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Mini Review

A Review of T.arjuna revealing phytochemical profile for cardiac activity

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ABSTRACT

According to the World Health Organization, 80% of people worldwide still utilize traditional herbal remedies, and people have traditionally used plant-based drugs to treat a wide range of illnesses. Because they are readily available, reasonably priced, and typically have fewer negative side effects than synthetic medications, these natural alternatives are frequently preferred. T.arjuna (also called Arjuna), a big tree indigenous to the Indian subcontinent that is particularly found in states like Madhya Pradesh, South Bihar, and Uttar Pradesh, is one of these priceless medicinal plants. Arjuna bark is known as a potent cardiotonic and has been used for thousands of years in the Indian medical system to treat a variety of ailments. In addition to heart health, it has historically been used to treat blood issues, anemia, and viral diseases. Although the bark is the main ingredient used in medicine, traditional methods also use fruit paste as a topical treatment, fresh leaf juice for earaches, and root paste for headaches.

INTRODUCTION

Historically, humans relied on plant-based medications to treat numerous health issues. According to WHO data, 80% of the world's population still uses traditional herbal Supplements and medications. In contrast to synthetic drugs, medicinal plants are widely accessible, especially in low-income nations, and typically have few side effects and are non-toxic. They are frequently the preferred course of

treatment, especially in developing countries.(1). In industrialized countries like the USA, 25% of prescription medications contain plant derived ingredients. Many plants have remarkable medicinal capabilities. Approximately,70,000 plant species, including trees and lichens, have been employed for medical purposes(2). The use of therapeutic plants, either alone or in combination, is becoming more and more common in human health care. Many people around the world have sought the use of the plant's bark,

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seeds, roots, berries, leaves, or blossoms for therapeutic purposes because they believe they are less harmful than conventional medications. As a result, using them to treat a variety of illnesses is encouraged. Manufacturers have required to guarantee the addition of excellent extracts utilizing optimal standardization techniques in order to comply with requests for the incorporation of components from therapeutic plants in treatments(3).

Herbal medicines have become even more popular in recent years. due to their efficacy, simplicity of usage, and rare side effects(4). For the past 200 years, plants have been a significant source of medications used in contemporary medicine. Among the hundreds of such instances are digoxin



Fig no. 1: Plant of T.arjuna with fruits and Seeds.

(*Digitalis lanata*), morphine (*Papaver somniferum*), reserpine (*Rauwolfia serpentina*), quinine/quinidine (*Cinchona ledgeriana*), and physostigmine (*Physostigma venenosum*)(5). Medicinal herbs were utilized to prevent a number of serious illnesses in ancient India. One significant source of herbal medications is the kingdom of plants. The significance of therapeutic plants has come to light even in recent years. Herbal medications are typically inexpensive, readily accessible, safe, effective, and rarely cause adverse effects. According to the World Health Organization, medicinal plants are the best source of a variety of drugs.. Bioactive chemicals such as

tannins, alkaloids, carbohydrates, steroids, flavonoids, and phenols are among the organic components found in medicinal plants that have a specific physiological effect on humans(6).

As early as 500 BC, it was discovered that *T.arjuna* had cardiovascular benefits, and for more than three centuries, its bark was utilized as a cardiogenic in Indian traditional medicine(7). The majority of diseases, including cancer, diabetes, ulcers, coughing, excessive perspiration, asthma, and Chest pain and inflammation, are currently treated with very few plant products in the modern medical system, despite the Subcontinent's traditional medical system using a wide variety of plants to treat various conditions. The Indian subcontinent is the natural home of the medicinal plant *T.arjuna*, commonly referred to as "Arjuna." Heart failure, atherosclerosis, ischemic cardiomyopathy and myocardial necrosis have all been treated with it as a cardiogenic. Along with maintaining good health, it has also been used to treat a number of human ailments, such as blood problems, anemia, and viral fever and venereal illnesses(8). Terminalia plants are widely recognized in folklore worldwide for its biochemical and antioxidant qualities(9). Numerous experimental research have clearly shown *T.arjuna*'s effectiveness as a cardio protective agent, a strong anti-inflammatory and antioxidant that inhibits the oxidation of LDL cholesterol, and its capacity to lower atherogenic lipid levels(10). Bark extracts from *T. arjuna* considerably lower blood pressure and improve lipid profiles(11). The majority of India, Burma, and Sri Lanka are home to *T.arjuna* Wight & Arn. It is essentially found in the Deccan, Madhya Pradesh, South Bihar, and Uttar Pradesh sub-Himalayan regions. For thousands of years, the Indian medical system has utilized *T. arjuna* bark to treat a wide range of illnesses(12). Arjuna's stem, bark, fruits, and leaves are typically utilized in medicine. Root paste is used to relieve

headaches, and the juice of fresh leaves is used to treat earaches. In south India, fruit paste was applied topically as a traditional remedy. Additionally, it was used to cure dyspepsia, cough, and sore throat. The bark was the primary component utilized in allopathy and Ayurveda to treat a variety of illnesses. Bark ash is recommended for scorpion stings and snakebite. The actions included astringent, cooling cardio tonic, anti-dysentery, urinary astringent, hypertension, bleeding, blood-related diarrhea, liver cirrhosis, inflammation, and skin disorders(13).

