrobial medications for wound healing was hindered by drug toxicity and resistance. More beneficial alternatives for wound healing may be available from a variety of plants with strong pharmacological characteristics. According to Khan et al., using *T. catappa* ointment on a wound may reduce its area by 97% compared to a control group that received 81% of the usual treatment and betadine ointment. The fact that *T. catappa* ointment speeds up the process of epithelization suggests that the bark extracts do a good job of healing wounds. [52]

Anti-Plasmodial Activity:

The chloroquine-sensitive (3D7), Dd2, and multidrug-resistant isolates were successfully decreased by methanol extracts of *T. catappa* leaves. From 5.03 to 9.76 µg/mL, the half-maximal inhibitory concentration (IC₅₀) was measured. With selectivity indices (SIs) ranging from 40 to 80, the extracts effectively suppressed parasites while causing almost little harm to

human cells. The liver enzymes of the mice that were treated did not show any significant negative effects either. [53]

Hepato-Protective Activity:

A hepatoprotective activity against both D-GalN & CCl₄-induced acute liver damage was shown in the present research by TCCE, which inhibits ALT and AST activities and changes liver shape. Based on the findings, two triterpenoids—ursolic acid and asiatic acid—may have a dose-dependent ability to protect liver mitochondria from Ca²⁺-induced swelling of mitochondria and scavenge superoxide anions and hydroxyl radicals. [54, 54, 56]

Anti-Atherosclerotic & Anti-Hyperlipidemic Activity:

The fruit of *T. catappa* showed inhibitory effects on atherosclerosis, hyperlipidaemia, and hypolipidemia in an in vivo model of the disease. The results showed that the *T. catappa* fruit extracts had anti-atherogenic and antihyperlipidemic effects when used with an atherogenic diet. This was supported by the fact that the CRI and AI reduced, while the CPI (Cell Proliferation Index) rose. Lipid profiles, enzyme biomarkers, histopathology, cardio protection, and atherogenic indices were all improved after extract administration. [57]

Anti-HIV Activity:

About 2 million people die each year from HIV infection, which destroys immune cells and poses a substantial therapeutic challenge due to drug resistance. As a result, there is a growing emphasis on studying compounds originating from plants in order to create anti-HIV medications. Natural product-based therapies for HIV/AIDS are still in the clinical testing phase, despite a mountain of data on the virus. Despite plants' promising anti-



HIV capabilities, complex extracts remain difficult to isolate their active ingredients. Advancements like real-time time-of-flight mass spectrometry provide help, even if they still need additional optimisation. *Terminalia catappa* has important phytochemicals that have shown anti-HIV activity. [58]

Aphrodisiac Activity:

In this study, rats were given *Terminalia catappa* Linn. seeds soaked in 1% methyl cellulose to investigate whether they had any aphrodisiac effects. Oral administration of 1,500 or 3,000 mg/kg SS or vehicle to male rats was followed by observation of their sexual conduct three hours later with an open-minded female. A separate group of rats were given SS or a vehicle orally for seven consecutive days. They were paired up with a pro-oestrous female for the night on days 1, 4, and 7 of therapy, & day 7 post treatment, to evaluate their sexual behaviour and fertility. The aphrodisiac qualities of *T. catappa* seed kernel may be useful in treating sexual insufficiency, including premature ejaculation. [59]

Haematological Activity:

Terminalia catappa nut (TCN) n-hexane extract is investigated in this research for its effects on several haematological parameters, oxidative stress markers, and bone/spleen histology in a Wistar rat model of benzene-induced leukaemia. *Terminalia catappa* nut extract may be useful as an adjuvant therapy agent due to its anti-leukemic, haemopoietic, antioxidant, and organ-protective effects in benzene-induced leukaemia in Wistar rats. [60]

Anti-Depressant Activity:

This study details physicochemical characterisation of *Terminalia Catappa* leaf

extracts and their antidepressant effects. The *in vivo* antidepressant properties of *Terminalia Catappa* Linn. Despair Swim test was utilised to ascertain the leaves, using a standard consisting of two extracts containing 200 mg/kg of imipramine (15 mg/kg orally). Period of immobility was significantly reduced on days 8 and 15 of trial due to concentration. [61]

