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Emerging Therapeutic properties of Terminalia Arjuna: A Review

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ABSTRACT

Medicinal plant Terminalia Arjuna are used in the treatment of the various disease and disorder since ancient time. This study validated with modern drug approaches. The main objective of this review was to explore the pharmacological aspect of Terminalia arjuna, a indigenous medicinal plant. Medicinal plants have been recognized as major source of therapeutic agents to cure the human disease, as green medicine is healthier than synthetic products. The Arjuna plant was introduced into Ayurveda as a treatment for heart disease by Vagbhata (c. 7th century CE). It is traditionally prepared as a milk decoction. This plant was a known practice for thousands of years, in ancient Indian Vedas, Vagbhata mentions Arjuna in the treatment of wounds, hemorrhages and ulcers, applied topically as a powder. There is a vast variety of plants, which are rich source of bioactive compounds and several more might still be lying unexplored. The available compounds of Arjuna are more potent against snail-borne diseases and used as molluscicidal agents. Arjuna has also been found effective as an antioxidant, protect cardiovascular diseases and very helpful in regulating the hormonal system of the body. Ailments like eczema, itching, rashes scars and serious skin conditions like psoriasis can also be treated with the regular use of Terminalia arjuna. On the basis of ongoing literature and scientific reports the medicinal plant Terminalia arjuna has nature's boon to mankind.

Keywords : Terminalia Arjuna, Medicinal Plant, Bio active compounds, Antioxidant, Heart disease treatment.

INTRODUCTION

Medicinal plants have been recognized as major component of all traditional system of medicine to cure the human disease, since ancient time and till today because of green medicine is healthier than synthetic counterparts. A large number of wild medicinal plants are to be brought in to cultivation in order to explore its therapeutic potential. Keeping this view the concentrate efforts are needed to make the available compound more potent against disease and safer to environment by way of improved formulations[26]. As per WHO reported about 80% of world population relayed on traditional medicine in India[1,2,21] . The main Indian traditional system of medicine is primarily plant based system[3] . Terminalia arjuna is traditionally widely used in the medical formulation of various aliment due to the presence of large number of active phytoconstituents[4] . In the Indian traditional system of medicine, the bark is used as astringent, cooling aphrodisiac, cardiotonic, tonic in fracture, ulcer, spermatorrhoea, leucorrhoea, diabetes, cough, tumor, asthma, inflammation and skin disorder[5,6,27]. Primarily, the dietary supplement prepared with bark of Arjuna ensures usual functioning of

the heart, provides energy to the heart muscles, promotes the functioning of platelets as well as helps in sustaining a steady blood pressure level [24]. Arjuna helps in thickening of the serum and the sperm that is very essential for the proper fertilization of the ovum. It is helpful in increasing the sperm count. It is capable in treating polyurea condition and is also helpful regularizing the increased urine frequency[7] . It is also useful to cure obesity, hypertension and hyperglycemia[8,25] . Keeping in the view of the medicinal importance of the tree in traditional and Ayurvedic system of medicine an attempt has been made to review the available literature. This aim of this comprehensive review was to provide the efficacy and advancement of Terminalia arjuna in herbal drug research covering the area of enthnomedical, phytochemical and pharmacological[9].

CLASSICAL NAMES

Terminalia arjuna is known by its various classical names, such as Arjuna, Dhavala, Kaubha, Nadisaraja, Veeravrikskha, Partha [9]. Botanical description: Terminalia arjuna L. (Combretaceae) is a large evergreen deciduous tree (Commonly known as Arjuna) found throughout India growing to a height of 20-25 m. It commonly grows on banks of rivers, streams and dry watercourses and distributed throughout the greater part of Indian sub-continent, Himalayan ranges, Chota Nagpur, Orissa, west Bengal, Punjab, Deccan and Konkan[9,10]. The bark of Terminalia arjuna is soft and thick with grey in colour on outer surface and tinge easily flakes off in flat large pieces inside. Leaves of T. arjuna are simple, borne opposite shortly acute or obtuse at the apex, glabrous 4-6 inch long and 2-3 inch wide, there are two glands near the base of the petiole. There is a morphological difference in leaf traits of this plant[Fig1]. It has pale yellow flowers with short auxiliary spikes or terminal panicle arrangement, which appear between March and June; its glabrous, 2.5-5 cm fibrous woody fruit with smooth skinned divided into five hard wings, appears between September and November. Phytochemistry: The molecular formula is C30H48O5[Fig2], The major chemical constituents analysis of different parts of T. arjuna was carried out by various standard technique like HPLC, UPLC and LC-ESI-MS/MS analysis[12,15]. The Terminalia arjuna bark extract revealed the presence of bio-active chemical constituents which are known to exhibit medicinal as well as physiological activities[16]. The chemical constituent of different classes such as; hydrolysable tannins, triterpenoides acid and their glycosides, flavonoids, phenolics, phytosterol found in stem bark portion of T.arjuna species[12,14,16]. Arjunglucoside 1-3, arjunolic acid and terminoic acid were important constituent of bark [2,5,11,27]. Ayurvedic formulation: Terminalia arjuna is tremendous plant having enormous influence in ayurvedic system of medicines. In Rigveda, the word 'Arjuna' used either to indicate the white colour or one of taintless fame and glow like silver. It may be the first reference of Arjuna used as medicine stated in chief or principle sutra volume of Atharvaveda, Kaushiksutra (400300 B.C.)[22,26].