It has been demonstrated to lower blood cholesterol and triglyceride levels, restore high density lipoprotein levels, prevent ischemia, alleviate myocardial necrosis, control platelet aggregation, and operate as an efficient antioxidant. It has long been recognized as a heart stimulant, and numerous indigenous medical systems recommend it to treat various issues. Several studies have examined this plant's ethnomedical significance in relation to cardiovascular conditions. According to experiments, *T. arjuna* bark significantly reduced

cholesterol, had hypotensive and inotropic effects, and enhanced coronary artery flow to shield the heart from ischemia injury. Despite reports of *T. arjuna*'s potent antioxidant, antibacterial, and other health-promoting qualities, its use as a natural preservative or functional component in the food sector is still untapped and requires additional scientific research. In light of the aforementioned information, the goal of the current study was to investigate the potential use of *T. arjuna* as a natural preservative and functional ingredient in muscle meals. The purpose of the study was to assess how various *T. arjuna* concentrations affected the lipid oxidative stability and storage quality of chevon sausages(14).

Taxonomical data:

T.arjuna Wight & Arn. is found in most of Sri Lanka, Burma, and India. From a practical standpoint, it can be found in the Deccan, Madhya Pradesh, South Bihar, and Uttar Pradesh sub-Himalayan regions parts. For thousands of years, *T. arjuna* bark has been utilized in Indian medicine to treat a variety of illnesses.(15)

| Sr.no | Taxonomical Class | Taxonomical Identity |
|-------|-------------------|---|
| 1. | Common Name | Arjuna tree, White Murdah |
| 2. | Kingdom | Plantae |
| 3. | Division/Phylum | <i>Magnoliophyta/Tracheophyta</i> |
| 4. | Class | <i>Magnoliopsida (Dicotyledons)</i> |
| 5. | Order | <i>Myrtales</i> |
| 6. | Family | <i>Combretaceae (Bushwillow family)</i> |
| 7. | Genus | <i>Terminalia</i> |
| 8. | Species | <i>T. arjuna</i> |

Phytochemical profile & phytoconstituent:

Arjun, also known as *T.arjuna*, is a big tree that is found throughout South Asia and is a member of the family Combretaceae. Because of its well-known astringent, anti-diarrheal, antipyretic, lithotriptic, hypolipidemic, and cardioprotective qualities, *T. arjuna* is frequently employed in

traditional medicine. It has been used to treat a number of human illnesses, including degenerative disorders, anemia, atherosclerosis, ischemia and cardiomyopathy. Research has shown that *T. arjuna* bark alcoholic extract has antioxidant and antibacterial qualities(16). In therapeutic plants, the primary or secondary metabolism produces the

active phytochemicals. Chemically and taxonomically, secondary metabolites are incredibly varied substances with unclear functions. In addition to many other fields, they are extensively utilized in human therapy, veterinary medicine, agriculture, and scientific research. A number of degenerative diseases can be prevented by medicinal plants that possess active chemical ingredients with strong antioxidant properties. These plants may also benefit humanity(6,8). *T. arjuna* has yielded numerous significant chemical compounds that are physiologically active(5).

The *T. arjuna* plant is known for containing a variety of naturally occurring classes of medicinally significant substances. For example, it has high concentrations of polyphenolic compounds (60–70%), such as gallic acid, ellagic acid, arjunolone, arjunone, oligomeric proanthocyanidins, and others(17). Numerous beneficial substances, including flavanoids, tannins, phenols, phytosterols, saponins, and alkaloids, are found in *T. arjuna* (18). Flavonoids are primarily responsible for its antioxidant action. *T. arjuna*'s antimicrobial and antioxidant qualities are the cause of its high flavonoid content. *T. arjuna* has potent hydrolipidemic characteristics. It is thought that *T. arjuna*'s cardioprotective qualities may be attributed to its saponin

glycosides, while its flavonoids and phenolics may provide antioxidant activity(16).

