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# A REVIEW ON PHARMACOLOGICAL ACTION OF ARJUNA (*Terminalia arjuna (Roxb.) Wt. and Arn.)*

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## ABSTRACT

From ancient time medicinal plants have been a main source of therapeutic agents to cure diseases. In Ayurvedic classical texts, use of Arjuna (*Terminalia arjuna (Roxb.) Wt. and Arn.* Family Combretaceae) has been described in various ailments skin disorders, hemorrhage, diabetes, cough, tumor, leucorrhoea, asthma, inflammation, leucoderma, ulcers, anemia. When the plant is used in combination with other traditional drugs it shows good safety result. As per classical texts (samhitas, samgraha granthas, nighantus) 125 formulations with ingredient Arjun has been described curing 20 diseases. Different parts of Arjuna is used in various dosage forms such as swarasa (juice), kwath(decoction), kshirapaka(milk decoction), churna(powder), lepa(paste). *Terminalia arjuna (Roxb.) Wt. and Arn* have various therapeutic properties such as cardioprotective, anti-inflammatory, anti-asthmatic activity, anti tumor activity, anti-microbial activity. So, the present review is carried out to summarise information and knowledge about *Terminalia arjuna (Roxb.) Wt. and Arn* on aspects of pharmacological and clinical studies to know more divinity of Arjuna.

**KEYWORDS:** Arjuna, Terminalia arjuna, Ayurveda, Medicinal property, Pharmacological action.

## INTRODUCTION

In Ayurveda many traditional drugs which are used are of plant, animal, metal and mineral origin, where maximum drugs are of plant origin.[1] 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).[2] Medicinal plants has a great role in maintaining health and are the major raw materials for both traditional and conventional medicine preparations. Most of the people choose plant based or herbal medicines than conventional.[3] 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. The quantitative ethnobotanical studies were used to identify the plant uses as food,[6] human health care medicines,[7] veterinary medicine[8] and economically importantance.[9] 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.[10]

Arjuna, a classical drug of herbal origin, botanically identified as *Terminalia arjuna (Roxb.) Wt. and Arn*., 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.[11,12,13] 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

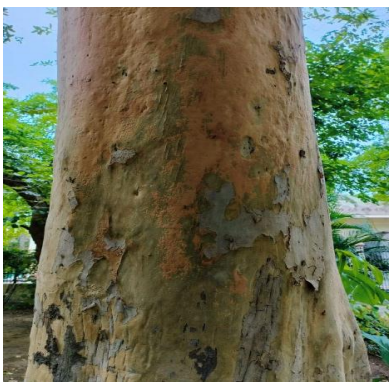
authenticating the multiple activities of this plant for its cardio-protective function.[14,15,16] The present review encompases morphological features, distribution, a few traditional and ethnomedicinal uses, pharmacological significance of Terminalia arjuna and can be referred for further scientific investigations on the bioactive secondary metabolites of the plant.

## BOTANICAL DESCRIPTION

It is a large evergreen deciduous tree with height 60-80 feet in height. Leaves are simple, sub-opposite, oblong or elliptical, cordate, shortly acute or obtuse at the apex, 5- 25,4-9 cm. The base is rounded in shape or sometimes cordate. The petiole is short (2-4cm long), sericeous with 2 (or 1) prominent two glands at the petiole apex, immediately below the leaf. This character represents a unique pharmacognostic feature of Terminalia arjuna. The bark is smooth, pinkish-grey, from outside and fakes off in large, curved, and rather flat pieces.[17] Each piece may vary in size up to15 cm or more in length, 10cm in width and 3-10 mm in thickness. Sapwood is reddish-white and the heartwood is brown and variegated with dark colored streaks. Bark consists of a single layer epidermis with hair-like projections and few scattered lenticels. The epidermis underlined by a thin layer of the cortex. Old bark contains periderm and secondary phloem. Flower, tree bears white sessile flowers arranged in short axillary spikes or Terminal panicle. The flowers are bisexual. Each flower consists of 10 stamens and an ovary which is a disk clothed with yellowish or reddish hairs. Bracteoles are linear, lanceolate. The calyx is glabrous. Flowering begins in April and extends to May. Fruit – Its fruit is a drupe, 2.5-5 cm long, ovoid or oblong, fibrous woody, smooth-skinned with five hard angles or wings. The lines of the wings are obliged and curved upwards.[18]

