



ARJUNA(*Terminalia arjuna* Roxb.) :- Its Medicinal & Therapeutic Properties

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ABSTRACT

Since the beginning of time, medicinal plants have been a major source of therapeutic compounds used to treat illnesses. One of the most popular and useful medicinal plants in indigenous systems of medicine for the treatment of several serious disorders is *Terminalia arjuna*. The present review is on *Terminalia arjuna*, popularly known as the Arjun tree or 'God of Heart' due to its high utility in treating the heart. The morphology, phytochemicals, and biogenic properties of the *T. arjuna* are explained. It contains tannins, flavonoids, terpenoids secondary metabolites, which show therapeutic potential. *T. arjuna* has antimutagenic, cardioprotective, hyper-cholesterolaemic, hypolipidemic, anticoagulant, antithrombotic, antiviral, antimalarial, antioxidant, antifungal, and antibacterial properties.

KEYWORDS – *Terminalia arjuna*, Antithrombotic, Antiviral, Antimicrobial, Antibacterial, Hyper-cholesterolaemic, Cardioprotective

INTRODUCTION

In Ayurveda many traditional drugs which are used are of plant, animal, metal and mineral origin, where maximum drugs are of plant origin. Information about such drugs are available in the classical texts of Ayurveda named as Vedas (6000 BC), Samhitas (1500 BC – 600 AD), Nighantu and Samgraha granthas (800AD – 1900AD). Most of the people choose plant based or herbal medicines than conventional. Worldwide, the traditional knowledge system has expanded great importance in reference with conservation, sustainable growth and search for new application patterns of plant resources. Traditional medicinal system includes the knowledge, expertise and implementation based on the assumptions, beliefs and experiences of folk people to protect their health problems. So, Ethnobotanical studies are most important to know about the ancient times and current culture about plants in the world and preserving original knowledge of medicinal plants. In India, medicinal plants are the best source to get variety of drugs, and used to treat critical diseases. The different systems of Indian traditional medicines are Ayurveda, Siddha, Unani etc. The awareness is increasing about the importance of herbal medicine. Herbal drugs gained popularity because of their benefits such as easy availability, secure, low cost, very rare side effects and also have cultural preferences. The plants contain organic compounds providing physiological action on human

body and the bioactive substances includes carbohydrates, terpenoids, steroids, alkaloids, tannins, flavonoids, phenols.

Arjuna, a classical drug of herbal origin, botanically identified as *Terminalia arjuna* (Roxb.), belongs to the Combretaceae family has been earlier used by the Ayurvedic physicians, for the management of various disease conditions. It is a deciduous tree found throughout India with height of 60-90 feet. The thick, white to reddish grey bark has been used in India's native Ayurvedic medicine for over three centuries, in various diseases. In recent years, there has also been an increasing demand for nanoparticles derived from medicinal plants like Terminalia family due to their applications in various fields of research like medicine, catalysis, energy and materials. It is seen that the saponin glycosides in *T. arjuna* may be responsible for its inotropic effects, while the flavonoids/phenolics may supply antioxidant activity as well as vascular amplification activity, in this manner authenticating the multiple activities of this plant for its cardio-protective function. The present review encompasses morphological features, distribution, a few traditional and ethnomedicinal uses, pharmacological significance of *Terminalia arjuna* and can be referred for further scientific investigations on the bioactive secondary metabolites of the plant.

BOTANICAL DESCRIPTION

- Type of Plant -----Deciduous riparian tree
- Native Range-----India
- Height -----20 to 27 meters
- Habitat-----It prefers humid, fertile and red lateritic soils, but it can grow in any type of soils. It can also grow in shade.
- Leaves -----Conical and oblong leaves. Leaves have a green color on the top and brown color below.
- Bark-----Grey and smooth bark
- Flowers-----Pale yellow flowers
- Bloom Time-----March and June
- Fruit ----- It has fibrous woody fruits with five wings division having size around 2 to 5 cm (between September and November)
- Fruition Time -----Between September to November



Botanical Name : *Terminalia arjuna* Roxb.

Common Name : Arjuna, Dhavala, Kakubha, Nadisarja, Veeravriksha, Partha, Indradru.

Parts Used : Bark, Roots, Leaves and Fruits

Taxonomical/ Scientific classifications : -

Kingdom : Plantae – Plants

Subkingdom : Tracheobionta - Vascular plants
Subkingdom : Spermatophyta- Seed plants