Total polyphenol, protein, carbohydrates, triterpenes, and ash content were all assessed in the compositional analysis of the aqueous extract (AE) of *T. arjuna*. According to a compositional analysis, *T. arjuna* (AE) included less than 1% triterpenes, 44% polyphenols, 12% sugars, 30% proteins, and 5% ash., protein, triterpenes, and ash content were all assessed in the compositional analysis of the aqueous extract (AE) of *T. arjuna*. According to a compositional analysis, *T. arjuna* (AE) included less than 1% triterpenes, 44% polyphenols, 30% proteins, 12% sugars and 5% ash. The amount of polyphenol in *T. arjuna* (AE) is incredibly high when compared to other well-known sources, such as tea and grapes. Only three polyphenols have been discovered to date, despite *T. arjuna* (AE) having a significant polyphenol concentration(19). Several bioactive components, such as arjunolic acid, arjunic acid, arjungenin, gallic acid, ellagic acid, β -sitosterol, terminolic acid, and casuarinin, were isolated from the bark of *T. arjuna* and characterized. Hepatoprotective, anti-histamine, anti-anaphylactic, antibacterial, anti-cancer, antiviral, antioxidant, and wound-healing properties were among the many medicinal advantages of *T. arjuna* (BTA) bark(8).

Table no. 1: Description of phytoconstituent from *T.arjuna*.

| Sr. No | Chemical Type | Major Chemical constituents | Found in part of plant | Reference |
|--------|----------------------------|---|------------------------|--|
| 1. | Triterpenoids | Arjunin Arjunic acid Arjungenin Terminic acid Terminoltin Arjunolic acid | Stem bark | Augustine et.al(20). Dinanath et. al(3). Hafsa et. al(8) |
| 2. | Triterpenoids & Flavonoids | Myristyl oleate, β -Sitisterol, Fridelin, Cerasidin, Arjunone | Fruits | Augustine et. al(20). Dinanath et. al(3) Hafsa et.al |

| | | | | |
|----|-----------------------------|--|-----------|--|
| 3. | Glycosides | Terminarjunoside I and II Terminoside Termionic acid Arjunoside I, II Arjunolone Arjunolitin Arjunaphthanoloside | Stem bark | Augustine et. al(20). Dinanath et. al(3) Hafsa et. al(8) |
| 4. | Tannins | Castalagin, Casuarinin, Casuariin, Terflavin C, Terchebulin, Punicallin | Stem Bark | Augustine et. al(20). Dinanath et. al(3) Hafsa et. al(8) |
| 5. | Minerals and trace elements | Calcium, magnesium, zinc, copper, silica, aluminium | Stem Bark | Augustine et. al(20) Hafsa et. al(8) |

Pharmacology action:

Pharmacological activity and the presence of phytoconstituents have been investigated in an extensive number of plant sections. *T. arjuna* is an excellent hypolipidemic, hypocholesteremic, anticoagulant, antithrombotic, antiviral, antihypertensive, antifungal, and antibacterial drug.. It was first identified as "Hirdya," a medication that fortifies the heart, but additional research and clinical data indicate that it also has strong antiviral and anticancer properties(12). *T. arjuna* bark powder's enormous potential to treat dyslipidemia in conjunction with statins was confirmed when it was administered for three months to thirty patients with CAD. This resulted in a 16% decrease in low-density lipoprotein cholesterol, a 15% decrease in total cholesterol, and an 11% decrease in triglycerides. The inclusion of several bioactive substances, including tannins, flavonoids, and phenolics, makes this plant useful for hepatoprotection(3). Numerous recent research have demonstrated *T. arjuna*'s antioxidant properties. It has been documented that pulverized *T. arjuna* bark powder

has an antioxidant effect on ischemia perfused rat hearts(5).

Anti-microbial activity:

Proteus vulgaris, *Escherichia coli*, and *Pseudomonas aeruginosa* were all susceptible to the antimicrobial action of an aqueous extract from *Arjuna* bark. According to reports, *Arjuna* leaves and bark extracts in acetone, alcohol, and water exhibit antimicrobial action. The most effective leaf extract against *S. aureus* is acetone.(21).