A B C

Fig1: (A) Arjuna leaves and Bark ,(B) Arjuna Tree trunk ,(C) Arjuna Tree

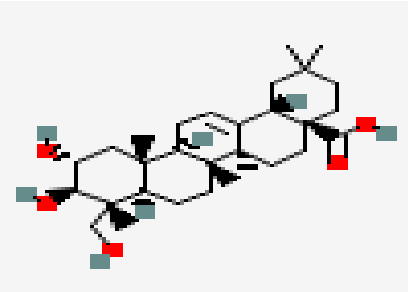

Fig. 2: Arjunolic acid

PHYTOCHEMISTRY

Ursane triterpenoids: 3β-dihydroyurs-12,18-oic acid 28-O-β-D-glucopyranosyl ester, 2α,3β,23-trihydroxyurs-12,18-dien-28-oic acid 28-O-β-glucopyranosyl ester, Qudranoside VIII, Kajiichigoside F1, 2α,3β,23-trihydroxyurs-23- trihydroxyurs-12,19-dien-28-oic acid 28-O-β-D-glucopyranosyl ester[11].

Glycosides Arjunetin: Arjunoside I, II, Arjunolone, Arjunolitin, Arjunaphthanoloside, Arjunglucoside IV and V, Arjunasides A-E, Olean-3β, 22β-diol-12-en-28 β-D-glucopyranosie-oic acid, Terminarjunoside I and II, Terminoside A, Termionic acid, Arjunetosie (3-O-β-D-glucopyranosyl-2α, 3β, 19α-trihydroxyolean-12-en28-oic acid 28-O-β-D-glucopyranoside)[12].

Terpenoids: Arjunin, Arjunic acid, Arjungenin, Terminic acid, Terminoltin, Arjunolic acid, Arjunoside I-IV, Oleanolic acid, 2α,19α-Dihydroxy-3Oxo-Olean-12-En28-Olic acid 28-O-β-D-glucopyranoside[9,13].

Flavonoids and phenolics: Arjunone, Luteolin, Ethyl gallate, Baicalein, Gallic acid, Oligomeric proanthocyanidins, Kempferol, Pelargonidin, Quercetin, , ellagic acid, Gallic acid and its derivatives such as 3-O-methyl-ellagic acid 4-O-βD-xylopyranoside, 3-O-methyl ellagic acid 3-O-rhamnoside, 3-O-methyl ellagic acid 4′-O-α-Lrhamnophranoside[13].

Tannins: Pyrocatechols, Castalagin, Punicallin, Casuariin, Casuarinin, Punicalagin, Terchebulin, Terflavin C[14]

PHARMACOLOGICAL ACTIVITY

The antibacterial activity of Terminalia species' leaf extracts used against human pathogens such as E. coli, Pseudomonas aeruginosa, Bacillus subtilis, Staphylococcus aureus, and Staphylococcus epidermidis, It was observed through Agar Well diffusion method. Testing was done on the Rf values and relative activity of isolated substances. More antibacterial components were detected in hexane and dichloromethane extracts than in acetone extracts, demonstrating the non-polar nature of the antibacterial chemicals [15,27].

