PHARMACOLOGICAL PROFILE AND ANTITHROMBOTIC POTENTIAL OF *CYNODON DACTYLON*: A COMPREHENSIVE REVIEW

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Abstract

Secondary metabolites obtained from medicinal plants continue to play a major role in modern drug discovery due to their structural diversity and wide therapeutic potential. *Cynodon dactylon* (L.) Pers., commonly known as Bermuda grass, is traditionally used in Ayurveda, Siddha, and folk medicine for the treatment of bleeding disorders, inflammation, wounds, and metabolic diseases. The present review summarizes the pharmacological profile and antithrombotic potential of *Cynodon dactylon* based on available scientific literature. The review discusses platelet physiology, platelet activation pathways, thrombotic disorders, phytochemical constituents, pharmacological activities, and experimental evidence related to antiplatelet and antithrombotic properties of the plant. Various studies have reported antioxidant, anti-inflammatory, antimicrobial, antidiabetic, antiviral, hepatoprotective, and wound healing activities of the plant, which are mainly attributed to flavonoids, phenolic compounds, alkaloids, glycosides, and terpenoids. Experimental findings suggests that the plant may inhibit platelet aggregation and thrombus formation by modulating platelet activation pathways. The review highlights the therapeutic relevance of *Cynodon dactylon* as a promising natural source for the development of safer antithrombotic agents.

Keywords— *Cynodon dactylon*, Antiplatelet Activity, Antithrombotic Activity, Medicinal Plants, Platelet Activation

I. INTRODUCTION

Natural products remain among the most important sources for the discovery and development of therapeutic agents. Medicinal plants possess structurally diverse secondary metabolites that exhibit a wide range of biological activities. Despite advances in synthetic chemistry, plant-derived compounds continue to contribute significantly to modern pharmacology and drug development [1], [2].

Traditional medicine systems such as Ayurveda, Siddha, and Traditional Chinese Medicine have long utilized medicinal plants for the treatment of several diseases. Many modern drugs, including quinine, morphine, paclitaxel, and artemisinin, were originally derived from natural sources [3], [4]. Modern technologies such as molecular docking, bioinformatics, and phytochemical analysis have further strengthened the role of medicinal plants in therapeutic research.

Cynodon dactylon (L.) Pers., commonly known as Bermuda grass or Arugampul, belongs to the family Poaceae and is widely distributed in tropical and subtropical regions. The plant has been traditionally been used for wound healing, control of bleeding, urinary disorders, inflammation, and fever. Recent pharmacological studies have demonstrated antioxidant, anti-inflammatory, antimicrobial, antidiabetic, hepatoprotective, antiviral, and antithrombotic activities of the plant [5].

This review focuses on the pharmacological profile and antithrombotic potential of *Cynodon dactylon* with special emphasis on platelet biology, platelet activation pathways, and therapeutic applications.

II. MEDICINAL PLANTS AND NATURAL PRODUCTS

Medicinal plants are plants containing biologically active compounds with therapeutic value. Plant-derived secondary metabolites such as alkaloids, flavonoids, tannins, glycosides, terpenoids, and phenolic compounds possess antioxidant, antimicrobial, anti-inflammatory, and anticancer activities [6].

The World Health Organization estimates that nearly 80% of the world population relies on traditional medicine for primary healthcare. Medicinal plants continue to provide affordable and accessible healthcare, especially in developing countries.

A. Historical Importance of Medicinal Plants

Medicinal plants have been used for thousands of years in different traditional systems:

- Ayurveda in India documented medicinal plants in the Charaka Samhita and Sushruta Samhita.
- Traditional Chinese Medicine recorded several medicinal herbs in the Shennong Ben Cao Jing.
- Ancient Egyptian medicine described medicinal plants in the Ebers Papyrus.
- Hippocrates emphasized the therapeutic role of plant-derived remedies.

