

Chapter VI

The Ancient Healer: Exploring the Medicinal Properties of *Terminalia arjuna*(Roxb. ex DC.) Wight & Arn.

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ABSTRACT

Terminalia arjuna, commonly known as Arjuna, is a deciduous tree of the family Combretaceae, widely distributed across the Indian subcontinent. Renowned in traditional medicine, especially Ayurveda, it has been utilized for its cardioprotective, hepatoprotective, and antioxidant properties. The bark, rich in bioactive compounds such as flavonoids, tannins, glycosides, and triterpenoids, is a key therapeutic part of the plant. It is traditionally used to treat cardiovascular disorders, diabetes, ulcers, and respiratory ailments. Modern pharmacological studies corroborate its efficacy in improving cardiac function, reducing hypertension, and enhancing lipid metabolism. This study highlights the importance of *Terminalia arjuna* in traditional medicine and modern pharmacology and advocates for its sustainable utilization and further research to unlock its full potential.

Keywords: *Terminalia*, therapeutic potential, pharmacological uses, bioactive compounds

INTRODUCTION

Terminalia arjuna, commonly known to as Arjuna, is a deciduous tree belonging to the Combretaceae family, predominantly found across the Indian subcontinent. This plant has been integral to traditional Ayurvedic medicine for centuries, primarily recognized for its cardioprotective properties. The bark of *T. arjuna* has been extensively utilized in treating various cardiovascular ailments, including ischemic heart disease, hypertension, and heart failure. The historical significance of this plant in Ayurvedic practices dates back to at least 500 BC, where it was esteemed for its ability to enhance cardiac function and overall health (Harshita and Sharma 2021; Kaur et al. 2014). The therapeutic efficacy of *T. arjuna* is attributed to its rich phytochemical profile, which includes flavonoids, tannins, glycosides, and triterpenoids such as arjunic acid and arjungenin (Thakur et al. 2021). These compounds exhibit a range of biological activities, including antioxidant, anti-inflammatory, and hypolipidemic effects. Extracts from *T. arjuna* can significantly lower total cholesterol, triglycerides, and low-density lipoprotein (LDL) levels in hyperlipidemic models (Barman and Das 2012; Borde et al. 2018). Additionally, the antioxidant properties of the plant's constituents help mitigate oxidative stress, which is a contributing factor in cardiovascular diseases (Gauthaman et al. 2005; Hebbani et al. 2021). Furthermore, the plant has the ability in managing diabetes and improve insulin sensitivity (Barman and Das 2012; Borde et al. 2018; Dwivedi and Chopra 2014). In addition to its cardiovascular and antidiabetic effects, *T. arjuna* has been explored for its anticancer properties (Kuo et al. 2005). *Terminalia arjuna* is a significant medicinal plant with a long history of use in traditional medicine. Its diverse pharmacological properties, particularly in

cardiovascular health and metabolic regulation, make it a valuable subject for further research and clinical application.

MORPHOLOGY

It is a large evergreen deciduous tree that can grow to a height of 20-25 m with a wide spreading canopy. The bark is smooth, grayish-white or slightly pinkish, silvery-gray in colour, shedding in thin strips. This is one of the main parts used medicinally because of the high content of phytochemicals. The leaves are simple, opposite, and sub-opposite in arrangement. The leaves are elongated or elliptic, with rounded or slightly notched apex and glabrous leathery texture. Leaves are about 10-20 cm long, 4-7 cm wide, shiny dark green above and with pale underside. Flowers are small, inconspicuous, and yellowish to whitish, borne in clusters (spikes) in leaf axils. They bloom usually between March and June. The flowers are mildly aromatic and are bisexually-both male and female parts are found. The fruit is a woody, fibrous drupe shaped like an elongated-2.5-5 cm long and having five to seven hard-winged ridges [Plate 1]. Fruits mature in the fall from September to December (Kumar et al. 2022; Saxena and Brahman 1995).

MEDICINAL USES

Ayurvedic medicine has a high esteem for Arjuna, due to its apparent health benefits with a focus on conditions affecting the heart. Ancient texts describe it as a “heart tonic,” and it has been widely used to treat cardiovascular conditions (Verma et al. 2023). The bark, rich in tannins, saponins, and glycosides, is often prepared as a decoction or powder to

strengthen the heart muscles, regulate blood pressure, and alleviate symptoms of heart diseases (Maulik and Talwar 2012). Traditional healers used Arjuna to manage heart palpitations and reduce cholesterol levels, making it a staple in Ayurvedic heart care. The therapeutic applications of *T. arjuna* extend beyond cardiovascular health; it has been traditionally used to treat conditions such as ulcers, diabetes, and dysentery (Kaur et al., 2014; Tahsin et al. 2021). *T. arjuna* can also be used for the treatment of respiratory disorders in addition to heart problems. Its use in alleviating asthma, bronchitis, and coughs has been attributed to its anti-inflammatory and soothing qualities. The bark has a cooling and astringent property and has therefore been used traditionally for the treatment of wounds, skin ulcers, and burns, and, in some cases, has been applied as a paste to relieve burnt skin or mixed into other ingredients for treating digestive complaints such as diarrhoea and dysentery. *Terminalia arjuna* has a long history of being used in traditional medicine as a panacea for any and every ailment affecting the heart, lungs, and skin (Kaur et al. 2014; Verma et al. 2023).