Nociceptive Activity:

The anti-nociceptive effects of pulverised activated carbon from *Terminalia catappa* was investigated in this study as instance of Results of this study indicate that analgesic activity of activated charcoal is linked with its multifaceted mechanism that is characterized by adsorption, anti-inflammatory, antioxidant, and modulation of neurotransmitter activity. Because of such properties, activated charcoal is an effective and cost-effective option to conventional analgesics. [62, 63]

Genotoxicity:

The objective of this study was to prove that the *T. catappa* extracts are antimutagenic and anticarcinogenic agents. Moreover, extracts at various concentrations decreased MMS toxicity 11.6–40.30% and *in vitro* it decreased sister chromatid exchange and increased the replication index. *In vivo*, the clastogeny reduction is effective between 19.70% and 40.90%. Their reducing capacity is dose and time dependent. [64]

Gastro Protective Activity:

FrAq from *Terminalia catappa* leaves with potent anti-*Helicobacter pylori* activity should be effective prophylactic and therapeutic agents against both acute and chronic gastric ulcer. The ulcer healing of this fraction by inhibition of MMP-9 and MMP-2 activities and NO pathway is



the underlying mechanism of trivial gastro-protection. [65]

Table 1: List of explored pharmacological activities of *Terminalia catappa*

S. No	Activity	Part used	Models	Conclusion	Reference
1.	Anti-bacterial activity	Bark and leaves	Agar disc diffusion method, Zone of inhibition	Significant anti-bacterial activity	Neelavathi.P <i>et al.</i> ,2015
2.	Anti-aging activity	Leaves	Enzyme inhibition assay, Erythrocyte protection assay	Significant anti-aging activity	Wen KC <i>et al.</i> ,2011
3.	Hypoglycaemic activity	Leaves	Streptozotocin induced diabetes mellitus	May possess Potent anti-diabetic activity	Natarajan Divya <i>et al.</i> ,2019
4.	Anti-microbial activity	Leaves	Disc diffusion assay	Potent anti-microbial activity	Chanda <i>et al.</i> ,2013
5.	Anti-helminthic activity	Leaves	Incubation	Significant anti-helminthic activity	Nurulain R <i>et al.</i> ,2011
6.	Anti-tumour activity	Leaves	Ehrlich ascites carcinoma	Significant anti-tumour activity	Yeh CB <i>etal.</i> ,2014
7.	Chemo preventive activity	Leaves	Azoxymethane(AOM)-induced colon carcinogenesis	Potent chemo preventive activity	Morioka, <i>etal.</i> ,2005
8.	Free radical scavenging and Antioxidant activity	Leaves	DPPH assay, nitric oxide assay, reducing power assay	Significant free radical and anti-oxidant activity	Annegowda HV <i>etal.</i> ,2010
9.	ACE inhibitory activity	Leaves	<i>Invitro</i> study	Significant ACE inhibitory activity	Fernão C. <i>etal.</i> ,2007
10.	Antioxidant activity	Leaves	Linoleic acid oxidation assay & the oxidative cell death assay	Significant Antioxidant activity	Toshiya <i>etal.</i> ,1999
11.	Antiparasitic and Antifungal activities	Leaves	<i>In vivo</i> aquatic model	Significant Antiparasitic& Antifungal activities	Chitmanat, <i>etal.</i> ,2005
12.	Anti-inflammatory activity	Leaves	Bioassay-oriented fractionation	Significant Anti-inflammatory activity	Y. Fan <i>et al.</i> ,2004
13.	Erythropoietic enhancing activity& modulatory activity	Leaves	<i>In vitro</i> differentiation of primary erythroid progenitor stem cells	Significant Erythropoietic enhancing activity& modulatory activity	Aimola <i>etal.</i> ,2014
14.	Toxicology	Leaves	Acute and subacute toxicity testing	No toxicological effects of T.catappa	Azrul LM, <i>etal.</i> ,2013