B. Significance in Modern Medicine

Plant-derived compounds continue to contribute to modern drug discovery. Medicinal plants provide:

- Novel lead molecules for pharmaceutical research
- Cost-effective therapeutic agents
- Eco-friendly alternatives to synthetic drugs
- Safer treatment approaches with fewer adverse effects

III. MOLECULAR DOCKING

Molecular docking is an important computational technique used to predict interactions between phytochemicals and target proteins. Docking studies help identify potential therapeutic compounds by evaluating binding affinity and molecular interactions. This technique supports the development of plant-based drugs by reducing the time and cost associated with experimental screening [7].

IV. OVERVIEW OF PLATELETS AND HEMOSTASIS

Platelets are small anucleate cytoplasmic fragments derived from megakaryocytes. They play an essential role in hemostasis by preventing blood loss after vascular injury. Platelet activation occurs when platelets come into contact with exposed collagen and von Willebrand factor following endothelial damage [8].

Hemostasis occurs through:

• Primary hemostasis
• Secondary hemostasis
• Fibrinolysis

During platelet activation, platelets release adenosine diphosphate (ADP), thromboxane A_2, calcium ions, and serotonin, which promote platelet aggregation and thrombus formation.

A. Platelet Morphology

Platelets contain:

• Peripheral membrane system
• Cytoskeletal zone
• Organelle zone
• Dense tubular system

The platelet membrane contains glycoprotein receptors such as GPIb-IX-V and GPIIb/IIIa, which are essential for platelet adhesion and aggregation [9].

B. Platelet Functions

Platelets perform several physiological functions including:

• Formation of primary platelet plug
• Promotion of coagulation
• Maintenance of vascular integrity
• Release of inflammatory mediators
• Wound healing and tissue repair

V. PATHOPHYSIOLOGY OF PLATELET ACTIVATION

Platelet activation is a highly regulated physiological process. Excessive platelet activation contributes to thrombotic disorders such as myocardial infarction and ischemic stroke [10].

Following vascular injury, platelets adhere to exposed collagen through glycoprotein receptors. Activated platelets release ADP and thromboxane A_2, which amplify platelet recruitment and aggregation. Activation of GPIIb/IIIa receptors promotes fibrinogen-mediated platelet cross-linking and thrombus formation.

Oxidative stress, inflammation, endothelial dysfunction, diabetes mellitus, smoking, and hyperlipidemia increase platelet reactivity and contribute to thrombosis.

VI. PLATELET HYPERACTIVITY AND THROMBOTIC DISORDERS

Platelet hyperactivity is associated with abnormal thrombus formation in arteries and veins. Excessive platelet aggregation contributes to cardiovascular diseases including:

- Myocardial infarction
- Ischemic stroke
- Atherosclerosis
- Venous thrombosis

Current antiplatelet drugs are effective but may produce adverse effects such as bleeding complications and drug resistance. Therefore, medicinal plants are being investigated as safer alternatives for antithrombotic therapy [11].

VII. MECHANISM OF ANTITHROMBOTIC

The antithrombotic activity of *Cynodon dactylon* is mainly attributed to its rich phytochemical constituents such as flavonoids, phenolic compounds, alkaloids, and terpenoids. These bioactive compounds interfere with different stages of platelet activation, aggregation, and thrombus formation.

Following vascular injury, platelets adhere to exposed collagen and become activated through the release of mediators such as adenosine diphosphate (ADP), thromboxane A_2 (TXA_2), serotonin, and calcium ions. Activated platelets express glycoprotein IIb/IIIa receptors, which promote fibrinogen-mediated platelet aggregation and thrombus formation.

Flavonoids and phenolic compounds present in *Cynodon dactylon* may inhibit platelet activation by reducing oxidative stress and suppressing the synthesis of thromboxane A_2. The antioxidant activity of the plant helps in scavenging reactive oxygen species, thereby protecting endothelial cells and reducing platelet hyperreactivity. In addition, certain phytoconstituents may inhibit intracellular calcium mobilization and ADP-induced platelet aggregation.

The anti-inflammatory activity of the plant also contributes to its antithrombotic effect by decreasing inflammatory mediators involved in endothelial dysfunction and vascular injury. Through these combined mechanisms, *Cynodon dactylon* may reduce platelet aggregation, prevent thrombus formation, and improve vascular health.

However, further molecular and clinical studies are required to clearly establish the exact pathways and therapeutic efficacy of *Cynodon dactylon* as a natural antithrombotic agent.