**ARJUNA TREE**

**ARJUNA BARK**



**ARJUNA TRUNK**

***ARJUNA TREE ARJUNA BARK ARJUNA TRUNK***

**Taxonomical Classification**

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Myrtales

Family: Combretaceae

Genus: *Terminalia*

Species: *T. arjuna*

**Ethnomedicinal Uses**

Over ten centuries *Terminalia arjuna (Roxb.) Wt. and Arn.* has been used in Indian Ayurvedic Medicine for, its cardioprotective properties include angina, hypertension, deposits in arteries. Traditionally kshirapaka is prepared as a milk decoction (Kwatha) for cardiovascular disease. It is used for skin disorder wounds, ulcers, hemorrhage, leucorrhoea, diabetes, cough, tumor, asthma, inflammation, leucoderma, anemia. The bark is sweet, acrid, cooling and heating, aphrodisiac, expectorant, tonic, styptic, antidysenteric, purgative, and laxative. In Charak Samhita the bark powder is used as an astringent and diuretic.[19] 1200 years ago 'Astang Hridayam' was written and later, Chakradutta and Bhava Mishra, described its use in chest pain.[20,21] The bark is traditionally prepared in the form of an alcoholic decoction called 'save, with clarified butter and along with boiled milk.[22,23]

**CLASSICAL REVIEW**

**Synonym**

**According to Habitat**

- Nadisarja: Arjuna commonly grows on the river bank.

**According to Morphology**

- Dhavala: The bark is white.
- Kakubha: Arjuna is a large tree that covers a large area.
- Sarpana: Arjuna is large tree with spreading branches.
- Madhu Gandhi Prasunak: Flowers are sweet- scented.

**According to Properties and action**

- Indradru: The tree which is very potent medicine.
- Veeravriksha: A potent tree.
- Devshal: Tree with strong action.

Various available samhitas (classical texts), nighantus (lexicons), samgraha granthas (compendia) and some other texts related to prayoga were referred; the synonyms, properties, actions and various formulations with their adhikara (prime indication) were compiled, critically analysed and arranged in a systematic manner.

**Pharmacological properties of Arjuna: (Ayurvedic view)[24]**

Arjuna has been attributed with Kashaya rasa, katu vipak, sheeta veerya, laghu and ruksha gunas. It pacifies kapha and pitta doshas. It also possesses the prabhava that is Hridya. It is being recommended to alleviate various disease conditions like charmaroga (skin diseases), Hridyaroga (heart diseases), Raktavikara (disorder of blood), Shotha (inflammation), Raktapitta (bleeding disorder), Pandu (anemia), Swasa (asthama), Kandu (itching), Kustha (leprosy), Jwara (fever), Medoroga (obesity), Asthibhanga (bone fracture), Vrana (wound), Yauvanpidika (acne), Netraroga (Eye diseases) and Karnaroga (ear diseases).

Part used of Arjuna[25,26]: Bark, Leaves and fruits.

Dose of Arjuna[25,26]: Bark powder; 3-6 gm Bark decoction; 50-100 ml. For Kshirapaka; 5-10 gm.

**PHARMACOLOGICAL STUDIES**

**Table 1: Pharmacological studies on *Terminalia arjuna (Roxb.) Wt. and Arn.***

| Pharmacological activity | Model used and study design | Type of extract | Observation | References |
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| Cardioprotective Activities | Frog and rabbit hearts. | glycoside in its bark | *Terminalia arjuna* has resulted in significant stimulant action on frog and rabbit hearts. It acts as a cardiotonic due to the presence of glycoside in its bark. | Ghoshal LM[27] |
| Cardioprotective Activities | Rabbit | Aqueous bark extract | Aqueous bark extract injected into rabbit dose (1024 µg/ml) resulted in to rise in coronary flow. | Bhatia J, Bhattacharya SK, Mahajan P[28] |
| Cardioprotective Activities | Frog and rabbit heart | Alcoholic extract | Effects of Terminalia species of plant on the cardiovascular system were studied in the isolated frog, rats atria, and isolated perfused frog and rabbit hearts. It was reported that | Srivastava RD, Dwivedi S.[29] |