15.	Wound healing	Bark	Excision wound model	Significant Wound healing activity	Khan AA <i>etal.</i> ,2014
16.	Anti plasmodial activity	Leaves	<i>In vitro</i> culture of <i>Plasmodium falciparum</i> strains	Potent anti-plasmodial activity	M.N. Ngemenya <i>et.al.</i> ,2021
17.	Hepato-protective activity	Leaves	D-GalN(D-galactosamine)-induced hepatocyte injury and CCl4-induced acute liver damage.	Potent Hepato-protective activity	Jing Gao <i>et al.</i> ,2011
18.	Anti-atherosclerotic & Anti-hyperlipidemic activity	Fruit	<i>In vivo</i> atherosclerosis model	Significant Anti-atherosclerotic & Anti-hyperlipidemic activity	Doris Tabansi <i>et al.</i> ,2023
19.	Anti-HIV activity	Leaves	HIV replication assay	May possess potent Anti-HIV activity	Alka Dwevedi <i>et al.</i> ,2016
20.	Aphrodisiac activity	Seeds	Aphrodisiac activity model	Significant Aphrodisiac activity	Ratnasooriya <i>et al.</i> ,2000
21.	Haematological activity	Nut	Benzene-induced leukaemia	Potent Haematological activity	Nimisoere P. Batubo <i>et al.</i> ,2024
22.	Anti-depressant activity	Leaves	Despair Swim test method	Potent Anti-depressant activity	Aarti Muttewar <i>et al.</i> ,2020
23.	Nociceptive activity	Bark	Hot plate test, tail flick test	Potent Nociceptive activity	Samuel I. Ojeaburu, <i>et al.</i> ,2024
24.	Genotoxicity	Leaves	<i>In vitro</i> and <i>in vivo</i> genotoxicity models	Terminalia extract shown time and dose dependent effect on genotoxicity	Mohammad Sultan Ahmad <i>et al.</i> ,2014
25.	Gastro protective activity	Leaves	Acute and chronic gastric ulcer model in animals	Significant Gastro protective activity	Laísa Pinheiro Silva <i>et al.</i> ,2015

CONCLUSION:

Phytochemistry and pharmacology of the genus Terminalia. Phytochemical investigations on *T. catappa* revealed its vast chemical diversity and multifarious pharmacological activities. The ethnomedicinal uses of this plant were verified in recent research, particularly in antimicrobial, anti-inflammatory, antidiabetic and hepatoprotective

aspects. The plant has significant medicinal potential due to the existence of a high content of bioactive compounds, including terpenoids, flavonoids, tannins, and essential fatty acids. Although *in vitro* and animal studies showed a promising outcome, more standardization, dose determination, and clinical trials should be conducted to make *T. catappa* a clinically acceptable phytotherapeutic. Such multiple-



benefits make it a potential candidate for the discovery of new therapeutic approaches for combating global health challenges, including cancer, diabetes, infectious diseases, and inflammatory diseases.

