JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Pharmacological and Therapeutic Potential of Terminalia Arjuna (Roxb.) wight & Arn: A Review

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Abstract: -

Terminalia arjuna (Roxb.) Wight & Arn., belonging to the family Combretaceae, is a medicinal plant widely recognized in traditional Indian medicine for its broad spectrum of therapeutic properties. The bark, rich in bioactive constituents such as triterpenoids, flavonoids, glycosides, and tannins, has been extensively used for its cardiotonic, antioxidant, anti-inflammatory, antimicrobial, and wound healing properties. Arjunolic acid, arjunin, arjun sides, and gallic acid are among the phytochemical compounds that contribute to its pharmacological properties. It has been found to be effective in diabetes management, hypolipidemic effects, antitumor activity, cardiovascular protection,and antitumor activity. Modern pharmacological evaluations have confirmed its efficacy in cardio protection, antitumor activity, hypolipidemic effects, and diabetes management. This review highlights the traditional uses, phytochemistry, and pharmacological significance of T. arjuna, supporting its potential as a valuable source of natural therapeutic agents.

Keywords: - Terminalia Arjuna pharmacological actions, Anti-oxidant and Anti-bacterial Anti-microbial, Anti-tumour, Wound healing, Cardioprotective, Anti-inflammatory, Anti-diabetic, Anti-lipidemic, Anti-asthmatic.

Introduction: -

Roxb. terminalia arjuna (Combretaceae), Arjuna, more commonly known as, is traditionally used in India for a variety of medical purposes. It is a massive tree that frequently has buttressed trunks. smooth grey bark and about 20 - 25 cm in height. It typically has sub-opposite leaves, pale dark green, oblong or elliptic in shape. above and below, 10-20 cm, pale brown hard and long. The flowers are pale yellow- white, and the fruits range in size from 2.5 to 5.0 cm or glabrous, fibrous, woody, and ovoid-oblong in shape. On the banks of rivers and streams, it is common. and dry watercourses in sub-Himalayan tract, Central and South India, West Bengal, and West Bengal India. The bark of the plant is known to contain arjunine, a crystalline compound essential oil, lactone, arjunetin, and reducing sugar. Along with these, it conprises 34% calcium carbonate, 9% of other salts of aluminium, 13 percent tannin, calcium, organic acids, magnesium, and colorants and other substances. Indian in traditional medicine, the fruits of the plant are known for their restorative properties. Externally, its leaves are utilized to cover wounds and ulcers. The bark is anti-dysenteric, antipyretic, astringent, tonic, cardiotonic, and lithotriptic, while the powder of the bark acts as a diuretic in cirrhosis of liver and gives relief in symptomatic hypertension. A concoction of the thick bark made with milk is given every morning without eating or it's as a cardiotonic, mix powder with milk and gurh. The bark powder is also given with honey in fractures and contusions with echymosis. Furthermore, the extract of the Bark is used to clean as an astringent. sores, ulcers and cancers, etc. Balm made from bark by mixing with honey is used to cure acne while the ashes of the bark are prescribed in scorpion stings. The current work was done to evaluate the methanol extract of T. arjuna leaves for its analgesic and anti-inflammatory activity. (1) Some chemical compounds have been recovered from its root bark, stem bark, leaves, seeds and fruits. Root contains triterpenoids and glycosides, fruit contains triterpenoids and flavonoids, Leaves and seeds contain glycosides and f flavonoids. But bark is considered most important component from a medicinal

standpoint due to its f flavonoids, tannins, triterpenoids, glycosides, polyphenols, sapiens, sterols, and minerals such as calcium, magnesium, zinc, copper, amino acids also. These phytochemical constituents have been reported to exhibit various pharmacological activities like antimicrobial, anticancer, cardio protective, antifungal, antidiabetic, antioxidant, anti-inflammatory, hypolipidemic, anthelmintic, insecticidal, wound healing, anticancer, gastroprotective and other. The molecular additionally action in various cardiovascular system cells are reported. It plays a significant role in improving autonomic controls in improving cardiovascular function. (2)

Fig: Terminalia Arjuna Tree

Taxonomical classification: - (3)

Kingdom – plantae

Sub-Kingdom- Viridiplantae

Infra Kingdom - Streptophyta (Land Plants)

Super Division - Embryophyta

Division- Tracheophyta (Tracheophytes or Vascular Plants)

Sub Division - Spermatophyta (Spermatophytes or Seed Plants)

Class- Magnoliopsida

Super order - Rosanae

Order - Myrtales

Family -Combretaceae (Comb returns)

Genus- Terminalia Linn

Species - Terminalia arjuna (Arjun Tree

Synonyms: -(4)

Terminalia glabra.