In addition, Antiatherosclerotic activity were studied to know the impact of indigenous medications taken orally. On experimental atherosclerosis, Terminalia arjuna, Terminalia belerica, and Terminalia chebula were studied[16]. In order to promote atherosclerosis, rabbits were fed a diet high in cholesterol. Cholesterol was fed along with the three medications. The animals were killed at the conclusion of the experiment, and the lipid content of their plasma and tissue was determined. Aortic atherosclerotic lesions were histologically investigated. The most effective hypolipidemic drug, T. arjuna, was discovered to elicit partial suppression of rabbit atheroma[16,26].

Anti-inflammatory Activity T. arjuna exhibits immunomodulatory effects, anti-inflammatory potential against some phlogistic compounds, and antinociceptive action that is likely mediated by opioid receptors. As a result, T. arjuna bark powder may show to be a significant homegrown medication for the treatment of atherosclerosis in the future[17,26].

Antiviral Activity was also done by using the Ames assay, the antimutagenic effects of a fraction derived from Terminalia arjuna were examined against 4-nitro-o-phenylenediamine (NPD) in TA98, sodium azide in TA100, and 2-aminouorene (2AF, S9- dependent), a promutagen, in both TA98 and TA 100 tester strains of Salmonella

typhimurium. The fraction considerably reduced the mutagenicity of 2AF in both strains while just slightly affecting the revertant colonies produced by sodium azide and NPD[18].

Reproductive activity was done to find out if arjunolic acid, a triterpenoid saponin derived from Terminalia arjuna bark, might protect mice's testicles from arsenic-caused injury. Arsenic was given orally for two days at a dose of 10 mg/kg body weight of sodium arsenite, or NaAsO(2), which significantly reduced intracellular antioxidant activity, antioxidant enzyme activities, and levels of cellular metabolites[19]. Additionally, testicular arsenic concentration, lipid peroxidation, protein carbonylation, and glutathione disulfide levels were all increased by arsenic intoxication (GSSG). The seminiferous tubules experienced severe degeneration due to arsenic exposure, along with spermatocyte necrosis and defoliation. Arjunolic acid pretreatment at a level of 20 mg/kg body weight for four days could stop the damage to the testes' histological architecture and oxidative stress brought on by arsenic. In vivo antioxidant activity and free radical scavenging activity were both present in arjunolic acid[19]

MEDICINAL USES

Terminalia arjuna is a wide spread medicinal plant. The different parts of Terminalia arjuna like bark, leaves and fruits etc., have different medicinal values and are used to cure various diseases. T.Arjuna bark is considered as main part used in ayurveda as well as in Allopathy for curing various diseases. The bark of arjuna tree contains magnesium salts, calcium salt and glucosides that have been used in traditional ayurvedic herbalism[3][8]. According to vagbhata, Terminalia bark is used in healing wounds, tuberculosis and help in cardiac restorative. Terminalia arjuna bark powder is used as cardio protective and it is known as a tonic to heart diseases to normalize high blood pressure and in many rural areas. Cardiomyopathy, coronary artery diseases, heart failure, hyper cholesterol and hypertension are cured by arjuna bark powder used as an ischemic and cardio protective agent in hypertension and ischemic heart diseases[20,27]. Arjuna improves the pumping capacity of heart by strengthening muscles and vascular system and also be functional in treating excess of cholesterol in blood [1]. The active action of arjuna helps as anti coagulant and anti platelet, that keeps the blood thin and lowers the bad cholesterol while increasing the good cholesterol. It helps to regulate high blood pressure, disturbed rhythms and regulate the heart beat rate. Arjuna reduces the effect of stress and nervousness on the heart[9,20,23]. It provides significant cardiac protection in heart attack. Although, there are many ayurvedic plants that have shown to help in coronary artery diseases, but Arjuna seems to be the best plant for heart health and Diabetic patients[6,20,27]. Bark extract exhibits anti diabetic activity by enhancing the peripheral utilization of glucose by correcting the impaired liver and kidney glycolysis and by limiting its gluconeogenic formation similar to insulin. It is due to the presence of tannin, saponin, flavonoids and other constituents' presence in the bark which could act synergistically or independently in enhancing the activity of glycolytic and gluconeogenic enzymes [6].Arjuna bark has anti cancerous properties that contains gallic acid, ethyl galate and flavone luteolin[18]. In studies Luteolin shows established record of inhibiting various cancer cell lines. Casuarinin, a hydrolysable tannin isolated from the bark of T. arjuna inhibits human non-small cell cancer A549 cell by blocking cell cycle progression in the G0/G1 phase and inducing apoptosis[4,18]. Aqueous extract of T.arjuna play a role in the anti carcinogenic activity by reducing the oxidative stress along with inhibition of anaerobic metabolism[3,8]. Kidney problems Consumption of boiled arjuna tree bark liquid helps to break the kidney stones that may have formed into small pieces and then eventually flush them out via urine[1,2,5]. It works as a wonderful antioxidant so it helps in stoping early aging and help in maintaining body physique. Arjuna is very effective in tuberculosis cough by stop blood in cough and healing the ruptured arteries in lungs[20,26]. Arjuna maintains normal urine flow and helps in kidney functioning thrives the medicinal aspect of bark,roots and leaves. Bark powder Bark powder of arjuna has diuretic properties that cure cirrhosis. Powder of the bark is also used in the treatment of gonorrhea, and spermatorrhoea [3,8,9]. T. Arjuna bark powder is used to treat asthma and also helps to treat Acne vulgaris when applied as a paste mixed with honey[26]. Bark paste of T. Arjuna is applied for bone bandage in fractures. T. Arjuna bark powder is effective in tubercular cough by stopping blood in cough and healing the ruptured arteries in lungs[9,20,21]. T.Arjuna act as diuretic helps to flush out the small stones formed in the kidneys. T.Arjuna reversing dysfunction an early event of antherosclerosis through oxidative stress process[16]. Juice of leaves is used in ear ache (otalgia) and Leaves also used to cure ulcers and sores externally[21].