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REFERENCES

1. Arumugam VA, Natarajan D, Pannerselvam PK. An updated review of *Terminalia catappa*. *Pharmacogn Rev.* 2015;9(11). doi:10.4103/0973-7847.162103
2. Mohale DS, Dewani AP, Chandewar AV, Khadse CD, Tripathi AS, Agrawal SS. Brief review on medicinal potential of *Terminalia catappa*. *J Herb Med Toxicol.* 2009;3(1):7–11.
3. Cock IE. The medicinal properties and phytochemistry of plants of the genus *Terminalia* (Combretaceae). *Inflammopharmacology.* 2015. doi:10.1007/s10787-015-0246-z
4. Mallik J, Faruq AA, Banik RK. A comprehensive review on pharmacological activity of *Terminalia catappa* (Combretaceae) – An update. *Asian J Pharm Res Dev.* 2013;1(2):65–70.
5. Behl T, Kotwani A. Proposed mechanisms of *Terminalia catappa* in hyperglycaemia and associated diabetic complications. *J Pharm Pharmacol.* 2016. doi:10.1111/jphp.12676
6. Dos Santos DV, Silva IO, Silva ARP, Silva EP, Da Silva LMA. Chemical, morphological, and thermogravimetric characterization of *Terminalia catappa* Linn. *Food Sci Technol (Campinas).* 2016;36(1):151–158. doi:10.1590/1678-457X.0090
7. Gholap VS, Shirsat AN, Gholap MD, Mohite SK. Review on *Terminalia catappa* and its pharmacological activity. *Int J Adv Res Sci Commun Technol (IJARSCT).* 2023;3(1). ISSN: 2581-9429.
8. Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S. *Agroforestry Database: A tree reference and selection guide version 4.0.* World Agroforestry Centre (ICRAF). 2009. Available from: <http://apps.worldagroforestry.org/treedb2/>
9. Morton JF. Indian almond (*Terminalia catappa*). In: *Fruits of Warm Climates.* Miami, FL: Creative Resource Systems, Inc.; 1985. p. 287–289.
10. Thomson LAJ, Evans B. *Terminalia catappa* (tropical almond). In: *Species Profiles for Pacific Island Agroforestry.* 2006 Apr. Available from: <http://www.traditionaltree.org>
11. Segaran G, Masilamani T, Sridevi M, Mohan VR, Sripriya N. Phytochemical profiles, in vitro antioxidant, anti-inflammatory and antibacterial activities of *Terminalia catappa*. *Int J Pharm Sci Rev Res.* 2019;55(2):51–59.
12. Nguy LH, Dao DTA, Hien LTM. Effect of some cultivation factors and extraction methods on *Terminalia catappa* L. seed oil. *Int J Food Sci.* 2022;2022:1–12. doi:10.1155/2022/5043752
13. Koffi N, et al. Effect of aqueous extract of *Terminalia catappa* leaves on the glycaemia of rabbits. *J Appl Pharm Sci.* 2011;1:59–64.