Division : Magnoliophyta - Flowering plants

Class : Magnoliopsida – Dicotyledons

Subclass : Rosidae

Family : Combretaceae – Indian Almond family

TABLE : CHEMICAL CONSTITUENTS

Plant parts	Chemical constituents
Stem Bark	<p>Triterpenoids : arjunolic acid, arjunic acid, arjunin, arjugenin, Ursane triterpenoids. Arjunahomosesquiterpenol & Stigmasteryl digalactoside. oleaterminaloic acid A, B & C, oleaterminolide and termiarjunoside I. Glycosides: arjunetin, arjunoside II, arjunoside I, arjunaphthanoloside, terminoside A Arjunasides A-E Arjunetoside, Ajunglycosides IV and V, Termiarjunoside I and II. β-Sitosterol.</p> <p>Flavonoids: arjunone, bicalein, arjunolone, luteolin, ethyl gallate, gallic acid, kempferol, pelargonidin, quercetin, oligomeric proanthocyanidins.</p> <p>Tannins: terflavin C, castalagin, punicallin, punicalagin, terchebulin, casuarinin, pyrocatechols, arjunin, gallic acid, ellagic acid.</p> <p>Trace elements/Minerals: zinc, copper calcium, aluminium, silica, magnesium</p>
Root	<p>β-Sitosterol</p> <p>Triterpenoids: terminic acid, arjunic acid, oleanolic acid, arjunolic acid</p> <p>Glycosides: arjunoside I, arjunoside II, arjunoside III, arjunoside IV, 2,19 dihydroxy-3-oxo-olean-12-en-28-oic acid 28-O-d glucopyranoside</p>
Leaves and fruits	<p>Glycosides</p> <p>Flavonoids: luteolin</p> <p>Tannins: Ellagic acid, Gallic acid, Corilagin, Chebulagic acid, etc. Chebuloside II and Bellericoside</p> <p>Dietary minerals of Calcium, Magnesium, Zinc, and Copper</p>



Arjun bark & Dried fruits



Arjun tree bark powder



Dried seeds of Arjun tree



Flowers of Arjun tree

PHARMACOLOGICAL ACTIVITIES

1. **Antimicrobial activity :** When total 34 plant species belonging to 18 different families were assayed for antibacterial activity against *Escherichia coli*, *Klebsiella aerogenes*, *Proteus vulgaris*, and *Pseudomonas aerogenes* (gram- negative bacteria) by the disc diffusion method, about 16 plants showed activity. Among them *Terminalia arjuna* showed significant antibacterial activity against the tested bacteria
2. **Cardioprotective activity :** There are different types of therapeutic use of *T. arjuna* for cardiac disease that based on empirical explanation recorded in various treatment of ancient medicine.
 - (a) **Cardiotonic activities :**
 - Arjunolic acid is used as a cardiac tonic in ayurvedic medicine for centuries and it has been first isolated from *T. arjuna*. The bark extracts have major component triterpenoid saponin is an arjunolic acid.
 - Besides Arjunolic acid, Arjungenin was also found to be most active as direct free radical scavenger and inhibitor for the hypochlorous acid production followed by its glucoside that was almost 50% active resulting in cardioprotective action.
 - The aqueous extract of the bark is isolated from rat atria that confirmed positive inotropic activity.
 - *Terminalia arjuna* (Aqueous Extract) increased the force of contraction of cardiac muscle in frog's heart in situ, hypodynamic frog's heart in situ and isolated perfused rabbit heart.
 - (b) **Anti-anginal effects & Myocardial infarction :**
 - Treatment with *T. arjuna* is fairly effective in patients with symptoms of stable angina pectoris. However, it has a limited role in unstable angina.
 - *Terminalia arjuna* ethanol extract (TAEE) and *Terminalia arjuna* aqueous extract (TAAE) both produced significant cardio protection in isoproterenol induced myocardial infarction in animals.
 - (c) **Coronary flow :**
 - *Terminalia arjuna* (Aqueous Extract) increased the coronary flow at a 400 µg dose in isolated perfused rabbit heart along with dose dependent bradycardia. However the doses required were high as compared to digoxin so the agent proved to be less potent as compared to digoxin.
 - The coronary flow was significantly enhanced with 1024 µg/ml dose of TA extract on the isolated perfused rabbit heart.
 - (d) **Hypotensive effects :**
 - Intravenous injection of alcoholic and aqueous extract of bark causes dose- dependent persistent bradycardia and hypotension.
 - 70% alcoholic extract of *Terminalia arjuna* produced hypotension of peripheral origin which may be due to adrenergic β₂ receptor agonistic and/or direct action on the heart.
3. **Antifungal activity :**
 - The organic extracts of five *Terminalia* species were tested with plant pathogenic fungi i.e. *A. flavus*, *A. alternata*, *A. niger*, *A. brassicicola*, and *H. tetramera*. The leaves extracts of all five plants found to inhibit these plant pathogens.
 - The polar extracts of *T.arjuna* demonstrated strong anti-fungal activity against eight species of *Candida*.
 - The bark extracts were more effective than fungicide (control) used in this antifungal test. Moderate antifungal activity against *C. albicans*, *C. krusei* and *C. parapsilosis* was exhibited by a mixture of arjunolic acid with minimum inhibitory concentration (MIC) values in the range of 50-200 µg/ml.
4. **Antioxidant activity :** The extracts of *Terminalia arjuna* may be explored as a potential source of antioxidants for their use in food and pharmaceutical industries.
 - The extracts from barks of investigated trees: *A. indica*, *T. arjuna*, *A. nilotica*, and *E. jambolana* Lam., exhibited outstanding antioxidant activity as measured by various antioxidant assays.⁵⁶ Because of antioxidant activity of *Terminalia arjuna*, it could be very well used as hepatoprotectant.
 - *Terminalia arjuna* shows potential antioxidant and free radical scavenging activity due to presence of more amount of flavonoid and phenolic content.