In Conclusion, This review gives a view on the biological activities of some species of the arjuna compounds isolated, pharmacological actions of the extracts and provides the medicinal applications of arjuna products. The need of time to explore further studies on medicinal values of T. Arjuna and other Terminalia species for emerging therapeutic values .

REFERENCES

[1] Gupta, R. Singhal, S. Goyle, A. and Sharma,V. N. 2001. Anti oxidant and hypo cholesterolaemic effects of Terminalia arjuna tree bark powder. J Assoc Physicians of India , 49: 231-235.

[2] Rajesh, K.V. Anil, N .K. Nibedita, J. and Sanjeet, K. A.2023.[Terminalia arjuna (Roxb. ex DC.) Wight & Arn.]: a medicinal tree of India. J Medico Biowealth of India, volume XI;ISBN:978-81-965138-8-7.

3. Kandil, F. E. and Nassar, M.I.1998. A tannin anti-cancer promoter from Terminalia arjuna. Phytochem ,47 (8): 1567-1568.

4. Kuo, P .L. Hsu, Y. L. Lin, T.C. Chanq, J.K .and Lin, C.C .2005. Induction of cell cycle arrest and apoptosis in human non-small cell lung cancer A549 cells by casuarinin from the bark of Terminalia arjuna Linn. Anticancer Drug , S16(4): 409-415.

5. Gunjan ,C. Raghunath, T.M. 2015.Comprehensive study on pharmacognostic , physico and phytochemical evaluation of Terminalia arjuna Roxb. stem bark. Journal of Pharmacognosy and Phytochemistry, 4(3): 186-193.

6. Raghavan B and Krishnakumari S. Antidiabetic effect of Terminalia arjuna bark extract in alloxan induced diabetic rats.2006. Indian J Clinical Biochem ,21 (2): 123-128.

7. Srivastava, A. K. Kumar, D. Pandey, J. P. Kumar, V. and Prasad, B.C.2012. Horticulture and tasar flora : status, scope and potential utilization. Hort Flora Res Spectrum , 1(1) : 13-16

8. Verma, N. and Vinayak, M . Effect of Terminalia arjuna on antioxidant defence system in cancer.2009. Mol Biol Rep,36 (1):159-64.

9.Sheetal ,Y. Sulochana, K. Sunil, K. Chhikara. Sandeep, S. Jaya, P. Y. Samander, K.2022. Terminalia arjuna(Arjun Tree):A Sacred plant with high medicinal and Therapeutic potential. Research Journal of Pharmacy and Technology,15(12):5859-7.

10. Neelam, S. and Vinay, K. S. Efficacy and Advancement of Terminalia arjuna in Indian Herbal Drug Research: A Review.2019. Trends Applied Sci, Res., 14 (4): 233-242.

11. Wang, W. Ali, Z. Shen, Y. Li, X. C. and Khan, I. A.2010. Ursane triterpenoids from the bark of Terminalia arjuna. Fitoterapa. vol.81, no.6, pp.480–484.doi: https://doi.org/10.1016/j.fitote.2010.01.006.