14. Behl T, Kotwani A. Terminalia catappa in the treatment of diabetes mellitus. *Asian J Biochem Pharm Res.* 2014;4:1–10.
15. Araújo SA, Abreu-Silva AL, Almeida-Souza F, Lima AS, Rocha CQ. In vitro antioxidant and antitrypanosomal activities of extract and fractions of Terminalia catappa. *Biology (Basel).* 2023;12(7):895.
16. Neelavathi P, Venkatalakshmi P, Brindha P. Antibacterial activities of aqueous and ethanolic extract of Terminalia catappa leaves and bark against some pathogenic bacteria. *Int J Pharm Pharm Sci.* 2013;5(1):114–120.
17. Naz S, Ahmad S, Rasool SA, Siddiqi R, Sayeed SA. [Title not provided]. *Res J Microbiol.* 2007:180–184.
18. Opara FN, Anuforo HU, Okechukwu WU, Mgbemena R, Akujobi I. Preliminary phytochemical screening and antibacterial activities of leaf extracts of Terminalia catappa. *J Emerg Trends Eng Appl Sci.* 2012;3(3):424–428.
19. Wen KC, Shih IC, Hu JC, Liao ST, Su TW, Chiang HM. Inhibitory effects of Terminalia catappa on UVB-induced photodamage in fibroblast cell line. *Evid Based Complement Alternat Med.* 2011;2011:Article ID 904532. doi:10.1155/2011/904532
20. Divya N, Vennila JJ, Parthiban M, Shree DG. Phytotherapeutic efficacy of the medicinal plant Terminalia catappa L. *Saudi J Biol Sci.* 2019;26(5):985–988. doi:10.1016/j.sjbs.2018.12.010
21. Nagappa AN, Thakurdesai PA, Rao NV, Singh J. Antidiabetic activity of Terminalia catappa Linn fruits. *J Ethnopharmacol.* 2003;88(1):45–50. doi:10.1016/S0378-8741(03)00203-6
22. Ahmed SM, Vrushabendra SB, Gopkumar P, Dhanapal R, Chandrashekara VM. Antidiabetic activity of Terminalia catappa Linn. leaf extracts in alloxan-induced diabetic rats. *Int J Pharmacol Ther.* 2005;4(1):36–39.
23. Chanda S, Rakholia K, Dholakia K, Baravalia Y. Antimicrobial, antioxidant, and synergistic properties of two nutraceutical plants: Terminalia catappa L. and Colocasia esculenta L. *Turk J Biol.* 2013;37:81–91. doi:10.3906/biy-1204-5
24. Pawar SP, Pal SC. Antimicrobial activity of extracts of Terminalia catappa root. *Indian J Med Sci.* 2002;56(6):276–278.
25. Mudi S, Muhammad A. Phytochemical screening and antimicrobial activities of Terminalia catappa leaf extracts. *Biokemistri.* 2011;23(1):35–39.
26. Nair R, Chanda S. Antimicrobial activity of Terminalia catappa, Manilkara zapota and Piper betel leaf extracts. *Indian J Pharm Sci.* 2008;70(3):390–393. doi:10.4103/0250-474X.42966
27. Nurulain R, Azrul LM, Effendy AWM, Imelda LV. Determination of anti-helminthic potential in Terminalia catappa by modified selected in vitro bioassay. In: *Proceedings of the 2nd International Conference on Biotechnology and Food Science (IPCBE, Vol. 7).* IACSIT Press, Singapore; 2011.
28. Yeh CB, Yu YL, Lin CW, Chiou HL, Hsieh MJ, Yang SF. Terminalia catappa attenuates urokinase-type plasminogen activator expression through Erk pathways in hepatocellular carcinoma. *BMC Complement Altern Med.* 2014;14:141. doi:10.1186/1472-6882-14-141
29. Saroja M, Annapoorani S. Antitumor activity of methanolic extract of Terminalia catappa leaves against Ehrlich ascites induced carcinoma in mice. *Int Res J Pharm.* 2011;2(12):253–254.
30. Saroja M, Annapoorani S, Santhi R. Evaluation of antitumor and antioxidant activity of flavonoid fraction of Terminalia catappa against Ehrlich ascites carcinoma in mice. *Int J Drug Dev Res.* 2012;4(2):180–187.