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| | | | the alcoholic extracts of three Terminalia species namely, *Terminalia arjuna* Wight & Arn., *Terminalia bellerica Roxb.* And *Terminalia chebulaWilld*, exhibited negative inotropic and chronotropic effects on the heart in a dose dependent manner. | |
| Cardioprotective Activities | human plasma LDL from copper mediated oxidation | Aqueous extract of Terminalia arjuna | Free radicals scavenging activities are also increased in polymorphonuclear cells by arjungenin and its glucoside, arjunglucoside. Aqueous extract of *Terminalia arjuna* protects human plasma LDL from copper mediated oxidation. | Singh S, Latheef SAA[30] |
| Cardioprotective Activities | in human LDL and rat liver microsomes | ethanolic extract methanolic extract of Terminalia arjuna | Metal ion-induced oxidative degradation of lipids in human LDL and rat liver microsomes was also suppressed by using ethanolic extract of *Terminalia arjuna*.[1] The high amount of DPPH (2, 2-diphenyl-1-pericrylhydrazyl) free radical, ascorbic acid, ferric reducing power present in methanolic extract of *Terminalia arjuna* stem bark were found highly reactive for antioxidant and free radical scavenging activities. | Mety SS, Mathad P.[31] |
| Wound healing activity | In vivo | Hydroalcoholic extract of bark Terminalia arjuna | Hydroalcoholic extract of bark *Terminalia arjuna* was applied on dermal wounds of rats. It was observed that tannins were found more effective than saponin for complete epithelialization. | Chaudhari M, Mengi[32] |
| Wound healing activity | In vitro | Triterpenoids compounds present in bark | Triterpenoids compounds present in the bark of *Terminalia arjuna*, also have a beneficial effect on the regeneration of bone and muscle tissue of frogs. | Patnaik T, Dey RK[33] |

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| Anti-inflammatory Activities | | Arjunolic acid | Arjunolic acid also showed anti-inflammatory activity, it inhibits the arachidonic acid-induced ear edema by 55.5%. It affects the cyclooxygenase and increasing its anti-inflammatory activities. | Thiagarajan H, Sivasami[34] |
| Antiasthmatic Activity | Mast cell disruption releases histamines | Alcoholic extract of Terminalia arjuna | Mast cell disruption releases histamines, acetylcholine, etc. Alcoholic extract of *Terminalia arjuna* which contains arjunolic acid was found significant for mast cell stabilization. Histamine causes bronchoconstriction leads to asthma. *Terminalia arjuna* act against histamine and acetylcholine. Acetylcholine induced bronchoconstriction, secondary to stimulation of histamine. | Prasad MVV, Anbalagan[35]<br><br>Summer R, Sigler R, ShelhamerJH,[36] |
| Antitumor activity | HepG2 cells (Human hepatoma cell line) at concentrations 60 and 100mg/L | Terminalia arjuna extract | *Terminalia arjuna* extract was treated to HepG2 cells (Human hepatoma cell line) at concentrations 60 and 100mg/L, which results in 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. | Pettit GR, Hoard MS, Doubek[37] |
| Antimicrobial Activity | In vitro | Bark extract | Bark extract has shown significant antibacterial activity against Staphylococcus aureus (MTCC 96), Staphylococcus | Singh DV, Gupta MM[38] |