Anti-diabetic activity:

An ethanolic extract containing the stem bark of *T. arjuna* was tested for possible antidiabetic effects. The study also examined the activity of gluconeogenic enzymes including glucose-6-phosphatase and fructose-1,6-diphosphatase in both normal and alloxan-induced diabetic rats, as well as specific liver and kidney enzymes such hexokinase, aldolase, and phosphoglucoisomerase. The researchers noticed a notable drop in blood glucose levels after oral administration of the ethanolic bark extract for 30 days at doses of 250 and 500 mg/kg body weight. The blood glucose levels decreased from $302.67 \pm$



22.35 to 82.50 ± 04.72 . The study also found that the tissues under investigation had higher levels of phosphoglucoisomerase and hexokinase and lower levels of glucose-6-phosphatase, fructose-1,6-diphosphatase, and aldolase. It's important to note, nevertheless, that these enzyme activities had a comparatively minor effect when the extract was administered at a level of 250 mg/kg body weight(8).

Lipid lowering effect:

Lipid lowering activity: Compared to the induced animals, the rats given *T.arjuna* showed a significant decrease in total cholesterol, LDL cholesterol, triglycerides and VLDL cholesterol as well as an increase in HDL cholesterol. Thus, the most effective hypolipidemic and hyperglycemic drug was found to be *T.arjuna*. *T. arjuna* dramatically lowers LDL, triglycerides, and total cholesterol while raising HDL and reducing atherosclerotic lesions in the aorta (22). Therefore, *T. arjuna* extract can successfully stop atherosclerosis from getting worse. This is probably because of how *T. arjuna* affects serum lipoproteins and because of its anti-inflammatory and antioxidant qualities. In rats fed a diet high in fat and cholesterol, arjuna bark reduces oxidative stress, hypolipidemia, and hypocholesterolemia(22).

Coronary flow enhancer:

Coronary flow in an isolated perfused rabbit heart, a 400 µg dosage of *T.arjuna* (Aqueous Extract) increased coronary flow and caused dose-dependent bradycardia. However, the agent turned out to be less effective than digoxin since the doses needed were higher. When 1024 µg/ml of TA extract was administered to the isolated perfused rabbit heart, the coronary flow was markedly improved(22).

Antioxidants activity:

Polyphenols, flavonoids (luteolin, kaempferol), and tannins (gallic acid, ellagic acid) found in *T.arjuna* are potent antioxidants. By scavenging free radicals, these substances lessen oxidative damage to the liver, heart, and neurological system. Its antioxidant properties also support neuroprotection, anti-aging, and a lower incidence of chronic illnesses(23).

Anti-inflammatory action:

Arjuna is helpful in the treatment of inflammatory diseases since its flavonoids and triterpenoids have anti-inflammatory qualities. It helps with chronic inflammatory illnesses, cardiovascular inflammation, and arthritis by lowering the synthesis of pro-inflammatory cytokines. It is well known that the bark extract lowers blood vessel inflammation, which lowers the risk of heart disease and atherosclerosis(23).

Marketed example:

Countless Ayurvedic formulations, consisting of Asvagandharishtam, Ayaskriti, Parthadyarishtam, Aravindasavam, Devadarvyarishtam, Nyagrodhadi kashayam, Virataradi kashayam, Trikantakadi ghritam, Virataradi ghritam, Sarvamayantaka ghritam, Lakshaguggulu, Arimedadi tailam, Nagarjunabhra rasa, and Arjunaghritam are prepared with arjuna bark(24). Additionally, the bark powder is readily accessible without a prescription as an over-the-counter (OTC) medicine. *T. arjuna* has yielded numerous significant chemical compounds that are physiologically active. These consist of minerals (magnesium, calcium, zinc, and copper), tannins (ellagic acid, gallic acid), flavonoids (luteolin, leucocyanidin), and triterpenoids (such as arjunolic acid, arjunic acid, arjungenin, and arjunoglucoside)(5).





Fig no. 2: Arjuna Tablet



Fig no. 3: Arjuna powder



Fig no. 3: Arjuna tincture

CONCLUSION

In brief, *T.arjuna* is a highly significant medicinal plant that connects ancient therapeutic methods with modern pharmacology research. A thorough examination of its phytochemical profile reveals an exceptionally high concentration of bioactive components, including polyphenols (60-70%), flavonoids, tannins, and powerful triterpenoids like arjunolic and arjunic acid. These varied phytoconstituents are directly responsible for its wide range of medicinal properties. Extensive research supports its major efficacy as a cardioprotective and hypolipidemic drug, capable of considerably lowering total cholesterol, LDL, and triglycerides while improving coronary flow and HDL. Furthermore, its anti-diabetic, antioxidant, anti-inflammatory, and antibacterial characteristics demonstrate its usefulness in treating complicated metabolic and chronic illnesses. *T. arjuna* stands out as a highly promising natural alternative for controlling cardiovascular health and overall well-being due to its safety, cost-effectiveness, and availability in several traditional Ayurvedic formulations such as Parthadyarishtam and Arjunaghritam.

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