[12] Alam, M. S. Kaur, G. Ali, A. Hamid, H. Ali, M. and Athar, M.2008. Two new bioactive oleanane triterpene glycosides from Terminalia arjuana. Nat Prod Res, vol. 22, no. 14, pp. 1279–1288, doi: 10.1080/14786410701766380.

13. Pettit, G.R. Hoard, M.S.Doubek, D.L . Antineoplastic agents 338. The cancer cell growth inhibitory. Constituents of Terminalia arjuna (Combretaceae).1996. Ethnopharmacol J,53(2):57-63. doi:10.1016/S0378-8741(96)01421-3

14. FL,H.Ta-C, L. Shu- C, C. Hsue-F, C.2000. Tannins and Related Compounds from Combretaceae Plants. Chinese Pharm J , vol. 52, p. 26, 2000, doi: 10.7019/CPJ.200002.0001.

[15] Chavan, V.P.2020. Antibacterial activity of Terminalia Arjun (COMBRETACEAE). International Journal of Emerging Technologies and Innovative Research, ISSN:2349-5162, Vol.7, Issue 2, page no.552-554.

[16] Shaila,H. P, Udupa,S. and Udupa, A .L. 1998.Hypolipidemic activity of three indigenous drugs in experimentally induced atherosclerosis. Int. J. Cardiol, vol. 67, no. 2, pp. 119–124 , doi: 10.1016/s0167-5273(98)00281-2.

[17] Halder, S. Bharal, N. Mediratta, P.K. Kaur, I. and Sharma, K. K. 2009.Anti-inflammatory, immunomodulatory and antinociceptive activity of terminalia arjuna roxb bark powder in mice and rats. Indian J Exp Biol ,vol. 47, no. 7, pp. 577–583.

[18] Kandil, F.E. Nassar, M.I.1998.A tannin anti-cancer promotor from Terminalia arjuna. Phytochemistry ,47(8):1567-8. doi: 10.1016/s0031-9422(97)01078-9. PMID: 9612958.

[19] Manna, P. Sinha M and Sil, P. C. Protection of arsenic-induced testicular oxidative stress by arjunolic acid.2008.Redox Rep ,vol. 13, no. 2, pp. 67–77, doi: 10.1179/135100008X259169.

20.Ramesh, P .J . and Palaniappan, A. K.2023. Terminalia Arjuna, a cardio protective herbal medicine relevancy in the modern era of pharmaceuticals and green nano medicines-A Review. Pharmaceuticals (Basel) ,16(1):126.

21. Dudhamal, T.S.2016. Wound healing activity of Arjuna bark powder in Dushta vrana (Non healing venous ulcers) - A Case Report. J Ayu Herb Med ,2(4):102- 103

22. WHO. Traditional medicine strategy report. Document WHO/EDM/TRH/2002; World Health Organization, Geneva, Switzerland.

23. Dwivedi,S. Chopra, D.2014.Revisiting Terminalia arjuna - An Ancient Cardiovascular Drug. J Tradit Complement Med,4(4):224-31.doi: 10.4103/2225-4110.139103. PMID: 25379463; PMCID: PMC4220499.

24. Ankit,S. Anil, K. Brijesh, S. Mondal, B. C, .Om. P. Sumit, G. Anupam, K. A. Kalicharan, N. and Shashikant.2023. Effect of dietary supplementation of Arjuna (Terminalia arjuna) Bark and Sahjan (Moringa oleifera) leaf powder on haematology and Serum Biochemicals of Uttara chicken. The Pharma Innovation Journal ,SP-12(8): 117-121.

25. Kalicharan, N. Anil, K. Gururaj, V. K. and Shrishtipriya, P. Effect of Arjun (Terminalia arjuna) bark powder supplementation on haemato-biochemical parameters in Uttara layers.2023. The Pharma Innovation Journal ,12(8): 906-911.

26. Mayur, R. Wagh. Shweta, G. Gunjal.2023. A Compendious Review on Terminalia Arjuna . International Journal of Creative Research Thoughts 2023 ;Volume 11 ISSN: 2320-2882.

27. Kuluvar, G . Heggar, V. S. Amritharaj, Anusha, S . Lingaraju, H .B . Prasanna, K . and Shyam, P. K.2024. Cardioprotective Potential of Cardiboost, a Standardized Extract from Terminalia arjuna Bark against H2O2 Induced Oxidative Stress in H9c2 Cardiomyocytes. Journal of Young Pharmacists ,16(1): 10