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| | | | epidermidis (MTCC 435), Streptococcus mutans (MTCC 890), Bacillus subtilis (MTCC121), and Mycobacterium smegmatis (MTCC155). The crude extract has shown activity against Klebsiella pneumonia (MTCC 109) and Enterococcus faecalis (MTCC 439). | |
| | In vitro | 100% ethanol extract and crude extract of bark of Terminalia arjuna. | Antibacterial activity against both Gram-positive and Gram-negative bacterial species Bacillus megatherium, Bacillus subtilis, Staphylococcus aureus, Sarcina lutea, and eight strains of Gram-negative bacteria - Salmonella paratyphi, Salmonella tiphi, Vibrio parahemolyticus, Vibrio mimicus, Escherichia coli, Shigella dysenteriae, Pseudomonas aureus, and Shigella boydii was reported in a crude extract of bark of *Terminalia arjuna*. Similarly, 100% ethanol extract also possesses antibacterial activity against Vibrio cholera. | Fakruddin M, Alam KMA, Mazumdar RM[39] |
| | In vitro | ethanol extract of bark of Terminalia arjuna | The antimicrobial potential was observed in 50% ethanol extract of bark of *Terminalia arjuna* against Bacillus megatherium, Bacillus subtilis, Staphylococcus aureus, Sarcina lutea, and eight strains of Gram negative bacteria - Salmonella paratyphi, Salmonella tiphi, Vibrio parahemolyticus, Vibrio mimicus, Escherichia coli, Shigella dysenteriae, Pseudomonas aureus, and Shigella boydii and maximum inhibition was | Morshed MA, Uddin A, Rahman A, Hasan T.[40] |

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| | | | found inS. Dysenteriae followed by S. paratyphi, S. tiphi, V. mimicus, E.coli, P. aureus, S. boydii, B. megaterium, S. aureus, S. lutea, B. subtilis, and V. parahemolyticus. Results indicate that ethanol extract of bark of *Terminalia arjuna* possesses broad-spectrum antimicrobial potential | |
| | In vitro | Methanol extract of apical bark | Stem bark samples, apical bark, middle bark, mature bark of *Terminalia arjuna* were studied for antimicrobial activity against different pathogenic bacteria such as Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, Salmonella typhi, Micrococcus,and Proteus mirabilissp. Methanol extract of apical bark was found more effective than middle and mature bark against all organisms but Staphylococcus aureus was most sensitive [56] | Patil UH, Gaikwad DK[41] |
| Antioxidant, anti-inflammatory, and immunomodulatory | CYP3A4, CYP2D6 and CYP2C9 enzymes in human liver microsome | Alcoholic and aqueous extract of T. arjuna at 35 mg/ml dose level | Alcoholic and aqueous extracts of *T. arjuna* showed significant inhibition activity of CYP3A4, CYP2D6 and CYP2C9 enzyme. Enzyme kinetic studies suggested that the extracts of *T. arjuna* showed rapidly reversible non-competitive inhibition of all three enzymes in human liver microsomes | Varghese et al[42] |
| Antioxidant | Human polymorphonuclear (PMN) cells and hypochlorous acid from human neutrophils | Methanolic extract of *T. arjuna* | Arjungenin is the most active compound than others and had moderate inhibitory effect on the process of respiratory oxyburst and its IC50 value is shown 60 | Pawar and Bhutani[43] |

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| | | | mg/ml. | |
| Antioxidant | Male Wistar albino rats (110 e140 g) e (6e7 weeks old) | *T.arjuna* was administrated orally to Wistar rat at different doses (0.42 mg/kg to 6.8 mg/kg) for 6 days/week for 4 weeks | Chronic administration of butanolic fraction of alcoholic extract of *T. arjuna* bark has cardioprotective potential against Dox-induced cardiotoxicity. | Singh et al[44] |
| Antioxidant and antimutagenic activity | Wistar rats (200e250 g) and Swiss albino mice (18e22 g) | Aqueous and ethanolic extraction of *T. arjuna* | The alcoholic extract of *T. arjuna* (ALTA) has shown potent antioxidant activity with EC50 of 2.491 ± 0.160, 50.110 ± 0.150 and 71.000 ± 0.025 in DPPH assay, superoxide radical scavenging activity and lipid peroxidation assay, respectively. In micronucleus test, EC50 of 2.410 ± 0.140, 40.500 ± 0.390 and 63.000 ± 0.360 in percentage of micronucleus in ALTA (100 and 200 mg/kg p.o) showed significant reduction in both polychromatic erythrocytes and normochromatic erythrocytes and also shown significant reduction in P/N ratio | Viswanatha et al[45] |
| Anticarcinogenic and antimutagenic spotential | In vitro and in vivo method | Aqueous extracts from 75 mg/ml to 200 mg/ml for lymphocyte culture for in vitro experiments Aqueous extracts from 50 mg/kg to 350 mg/kg body weight for in vivo experiments | Used human lymphocyte culture and bone marrow cells of albino mice (8e10 weeks old and weight ranges between 25-35 g) The number of sister chromatid exchanges got reduced from a higher level of 15.0 ± 1.4 per cell to 7.7 ± 0.5 per cell with S9 mix at 48 h of treatment. The replication index was enhanced from 1.33 to 1.55 in vitro. In the in vivo experiments, effective reduction in clastogeny ranging from 15.22% to 54.82% from the mutagen | Ahmad et al[46] |