Terminalia arjuna Roxb.

Terminalia cuneate.

Penta tera arjuna.

Terminalia arjuna.

Terminalia arjuna Wight & Arn.

Terminalia elliptica.

Terminalia tiliaefolia.

Terminalia nudiflora.

Terminalia roxburghii

Chemical constituents: - (5)

1)Chemical constituents of plant parts Stem bark Glycosides: arjunetin, arjunoside II, arjunoside I, arjunaphthanoloside, Ajunglycosides IV and V, terminoside A, arjunasides A-E, arjunetoside, Termiarjunoside I and II.

Triterpenoids: arjunolic acid, arjunic acid, arjunin, arjugenin, Ursane triterpenoids. Arjunahomosesquiterpenol & Stigmasteryl digalactoside.

Flavonoids: arjunone, bicalein, arjunolone, luteolin, ethyl gallate, gallic oligomeric proanthocyanidins, quercetin, pelorgonidin, acid, and kempferol Terflavin C, castalagin, punicallin, punicalagin, and terchebulin are all tannins. casuarinin, pyrocatechols, arjunin, gallic acid, ellagic acid.

Trace elements/Minerals: zinc, copper calcium, aluminium, silica, magnesium

2)Roots Triterpenoids: terminic acid, arjunic acid, oleanolic acid, arjunolic acid.

Glycosides: arjunoside I, arjunoside II, arjunoside III, arjunoside IV,2,19-dihydroxy-3-oxo-olean-12-en28-oic acid 28-O-d glucopyranoside

3) Leaves and fruits

Flavonoids: luteolin

Tannins: Gallic acid, Corilagin, Chebulagic acid, etc.

Traditional uses: - (6)

The following are situations in which Arjuna is very helpful: -

Cardio modulator

High blood pressure

Hypo lipedimia

Hyper lipidemia

Hypercholesterolemia.

Reduces stress

Urinary tract toner

Arjuna is very helpful in treating various health related problems. Below are actions of Arjuna as per the body`s organ system.

Pharmacological activities: -

1) Anti-oxidant and Anti-bacterial activity

Terminalia arjuna was used in the development of herbal green tea. The nutritional, phytochemical, antioxidant, and antibacterial activity showed that Withania somniferous stem, Cinnamon bark, Tinospora cordifoliastems, bark of Terminilia arjuna, green tea, and a mixture of these in the formulation herbs showed that they can be proven to be an excellent source of nutraceuticals and flavoring agents. (7)

2) Anti-Microbial Activity

Terminalia arjuna extracts have demonstrated remarkable antimicrobial properties Water and acetone-based extracts effectively combated S. aureus, while organic extracts targeted Gram-negative bacteria, with one exception. A study examined 34 plants from 18 families for their antibacterial effects on four Gram-negative bacteria. Nearly half (16 plants) demonstrated antimicrobial qualities.(8)

3) Anti-tumour Activity

Cancerous cells are generally treated with antitumor drugs that cause DNA damage thereby leads to apoptosis. Terminalia arjuna extract was treated to HepG2 cells (Human hepatoma cell line) at concentrations 60 and 100mg/L, which resultsin increased intracellular ROS, and a gene was also activated that governs the apoptosis. Therefore, Terminalia arjuna extract can deplete GSH levels and promote oxidation induction that results in apoptosis of HepG2 cells, due to the accumulation of p53 protein and proteolytic cleavage of caspase-3 protein. Luteolin has antimutagenic activity, it inhibits the growth of the cancerous cell. Ethyl gallate and gallic acid have antimutagenic action. It was reported that gallic acid induces cell death in various transformed cell lines such as PLC/PRF/5 (human hepatoma) HL- 60, RG (human promyelocytic leukemia), and P- 388D1(mouse lymphoid neoplasm). It has been reported that the plant's bark is a potent chemopreventive against liver cancer caused by N-nitrosodiethylamine. The aqueous extract significantly slowed the growth of tumours. Inhibition of lipid peroxidation and elevated antioxidant potential in animals reduced hamster buccal pouch carcinogenesis caused by DMBA (7,12 dimethylbenz(a) anthracene).The chemo preventive effect of Terminalia arjuna is due to the presence of several bioactive compounds and their synergistic effect. Tannic acid, flavonoid (luteolin) isolated from Terminalia arjuna also inhibits the tumors and leukemia Terminalia arjuna extract have been also reported for inhibition of growth osteosarcoma (U 205) and glioblastoma. (9)

