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RESEARCH ARTICLE

A COMPREHENSIVE REVIEW ON PHYTOCHEMICALS, AND MEDICINAL APPLICATIONS OF CASSIA AURICULATA (L.,)

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Abstract

Cassia auriculata L. (syn. Senna auriculata; family: Fabaceae) is a shrub long used in traditional medicine, especially in South Asia, for diabetes, skin and eye disorders, and inflammatory conditions. Modern phytochemical studies show the plant contains flavonoids, phenolics, anthraquinones,saponins,tannins,terpenoids and glycosides. Pharmacol ogical investigations(in vitro and in vivo)report antioxidant, antihypergl ycemic,hepatoprotective,anti inflammatory,antimicrobial,and anticance r activities. While preclinical evidence is promising, standardization, bioavailability studies, mechanistic molecular work and human clinical trials remain limited. This review summarizes current phytochemical constituents, summarizes major pharmacological findings, highlights knowledge gaps, and suggests directions for future research.

Introduction:-

Cassia auriculata (avartaki/avaram) is native to India and is widely used in Ayurveda and folk medicine. Traditional uses include remedies for diabetes, urinary disorders, skin diseases, eye ailments (conjunctivitis), fever, and wound healing[1]. These ethnomedicinal claims motivated phytochemical and pharmacological investigations over the past decades[2]. The value of traditional medical practices and medicinal plants in resolving global health issues is becoming more and more well-known every day. The majority of developing countries have included traditional medicine in their cultural fabric. Although they are found throughout the world, tropical nations have the greatest abundance of medicinal plants[3]. Pharmaceutical corporations are keenly interested in using the extensive knowledge bases of nations like China,India,and Sri Lanka about medicinal plants and health care as are source for research and development initiatives aimed at finding novel medications[4,5,6]. Cassia auriculataisoneof the extra ordinarily commonly used medicinalplantsin traditional medicine especially in Indian Ayurvedic systems.Belonging to the genus Cassia and the family Caesalpiniaceae, C. auriculata, also known as tanner's cassia, holds cultural significance. Its distribution spans tropical countries, including America, India, Fiji, Indonesia,Malaysia, Brazil, and Africa[7,8,9].The plantha sbeen reportedtocontainadiversearrayofphytochemicalconstit uents,suchasalkaloids,phenols, glycosides, flavonoids, tannins, saponins, emodin, and anthraquinone derivatives, each contributing to various health benefits [10,11,12].This review article aims to consolidate the existing knowledge on the nutritional, phytochemical and pharmacological properties of C. auriculata, shedding light on its potential health benefits.

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Botanical description & plant parts studied:
A deciduous shrub 1–3 m tall with pinnate leaves and yellow flowers; commonly studied parts are flowers, leaves, roots, and bark. Different plant parts and extraction solvents (aqueous, ethanol, methanol, petroleum ether) yield variable phytochemical profiles — an important source of heterogeneity in reported bioactivity.

Phytochemical profile:
Multiple qualitative and quantitative studies report the presence of: Flavonoids & phenolics (rutin, quercetin-like compounds, other flavones) often abundant and linked to antioxidant effects. Flavonoids & phenolics (rutin, quercetin-like compounds, other flavones) — often abundant and linked to antioxidant effects.Anthraquinones / emodin-type compounds reported in some extracts.Tannins and saponins.Terpenoids and sterols.Glycosides and small amounts of alkaloids (reported variably).

Flower: Cassia flowers have been documented to encompass a spectrum of main phytochemical constituents, includingtotal phenols,flavonoids, tannins, phytates, saponins, quinines, coumarins, andoxalates[13,14,15].

Leaves: The leaves of the Cassia plant have been documented to contain a rich array of major phytochemical constituents, including alkaloids, flavonoids, phenols, saponins, tannins, terpenoids, and glycosides[7,8,13,16]. In a quantitative analysisconductedby[14]thebioactivecompoundswerespecificallyidentified,revealingthepresence of α-Tocopherol-β-D-mannoside(14.22%), Resorcinol(11.80%), and 1,2,3,4-Tetrahydroisoquinolin- 6-ol-1-carboxylic acid (1.98%) in the leaf extract.

Seeds: The seeds of the cassia plant have been noted for their rich phytochemical composition, encompassing alkaloids, phenols, flavonoids, tannins, phytosterols and anthraquinones as highlighted by various studies. A quantitative analysis conducted by further unveiled specific bioactive constituents in the seed extract. Notably, benzoic acid, 2- hydroxyl methyl ester (0.07%), 1- methylbutyl ester (0.10%), 2,3 dihydro-3,5 dihydroxy- 6 methyl-4H-pyran-4-one (0.12%), Capric acid ethyl ester (0.16%), Resorcinol (0.21%) were identified as prominent beneficial compounds present in the seeds of the Cassia plant[13,15,16].