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| | | | treated positive control and the total frequencies in aberrant cells got reduced from 429 due to AFB1 to 141 due to 5th concentration of T. arjuna extracts at 32 h of exposure. | |
| Antioxidant, anti-inflammatory and immunomodulatory | Cell cultures of human monocytic (THP-1) and human aortic endothelial cells (HEACs) | *T.arjuna* alcoholic extract (TAAE) and *T. arjuna* Aqueous extract (TAWE) from steam bark at a dose of 1e50 mg/ml | TAAE and TAWE inhibited the lipid peroxidation and attenuated H2O2 mediated ROS generation in THP-1 cells by promoting catalase, glutathione peroxidase activities and by sustaining cellular reducing power. Marked effects of *T. arjuna* steam bark on cultured human monocytic and aortic endothelial cells provide the biochemical and molecular basis for therapeutic potential of T. arjuna steam bark against cardiovascular diseases (CVD). | Kokkiripati et al[47] |
| Antioxidant | Male albino Wistar rats (120 e150 g body weight) were subjected to oxidative stress associated with in vitro ischemic reperfusion injury (IRI | Two doses (500 and 750 mg/kg in 2% carboxy methyl cellulose (CMC)), 6 days per week for 12 weeks | *T. arjuna* augments endogenous antioxidant compounds of rat heart and also prevents oxidative stress associated with IRI of the heart. | Gauthaman et al[48] |
| Antioxidant | Human neutrophils isolated from fresh, heparinized human blood by using Histoprep and suspended in HBSS medium containing gelatin. | Ethanolic extraction of *T. arjuna* containing arjunic acid, arjungenin, arjunetin and arjunglucoside I | Arjungenin and its glucoside extracted from *T. arjuna* and are exhibited a significant free radical scavenging activity on the superoxide release from PMN cells. Arjungenin exhibited great inhibitor action on the hypochlorous acid productin from human neutrophils. | Pawar and Bhutani[49] |
| Antioxidant | Male Swiss albino mice treated with NaF at a dose of 600 mg/L for 1 week. | Ethanolic extract of *T. arjuna* at a dose of 50 mg/kg of body weight and with vitamin C at a | Ethanolic extract of *T. arjuna* protects murine hearts from NaF-induced oxidative stress via its antioxidant properties. | Sinha et al[50] |

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| | | dose of 100 mg/kg body weight for 1 week | | |
| Antioxidant | Poloxamer (PX)-407 induced hyperlipidemic albino Wistar rats | Three fractions diethyl ether, ethyl acetate and ethanol of *T. arjuna* exerted hypolipidemic and antioxidative effects at two different doses levels (175 and 350 mg/kg body weight | Hypolipidemic and antioxidant effects of *T. arjuna* fractions were noticed as ethanol > diethyl ether > ethyl acetate. Ethanolic fraction of *T. arjuna* possesses the potent properties of antioxidant and hypolipidemic than other fractions and has therapeutic potential for the prevention of coronary arterial disease. | Subramaniam et al[51] |
| Antioxidant | Male Wistar rats treated with isoprenaline to produce LVH | Aqueous extract of *T. arjuna* bark was evaluated at 63, 125 and 250 mg/kg given orally for antifibrotic and antioxidant effects in male Wistar rats given selective b-adrenoceptor agonist isoprenaline (5 mg/kg) for 28 days Captopril has given orally 50 mg/kg per day, an inhibitor of angiotensin-converting enzyme used as a standard cardioprotective drug | Aqueous extract of *T. arjuna* significantly prevented isoprenaline-induced increase in oxidative stress and decline in endogenous antioxidant level and also prevented fibrosis | Kumar et al[52] |
| Antioxidant and antimicrobial activity | DPPH methods and Agar well diffusion method | Methanol extracts | Methanolic extracts has great free radical scavenging properties. It contains liberal amount of flavonoid compounds. It is exhibited | Mandal et al[53] |