5. **Anti-inflammatory** : The methanol extract of the leaves of *Terminalia arjuna* demonstrated significant analgesic and acute anti inflammatory activities in the tested models. *T.arjuna* has anti-inflammatory potential against some phlogistic agents, immunomodulatory effect and also has anti-nociceptive action probably mediated via opioid receptors.
6. **Lipid lowering activity** : The rats receiving *Terminalia arjuna* had a marked reduction in total cholesterol, triglycerides, LDL cholesterol, and VLDL cholesterol as well as an increased HDL cholesterol when compared to the induced animals.
 - Thus, *Terminalia arjuna* was observed to be the most potent hypolipidemic & hyperglycemic agent. *T. arjuna* significantly decreases Total Cholesterol, LDL and Triglyceride levels and increases HDL and lessens atherosclerotic lesion in aorta. Hence *T. arjuna* extract can effectively prevent the progress of atherosclerosis.
 - This is likely due to the effect of *T. arjuna* on serum lipoproteins and its antioxidant and anti-inflammatory properties. Arjuna bark acts as a hypolipidemic, hypocholesterolemia and oxidative stress lowering agent induced by high fat high cholesterol diet in rats.
7. **Anthelmintic activity** : Crude methanolic extracts of *T. arjuna* bark exhibited anthelmintic activity both in vitro and in vivo studies which may be mainly attributed to its tannin content. All extracts showed effective anthelmintic activity at 20 mg ml⁻¹ concentration.
8. **Insecticidal property** : Arjunolic acid isolated from the stem of *T. arjuna* exhibits significant inhibitory activity towards fourth instar larvae of *Spilarctia obliqua*.
9. **Wound healing activity** : The hydroalcoholic extract of *T. arjuna* bark phytoconstituents was reported to be used in topical application on healing rat dermal wounds. *T. arjuna* has capability to complete epithelization of excision wounds and increased tensile strength of incision wounds.
10. **Against ear infection** : *T. arjuna* plants extracts having a great potential to be developed as herbal ear drop to control the bacterial ear infections.
 - All the organic *T.arjuna* extracts (acetone, ethanol or methanol) have shown good activity against both the Gram positive and Gram-negative ear pathogens, the inhibition being higher in Gram positive bacteria than the Gram negative bacteria.
11. **Anti-acne activity** : Herbal anti-acne cream is non-toxic, safe, effective and improves patient compliance by the utilization of herbal extracts from *T. arjuna* would be highly acceptable.
12. **Gastroprotective effect** : Hydro alcoholic extract of TA was found to possess anti-ulcerogenic as well as ulcer healing properties, which might be due to anti-secretory activity.
 - *T. arjuna* acts as a gastroprotective agent probably due to its free radical scavenging activity and cytoprotective nature.
13. **Anti-asthmatic activity** : Arjunolic acid and alcoholic extract of *T. arjuna* have significant mast cell stabilization activity and specifically, arjunolic acid exhibits comparatively better stabilization activity than alcoholic extract of TA.
 - The antiasthma tic and antianaphylaxis activity may be due to the mast cell stabilizing potential and inhibition of antigen induced histamine and acetylcholine release.
14. **Decrease arsenic-induced toxicity** : Arsenic, one of the environmental pollutants, causes tissue damage. Its exposure occurs from inhalation, absorption through the skin and by ingestion of contaminated food and drinking water.
 - An impaired antioxidant defense mechanism followed by oxidative stress is the major cause of arsenic induced toxicity. Arjunolic acid has been shown to protect against arsenic induced cytotoxicity probably due to its free radical scavenging as well as metal chelating properties.

CONCLUSION

- There are so many benefits of arjuna, and what makes this natural health food even more appealing is that it has virtually no side effects. It's safe for most people to consume, with a few exceptions.
- The present review reveals that Terminalia arjuna is utilized for the treatment of some common disease. In the present review we have congregated information pertaining to botanical, phytochemical, pharmacological studies.
- The plant has been studied for their various pharmacological activities like antioxidant, antihyperglycemic, antihyperlipidemic, cardio protective, immunomodulatory effects, hepato protective, in hyperthyroidism, hyperglycemia and lipid peroxidation, analgesic and anti-inflammatory, anthelmintics, antinociceptive activity studies have also been studied.
- Therefore it is necessary to exploit its maximum potential in the field of medicinal and pharmaceutical sciences for novel and fruitful application.

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