31. Chiou Y, Bin-Lin S, Ming-Weng Y, Ko FT. Anti-mutagenicity of supercritical CO₂ extracts of Terminalia catappa leaves and cytotoxicity of the extracts to human hepatoma cells. *J Agric Food Chem.* 2003;51:3564–7. doi:10.1021/jf025963n
32. Croce CM. Oncogenes and cancer. *N Engl J Med.* 2008;358:502–11. doi:10.1056/NEJMra072367
33. Chen PS, Li JH, Liu TY, Lin TC. Folk medicine Terminalia catappa and its major tannin component, punicalagin, are effective against bleomycin-induced genotoxicity in Chinese hamster ovary cells. *Cancer Lett.* 2000;152(2):115–22. doi:10.1016/S0304-3835(99)00414-4
34. Chen PS, Li JH. Chemopreventive effect of punicalagin, a novel tannin component isolated from Terminalia catappa, on H-ras-transformed NIH3T3 cells. *Toxicol Lett.* 2006;163(1):44–53. doi:10.1016/j.toxlet.2005.09.010
35. Naitik P, Prakash T, Kotresha D, Rao NR. Effect of Terminalia catappa on lipid profile in transplanted fibrosarcoma in rats. *Indian J Pharmacol.* 2012;44(3):390–2. doi:10.4103/0253-7613.96329
36. Pandya NB, Tigari P, Dupadahalli K, Kamurthy H, Nadendla RR. Antitumor and antioxidant status of Terminalia catappa against Ehrlich ascites carcinoma in Swiss albino mice. *Indian J Pharmacol.* 2013;45(5):464–9. doi:10.4103/0253-7613.117771
37. Chu SC, Yang SF, Liu SJ, Kuo WH, Chang YZ, Hsieh YS. In vitro and in vivo anti-metastatic effects of Terminalia catappa L. leaves on lung cancer cells. *Food Chem Toxicol.* 2007;45(7):1194–201. doi:10.1016/j.fct.2007.01.003
38. Morioka T, Suzui M, Nabandith V, Inamine M, Aniya Y, Nakayama T, et al. Modifying effects of dried leaf powder of Terminalia catappa L. on tumor promotion in a two-stage mouse skin carcinogenesis model. *Eur J Cancer Prev.* 2005;14(2):101–5. doi:10.1097/00008469-200504000-00006
39. Annegowda HV, Anwar LN, Mordi MN, Ramanathan S, Mansor SM. Influence of sonication on the phenolic content and antioxidant activity of Terminalia catappa L. leaves. *Pharmacogn Res.* 2010;2(6):368–73. doi:10.4103/0974-8490.75449
40. Mety S, Mathad P. Antioxidative and free radical scavenging activities of Terminalia species. *Int Res J Biotechnol.* 2011;2(5):119–27.
41. Lin CC, Hsu YF, Lin TC. Antioxidant and free radical scavenging effects of the tannins of Terminalia catappa L. *Anticancer Res.* 2001;21(2A):237–43. PMID: 11396292
42. Tang XH, Gao J, Dou H, Wang YP, Xu LZ, Zhu ZR, Chen X. Protective effect of the extract of Terminalia catappa leaves on acute liver injury induced by D-GalN in mice. *Zhongguo Zhong Yao Za Zhi.* 2004;29(11):1069–73. PMID: 15504056
43. Kotti PP, Anand AV. Phytochemical analysis and in vitro antioxidant activity of Terminalia catappa. *World J Pharm Sci.* 2014;2(9):1495–8.
44. Fernão CB, Carla PS, Nilton SV Jr, Alaíde B, Oliveira S, Côrtes F, Júlio A. Evaluation of antinociceptive and anti-inflammatory activities of Terminalia catappa Linn. using in vivo experimental models. *Fitoterapia.* 2007;78:353–8. doi:10.1016/j.fitote.2007.03.009
45. Toshiya M, Sigetomo Y, Yasuo O, Yoshio T, Tomochika T, Tadao A, Ayumi S, Mami N. Cytotoxic triterpenes from the leaves of Terminalia catappa L. *J Agric Food Chem.* 1999;47(5):1749–54. doi:10.1021/jf981080b