VIII. PLANT PROFILE OF *CYNODON DACTYLON*

A. Botanical Classification

Category	Classification
Kingdom	Plantae
Division	Magnoliophyta
Class	Monocotyledonae
Order	Poales
Family	Poaceae
Genus	Cynodon

Category	Classification
Species	*Cynodon dactylon*

B. Vernacular Names

Language	Name
English	Bermuda Grass
Tamil	Arugampul
Hindi	Doob Grass
Sanskrit	Durva
Telugu	Garikagoddi
Malayalam	Karuka
Kannada	Garike Hullu

C. Distribution

Cynodon dactylon is widely distributed in tropical and subtropical regions. In India, it commonly grows in grasslands, roadsides, agricultural lands, and wastelands.

D. Phytochemical Constituents

Major phytochemicals present in *Cynodon dactylon* include:

- Flavonoids
- Phenolic compounds
- Alkaloids
- Glycosides
- Saponins
- Tannins
- Terpenoids

These phytochemicals contribute to the therapeutic activities of the plant.

IX. PHARMACOLOGICAL ACTIVITIES OF *CYNODON DACTYLON*

A. Anti-Inflammatory Activity

Studies have shown that ethanolic extracts of *Cynodon dactylon* significantly reduce carrageenan-induced paw edema in animal models [12].

B. Antioxidant Activity

The flavonoid and phenolic contents of the plant exhibit free radical scavenging activity and reduce oxidative stress [13].

C. Antidiabetic Activity

Experimental studies demonstrated antihyperglycemic activity in alloxan-induced and streptozotocin-induced diabetic models [14], [15].

D. Antimicrobial Activity

The plant exhibits antibacterial and antifungal activity against several Gram-positive and Gram-negative microorganisms [16].

E. Antiviral Activity

Flavonoid-rich extracts of *Cynodon dactylon* demonstrated *In-vitro* inhibitory activity against chikungunya virus [17].

F. Hepatoprotective and Wound Healing Activity

The plant protects against chemically induced liver damage and promotes tissue regeneration and epithelialization [18].

G. Antiplatelet and Antithrombotic Activity

Polyphenolic compounds present in medicinal plants have shown significant antiplatelet activity through inhibition of platelet activation pathways [19].

X. LITERATURE REVIEW

A. Fernández-Rojas et al.

Fernández-Rojas et al. reviewed antiplatelet, anticoagulant, and fibrinolytic activities of orchid molecules and highlighted the therapeutic potential of natural products as antithrombotic agents [20].

B. Ibrahim et al.

Ibrahim et al. reported significant antioxidant and antimicrobial activity of *Cynodon dactylon* extracts against *Escherichia coli* and *Staphylococcus aureus* [21].

C. Kim et al.

Kim et al. investigated cirsilineol isolated from *Artemisia vestita* and demonstrated potent antiplatelet and anticoagulant activity through inhibition of factor Xa [22].

D. Furhatun-Noor et al.

The ethanolic extract of *Cynodon dactylon* showed significant analgesic and anti-inflammatory activity in stressed rodent models [23].

E. Choi et al.

Cordyceps militaris extract exhibited significant antiplatelet and antithrombotic activity in thrombosis models [24].

XI. AIM AND OBJECTIVES

A. Aim

This review aims to systematically summarize the pharmacological profile and antithrombotic potential of *Cynodon dactylon*.

B. Objectives

- To review published literature related to *Cynodon dactylon*
- To summarize antiplatelet and antithrombotic activities
- To identify major phytoconstituents responsible for pharmacological activity
- To evaluate therapeutic potential and future clinical applications

XII. CONCLUSION

Cynodon dactylon is an important medicinal plant possessing diverse pharmacological properties including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, antiviral, hepatoprotective, wound healing, antiplatelet, and antithrombotic activities. The presence of flavonoids, phenolic compounds, alkaloids, and terpenoids contributes significantly to its therapeutic effects. Experimental evidence supports the role of the plant in inhibition of platelet aggregation and thrombus formation. Further preclinical and clinical studies are required to establish its efficacy and safety as a natural antithrombotic agent.

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