Root: Comprehensive studies conducted by identified key bioactive constituents in the root extract. Notably, the studies revealed that significant amounts of7,4-dihydroxy flavone- 5-o-beta-d-galactopyranoside, 1,3-dihydroxy-2 methyl-anthraquinone, 1,3,8- trihydroxy- 6methoxy -2 methyl- anthraquinone and rutinoside as prominent phytochemicals contained in roots[14].

Pharmacological activities:
Antidiabetic / Antihyperglycemic:
Several animal studies show that flower and leaf extracts reduce blood glucose, improve lipid profiles, and increase plasma insulin markers; mechanisms proposed include inhibition of carbohydrate-hydrolyzing enzymes (α-amylase, α-glucosidase), antioxidant protection of pancreatic β-cells, and modulating insulin sensitivity. The antidiabetic use is the most consistently reported traditional and preclinical effect[16,17,18].

Antioxidant activity:
Multiple in vitro assays (DPPH, FRAP, etc.) and in vivo oxidative stress markers indicate strong antioxidant potential — typically attributed to flavonoids and phenolics concentrated in flowers and leaves. Antioxidant action may underlie other protective effects (hepatoprotection, antidiabetic benefits)[13,19].

Anti-inflammatory and analgesic effects:
Ethanolic extracts exhibit anti-inflammatory activity in protein denaturation and membrane stabilization models; in vivo models (carrageenan-induced edema, etc.) also show reduction in inflammation and related biomarkers. These effects are again often linked to phenolic and flavonoid constituents[20,21].

Hepatoprotective effects:
Preclinical studies report protective effects against chemically induced liver injury (reduced ALT/AST, histological improvements), which may be mediated by antioxidant and membrane-stabilizing phytoconstituents[22,23].

Antimicrobial & antifungal activity:
Leaf and flower extracts show in vitro antibacterial and antifungal activity against several pathogens; activity correlates with presence of tannins, flavonoids and saponins. Results vary by organism and extract; standardized MICs are not comprehensively reported.

Anticancer / Cytotoxicity:
Limited in vitro cytotoxicity studies report growth inhibition in certain cancer cell lines, but results are preliminary and mechanistic data (apoptosis pathways, specific molecular targets) remain sparse[24.25].

Other reported activities:
Reports include antipyretic, wound-healing, anti-obesity (animal model), and ocular-protective actions in traditional contexts; many are supported by a small number of preclinical studies[26,27,28,29,30].

Mechanisms of action — what is known:
Proposed mechanisms across activities include antioxidant/free radical scavenging, inhibition of carbohydrate-digesting enzymes, modulation of inflammatory mediators (cytokines, prostaglandins), membrane stabilization, and hepatoprotective enzyme modulation. However, few studies provide detailed molecular pathway confirmation[26,27] (e.g., receptor binding, transcriptomics, or proteomics).

Safety, toxicity, and pharmacokinetics:
Acute toxicity studies in rodents suggest a relatively wide safety margin for many extracts at commonly tested doses, but standardized chronic toxicity, reproductive toxicity, and human safety data are scarce. There are virtually no robust pharmacokinetic (absorption/distribution/metabolism/excretion) studies on major active constituents from C. auriculata; this is a major gap before clinical translation[31,32,33].

Limitations and knowledge gaps:
Heterogeneity of extraction methods, doses, and plant parts makes cross-study comparisons difficult. Most evidence is preclinical (in vitro / animal); clinical trials in humans are almost absent. Few studies isolate and test purified bioactive compounds — most use crude extracts. Mechanistic molecular work and PK/PD data are limited. Standardized quality-control markers (content of marker compounds) and GMP-grade preparations are lacking[34].

Future directions / Recommendations:
1. Standardize extraction and phytochemical fingerprinting (HPLC/LC-MS marker profiling).
2. Bioassay-guided fractionation to isolate active molecules and determine structure–activity relationships.
3. Mechanistic studies using modern molecular approaches (omics, receptor assays, pathway analysis).
4. Toxicology (sub chronic, genotoxicity) and human pilot clinical trials for prioritized indications (e.g., type 2 diabetes, hepatoprotection).
5. Formulation and bioavailability work (poorly soluble flavonoids often require delivery optimization).

Conclusion:-

Cassia auriculata is phytochemically rich and shows multiple promising pharmacological activities in preclinical studies — most notably antidiabetic, antioxidant and hepatoprotective effects. However, translation into clinical practice requires rigorous standardization, mechanistic clarification, safety profiling and human trials. The plant remains a promising candidate for natural-product drug discovery once these gaps are addressed.

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