4) Wound Healing Activity

Activity for wound healing Terminalia Arjuna bark extract contain hydroalcoholic, phytoconstituents was reported to be used in topical application on healing rat dermal wounds. It has a back wound caused by a rat. have been treated with topical applied as simple ointment. Results prove that fraction III prepared as a simple 1% ointment, fraction I completed epithelialization on day 20. react complete epithelialization on day 9, which necessary consists of tannins. The ability of Terminalia Arjuna to fully epithelize excision wounds and achieve maximum tensile strength in incision wounds is demonstrated. (10)

5) Cardio-protective Activity: -

The protective effects of Terminalia arjuna bark powder when taken 12 weeks before a simulated heart attack or stroke were studied by scientists. Supplements containing terminalia arjuna bark increased the heart's natural defenses and activated protective proteins in rabbits, preventing heart damage caused by decreased blood flow. (11)

6) Anti-Inflammatory Activity

Arjunolic acid demonstrates potent anti-inflammatory activity by significantly inhibiting arachidonic acid ear edema. It also affects COX enzymes possessing its anti-inflammatory activity. standard hydroalcoholic extract of T. arjuna was determined for overall photochemical constituents and the antioxidant property was examined using DPPH radical scavenging activity. The hydroalcoholic extract having a good concentration of total polyphenol concentration and also it was high in antioxidant activity. Termiarjunosides I and II obtained and isolated from the stem barks of T. arjuna was found to be inhibiting the conglomeration of platelets and declined the release of Nitric oxide and superoxide from macrophages. (12)

7)Anti-Diabetic Activity

In alloxan-induced diabetic rats, the effects of ethanol extract (250 and 500 mg kg b.w.t.) of T. arjuna stem bark on lipid peroxidation, enzymatic and nonenzymatic activity, and lipid peroxidation were examined.Superoxide dismutase, catalase, glutathione peroxidase, glutathione-s-transferase,glutathione-reductase,glutathione-s-transferase, glucose-6-phosphate dehydrogenase, glutathione, vitamin A, vitamin C, vitamin E, total sulfhydryl groups (TSH), and non-protein sulfhydryl groups (NPThe result confirms the traditional use of this plant in diabetic animals (Raghavan and Kumari, 2006) and indicates that the extract exhibits antioxidant activity by reducing oxidative stress. (13)

8) Anti-Lipidemic Activity

The hypolipidemic property of Tarjuna was carried out in rabbits fed with high cholesterol diet. The powder bark weighing around 250mg/kg helped decline cholesterol level significantly ($p<0.020$) than control group in rabbits. This research work states that the

ethanolic extract of Tarjuna decreases serum cholesterol volume by ($p<0.05$) and Triglyceride measure by ($p<0.001$). Arjunic acid a major component of the drug undergoes hepatic metabolism to produce active metabolites which are mainly regulating the lipid lowering activity. This study was conducted in type-2 diabetic rats with ethyl alcoholic extract of Tarjuna. (14)

9) Anti-Asthamatic Activity

Terminalia Arjuna Fights asthma and allergic reactions. Histamine and acetylcholine are released by mast cells when they are disrupted, resulting in asthma and allergic reactions. According to research, Terminalia Arjuna protects against asthma and allergies by stabilizing mast cells, preventing histamine release, counteracting histamine and acetylcholine effects. The studies found that Terminalia Arjuna extract offered 28-40% protection against histamine-induced bronchoconstriction and also provided 25-35% protection against acetylcholine-induced bronchoconstriction. Asthma, allergic rhinitis, and chronic obstructive pulmonary disease (COPD) are just a few of the respiratory conditions that the natural compounds of Terminalia arjuna, particularly arjunolic acid, have shown great promise in treating. (15)

Conclusion: -

Traditional wisdom and contemporary scientific research both confirm Terminalia arjuna's potency and extensive therapeutic potential. Its diverse pharmacological properties-especially cardioprotective, antioxidant, anti-inflammatory, and hypolipidemic activities-are primarily attributed to its rich phytochemical profile. The plant has a lot of potential for pharmaceutical formulations and natural remedies for cardiovascular diseases, metabolic disorders, and inflammatory conditions. Further clinical and mechanistic studies are warranted to fully explore its bioactive compounds and ensure safe, standardized medical applications

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