46. Chitmanat C, Tongdonmuan K, Khanom P, Pachontis P, Nunsong W. Use of Terminalia catappa leaf extract in aquaculture. *Acta Hort.* 2005;678:145–8. doi:10.17660/ActaHortic.2005.678.22
47. Fan Y, Xu L, Gao J, Wang Y, Tang X, Zhao X, Zhang Y. Phytochemical and anti-inflammatory studies on Terminalia catappa. *Fitoterapia.* 2004;75(3–4):253–60. doi:10.1016/j.fitote.2003.11.007
48. Fan YM, Xu LZ, Gao J, Wang Y, Tang XH, Zhao XN, Zhang Y. Phytochemical and anti-inflammatory studies on Terminalia catappa. *Fitoterapia.* 2004;75:253–60.
49. Aimola I, Inuwa H, Mamman A, Omoniwa D. Terminalia catappa extract enhances erythropoiesis in adult BALB/c mice. *J Mol Biol Res.* 2011;1(1):40–6. doi:10.5539/jmbr.v1n1p40
50. Aimola IA, Inuwa HM, Nok AJ, Mamman AI. Induction of foetal haemoglobin synthesis in erythroid progenitor stem cells: Mediated by water-soluble components of Terminalia catappa. *Cell Biochem Funct.* 2014;32(4):361–7. doi:10.1002/cbf.3016
51. Azrul LM, Adzemi MA, Ahmad WM, Effendy AW. Determination of toxicological effects of Terminalia catappa leaves on Sprague-Dawley white rats in short-term period. *Int J Toxicol Appl Pharmacol.* 2013;3(2):44–7.
52. Khan AA, Kumar V, Singh BK, Singh R. Evaluation of wound healing property of Terminalia catappa on excision wound models in Wistar rats. *Drug Res (Stuttg).* 2014;64(4):225–8. doi:10.1055/s-0033-1358776
53. Ngemenya MN, Ngeu Kanga HL, Tamokou JD. Antiplasmodial activity against resistant strains, toxicity and effect on mouse liver enzymes of extracts of Terminalia species found in Southwest Cameroon. *J Herb Med Pharmacol.* 2021;10(1):132–8.
54. Gao J, Fan Y, Xu L, Wang Y, Tang X, Zhang Y. Hepatoprotective activity of Terminalia catappa L. leaves and its two triterpenoids. *J Pharm Pharmacol.* 2004;56(11):1449–55. doi:10.1211/0022357044733
55. Liu TY, Ho LK, Tsai YC, Chiang SH, Chao TW, Li JH, et al. Modification of mitomycin C induced clastogenicity by Terminalia catappa L. in vitro and in vivo. *Cancer Lett.* 1996;105(2):113–8.
56. Kinoshita S, Inoue Y, Nakama S, Ichiba T, Aniya Y. Antioxidant and hepatoprotective actions of medicinal herb, Terminalia catappa L. from Okinawa Island and its tannin corilagin. *Phytomedicine.* 2007;14(10):755–62. doi:10.1016/j.phymed.2007.02.009
57. Tabansi D, Ibe BC, Ekpo OE, Ikpeama A. Anti-Atherosclerosis and Anti-Hyperlipidemia Functions of Terminalia catappa Fruit. *ACS Omega.* 2023;8(42):35571–9. doi:10.1021/acsomega.3c00685
58. Dwivedi A, Gupta P, Singh P. Exploration of phytochemicals found in Terminalia sp. and their antiretroviral activities. *Pharmacogn Rev.* 2016;10(20):73–83. doi:10.4103/0973-7847.194048
59. Wanigasekara DR, Seneviratne U, Ratnasooriya WD. Effects of Terminalia catappa seeds on sexual behavior and fertility of male rats. *Asian J Androl.* 2000;2(3):213–9.
60. Batubo NP, Ojezele MO, Eze CO, Akanbi O. Haematological, histopathological and oxidative stress responses to n-hexane extract of Terminalia catappa nuts in leukaemia-induced Wistar rats. *Int J Res Med Sci.* 2024;12(1):1–10.
61. Muttewar A, Shende P, Bhandari A. Phytochemical and pharmacological evaluation of Terminalia catappa leaves extracts for antidepressant activity. *ASIO J Exp Pharmacol Clin Res.* 2020;6(1):92–101.

62. Ojeaburu SI, Olasehinde O, Enadeghe R. Anti-nociceptive effect of activated charcoal of Terminalia catappa stem bark on acetic acid-induced pain in Wistar albino rats. *FUDMA J Sci.* 2024;8(3):362–7. doi:10.33003/fjs-2024-0803-2458
63. Ratnasooriya WD, Dharmasiri MG, Rajapakse RA, De Silva MS, Jayawardena SP, Fernando PU, et al. Tender leaf extract of Terminalia catappa anti-nociceptive activity in rats. *Pharm Biol.* 2002;40(1):60–6. doi:10.1076/phbi.40.1.60.1203
64. Ahmad MS, Alam MK, Khan MI. Terminalia catappa, an anti-clastogenic agent against MMS induced genotoxicity in the human lymphocyte culture and in bone marrow cells of albino mice. *Eur J Med Genet.* 2014;57(9):465–71. doi:10.1016/j.ejmhg.2014.04.001
65. Silva LP, Mota JM, de Souza FF, de Oliveira MC, de Andrade SF. Terminalia catappa L.: A medicinal plant from the Caribbean pharmacopeia with anti-Helicobacter pylori and antiulcer action in experimental rodent models. *J Ethnopharmacol.* 2015;159:285–95. <https://doi.org/10.1016/j.jep.2014.11.015>.

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