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| | | | good antimicrobial activity against two gram negative bacteria (E. coli and K pneumonia) | |
| Antimicrobial activity | Five bacteria namely Staphylococcus aureus (Gram Positive) Acinetobacter sp., Proteus mirabilis, Escherichia coli and Pseudomonas aeruginosa (Gram negative) were used | Methanol, ethanol, acetone aqueous extracts from the leaves and bark of *T. arjuna.* | Acetone leaf extract was found to be best against S. aureus.Organic extract showed almost equal inhibition of all tested Gram negative bacteria except P. aeruginosa. Aqueous extract of *T. arjuna* bark exhibited good activity against S. aureus | Aneja et al[54] |
| Antimicrobial activity | NZW albino rabbits subjected to 15 min coronary artery ligation followed by 60 min of reperfusion injury | Pretreatment of bark powder of 500e750 mg/kg/day for 12 weeks before ischemic-reperfusion injury | Chronic oral administration of the bark of *T. arjuna* in rabbit causes augmentation of myocardial endogenous antioxidants along with induction of HSP 72. It is offered further protection against oxidative stress associated with myocardial ischemic reperfusion injury. | Gauthaman et al[55] |
| Anticarcinogenic potentia | Adult ventricular myocytes isolated from hearts of adult male Sprague-Dawley rats (250 e300 g) | Ethanolic and aqueous extract of *T. arjuna* at a dose of 0.05 e100 mg/ml | Aqueous extract of *T. arjuna* induced cardiotonic action via enhancing sarcoplasmic reticular function, an unique action minimizing the occurrence of arrhythmias, makes aqueous extract of *T. arjuna* a promising and relatively safe cardiotonic beneficial to the health heart and the treatment for chronic heart diseases | Oberoi et al[56] |
| DNA damage protecting and free radical scavenging | DNA stand breakage assay and comet assay analysis by using of pBR 322 plasmid and rat adrenal PC-12 cell | Ethanolic extracts and its fraction | Ethanolic extracts and its fractions of. *T. arjuna* bark protected H2O2 induced DNA damage. Maximum inhibition of DPPH, hydroxyl, ABTS, nitric oxide radicals and metal chelation was observed in ethyl acetate fraction. *T. arjuna* extracts ameliorate various impairments | Phani Kumar et al[57] |

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| | | | associated with DNA damage and free radical formation | |
| Gastro-productive effect | Diclofenac sodium (DIC) induced gastric ulcer in experimental rats (male albino rats of Wistar e (150e200 g weight) | Methanolic extract of *T. arjuna* | A significant increase was observed in pH, NP-SH, GSH, enzymatic antioxidants, protein bound carbohydrate complexes, adherent mucus content, nucleic acid with a significant decrease in volume of gastric juice, free and total acidity, pepsin concentration, acid output, LPO levels and MPO activities in DIC þ TA rats compared to DIC rats. | Devi et al[58] |

## CONCLUSION

Globally all medicinal plants are local heritage. The review is the compiled information about botanical, ethno-medical, pharmacological studies of Terminalia arjuna**.** The efficacy of Terminalia arjuna has been proved by its scientific evaluation of many bioactive ingredients. On the basis of the available literary evidences, T. arjuna is widely used for treatment of cardiovascular diseases, including heart diseases and related chest pain, high blood pressure and high cholesterol. The plant has many therapeutic uses which can be analysed by referring to traditional ethnomedicinal experts, advisors and literature and it can be scientifically accepted so that side effects and dosage can be measured and quantified. Further studies are also required to evaluate and characterize, functional groups of pharmacologically active compounds by which they manifest various therapeutic actions. However, continuous research progress of using T. arjuna is very much needed in regards to exact molecular mechanism, drug administration, drug-drug interactions and toxicological studies to know its maximum potential in field of medicinal and pharmaceutical sciences for beneficial application.

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