BIOACTIVE COMPOUNDS

Terminalia arjuna is recognized for its diverse bioactive compounds that contribute to its therapeutic efficacy. The bark of *T. arjuna* is particularly rich in phytochemicals, including tannins, flavonoids, glycosides, and triterpenoids, which are responsible for its various pharmacological activities (Abo-Elghiet et al. 2022; Kaur et al. 2014; Stepnik 2023). Among these compounds, triterpenoid saponins such as arjunic acid and arjunolic acid have been highlighted for their cardioprotective properties, while flavonoids like quercetin exhibit significant antioxidant effects (Amalraj and Gopi 2017; Tahsin et al. 2021). Phytochemical screening has revealed

that *T. arjuna* contains a variety of bioactive constituents, including phytosterols, lactones, and phenolic compounds, which contribute to its anti-inflammatory and antioxidant properties (Mandal et al. 2013). The presence of these compounds allows *T. arjuna* to scavenge reactive oxygen species (ROS), thereby mitigating oxidative stress, which is implicated in numerous chronic diseases (Chatha et al. 2014; Tahsin et al. 2021). *T. arjuna* is a valuable source of bioactive compounds that confer a wide range of health benefits. Its rich phytochemical profile, characterized by triterpenoids, flavonoids, and tannins, supports its use in traditional medicine for the treatment of various ailments, particularly those related to cardiovascular health and oxidative stress. Different triterpenoids, such as arjunolic acid, arjunic acid, arjungenin, arjunetin, arjunoglycoside, arjunoglucoside, arjunoside, arjunoside, arjunoside, terminic acid, arjunolitin, terminolitin, arjunoside, methyl oleanate, arjunetoside, lupeol, oleanolic acid, arjunoglucoside, β -sitosterol-d-glucoside, arjunin, casuarinin, ellagic acid, and gallic acid, as well as flavonoids like leucocyanidin, cerasidin, quercetin-7-o-rhamnoside, and luteolin, were isolated from different parts of the plant (Jain et al. 2009).

PHARMACOLOGICAL USES

T. arjuna is a significant medicinal plant in traditional Ayurvedic medicine, primarily recognized for its cardioprotective properties. The pharmacological uses of *T. arjuna* are extensive, with a focus on cardiovascular health, metabolic disorders, and various other therapeutic applications. The bark of *T. arjuna* is particularly noted for its ability to manage coronary artery diseases, heart failure, and hypercholesterolemia, primarily due to its antioxidant properties that help in scavenging free

radicals (Subramaniam et al. 2011). The active constituents of *T. arjuna*, including tannins, flavonoids, and triterpenoid saponins, contribute to its cardiogenic effects, which have been validated through various studies (Kaur et al. 2014; Ramesh and Palaniappan 2023).



Plate 1: Vegetative parts of *T. arjuna* a) Leaf and flower, b) bark, c) Inflorescence, d) flowers, e) fruits

It exhibits significant hypolipidemic effects, leading to reductions in total cholesterol (TC), triglycerides (TG), very low-density lipoprotein (VLDL), and low-density lipoprotein (LDL) levels in hyperlipidemic models (Tahsin et al. 2021). These effects are attributed to the plant's ability to modulate lipid metabolism and enhance antioxidant defences, which collectively mitigate oxidative stress associated with cardiovascular diseases (Gauthaman et al. 2005). Furthermore, *T. arjuna* has been shown to improve endothelial function and reduce the risk of ischemic heart disease, making it a valuable therapeutic agent in the management of cardiovascular conditions (Ramesh and Palaniappan 2023). In addition to its cardiovascular benefits, *T. arjuna* has demonstrated anti-diabetic properties. Extracts from the bark can enhance insulin sensitivity and improve glycemic control in diabetic models (Dwivedi and Chopra 2014). Its anti-inflammatory properties, mediated by the inhibition of prostaglandin production, further support its use in treating conditions characterized by inflammation (Tahsin et al. 2021). The plant's ability to enhance baroreflex sensitivity and myocardial function further underscores its role in managing heart-related ailments (Parveen et al. 2012). Furthermore, studies have indicated that *T. arjuna* possesses hepatoprotective effects, particularly against cadmium-induced toxicity, highlighting its potential in detoxification and liver health (Haidry and Malik 2014). The antimicrobial activity of *T. arjuna* is another significant aspect of its pharmacological profile. The plant has shown efficacy against various pathogens, including bacteria and fungi, which can be attributed to its rich phytochemical composition (Abo-Elghiet et al. 2022; Akter et al. 2019; Gupta and Kumar 2017). This antimicrobial property is particularly relevant in the context of treating infections and enhancing overall health,

further establishing *T. arjuna* as a versatile medicinal plant. It has been explored for its anti-urolithic effects, with studies indicating its ability to inhibit calcium oxalate crystal formation, thereby preventing kidney stones (Mittal et al. 2015). The extract's protective effects against oxidative damage, particularly in erythrocyte membranes, also underscore its potential in mitigating oxidative stress-related disorders (Hebbani et al. 2021).

CONCLUSION

T. arjuna is a revered medicinal tree in India, deeply rooted in traditional Ayurvedic practices and known for its significant health benefits, particularly for cardiovascular health. The tree's bark, enriched with bioactive compounds such as tannins, flavonoids, triterpenoids, glycosides, and saponins, has made it a cornerstone in treating heart ailments, regulating blood pressure, and reducing cholesterol levels. Beyond heart health, *T. arjuna* offers anti-inflammatory, antioxidant, hepatoprotective, and antimicrobial properties, supporting diverse treatments for respiratory, digestive, and skin-related conditions. As research continues to validate its traditional uses, *T. arjuna* stands out as a natural, multifaceted remedy with therapeutic potential that extends beyond traditional medicine into modern healthcare.

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