Evaluation of Traditional Medicinal Uses, Phytochemical and Pharmacological Activities of Cassia angustifolia (Senna): A Recent Review

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ABSTRACT

Herbal medicines are used traditionally in treatment of disorders with less side effects. Cassia angustifolia is medicinal plant having effective biological potential. It belongs to Leguminosae family. It is small herb with height of 2.3 feet. Mostly cultivated in Saudi Arabia, Egypt, Yemen, India, Bangladesh and Pakistan in warm weather conditions. Main objective of this study is to provide a more recent literature work on traditional medicinal uses, phytochemical constituents as well as pharmacological aspects of C. angustifolia. It is traditionally used as laxative due to anthraquinone derivatives. It also shows synergetic effects against constipation. Present review provides a recent information about pharmacological properties of C. angustifolia because of its medically important phytochemicals.

Keywords: Cassia angustifolia, Traditional medicinal use, Phytochemistry, pharmacological activities.

INTRODUCTION

There is increased attention globally towards use of herbal medicines as traditional medicines. Herbal medicines are used safely and effectively (encouraged by WHO). Now herbal medicines are used worldwide by people as preferable treatment which is reliable and satisfactory.1 Modern or allopathic medicines, especially in rural areas, are imprudent and unaffordable. In these situations, different human and animal diseases are treated by using medicinal plants as valuable resource.2 Herbal medicines from medicinal plants can be taken in raw extract form or in form of chemical constituent.3 Phytopharmaceutical use of herbal medicines has been popularized.4 Synthetic drugs also give treatment against diseases but there are reported side effects which are increasing complications. Herbal medicines in such situation are more advantageous for as these have low cost, less side effects and much effective.5 Alkaloids, flavonoids, tannins, steroids, glycosides and phenolic compounds are bioactive constituents that produce physiological effects.6 These bio constituents are attributing towards health maintaining agents. These are secondary metabolites produced as a result of plant metabolic reactions.7

Cassia angustifolia commonly known as Senna approved by WHO. It is non prescriptive drug approved by FDA.8 It belongs to family of Leguminosae. Every part (leaf, pods and seeds) of C. angustifolia is used effectively for medicinal application.9 Cassia angustifolia yield 2000 kg dry leaves and 800-1000 kg pods under irrigated condition.8

Distribution

Senna is Arabic name of Cassia angustifolia and native to Sudan. Senna is small herb with 2-3 feet height. Its cultivation maintained for 2-3 years as perennial crop. In India, Senna is cultivated in Tamil, Andhra Pradesh and Karnataka. It has 500 species.8 Warm climate is required for its cultivation.10 Senna is native to Yemen, Saudi Arabia, Egypt is commonly known as sennamakki.5 In hot arid areas of Pakistan, it is 5-8 m tall fastly grown shrub. It is British and USA pharmacopoeias recognized.5

Botanical description

Cassia angustifolia is less than 1 m in height and consider small under shrub (perennial) with upward growing branches. During cultivation period its height becomes 0.7-1.0 m. But it can attain height of 1.5 m sometimes. In Northern India, its leaves shed at onset of winter season. Leaves are of two type, Compound and Pinnate, with leaflet in 5-8 pairs. Leaflets are appeared as pale green, glabrous and oval-lanceolate with 2 to 5 × 1.5 cm, pale green and glabrous. Leaflets have oblique, smooth margins and sharp peak ends. After sowing, plants of average 67 age, show onset of flowering. Subterminal and axillary
racemes are produced with 30 to 45 cm length. These racemes have yellow showy flowers that looks brilliant. Pods show the color changes from pale green to greenish brown on maturity. Pods are 3.5 to 8.5 cm × 1.5 cm in dimension. 9 Pods are 1.4-0.8 cm wide and contain 5-7 obovate dark brown and smooth seeds. 11

**Synonym(s): Cassia angustifolia Vahl.**

**Vernacular names of Cassia angustifolia**

Arabic: Sana makkii, Hijazi
Hindi: hindi-sena, sonamukhi
Kannada: soanaamukkh, nelavarike
Malayalam: sunnamukki, nilavaka
Persian: Sana-e-makki
Sanskrit: svarnapatri, Kalyani
Tamil: cimainilavakai
Telugu: nelatagedu
Urdu: Sana-i-makki, sena
English: Senna
Marathi: bhitharvada

**Scientific classification**

Kingdom: Plantae
Subkingdom: Tracheobionta
Division: Magnoliophyta
Class: Magnoliopsida
Sub class: Rosidae
Order: Fabales
Family: Fabaceae/Leguminosae
Sub family: Caesalpinioideae
Genus: Cassia
Specie: angustifolia

**TRADITIONAL MEDICINAL USES**

C. angustifolia is a famous laxative drug. 12 Being laxative, it shows slow onset of action because of stimulated peristalsis process in colon. 13 Laxative property is due to anthraquinone derivatives. 8 It is used synergistically along with Mentha piperita L., Zingiber officinale Rosc. and Glycyrrhiza glabra L. in equal amount for treating constipation. 34 Detected Sennosides are also medicinally important. 12 C. angustifolia have been traditionally used to regulate bowel movement. 5 In addition, for hemorrhoids and weight loss, Senna is used traditionally. 8 Senna considered as digestive system cleanser and body tonic. Senna is also effective against migraine, heart diseases, piles, epilepsy, skin infections and respiratory problems. 8 Externally used for healing wound, scabies and hair loss. It is compatible with breast feeding. 11 To cure amoebic dysentery, it acts as anthelmintic and liver stimulant. C. angustifolia is used as fever reducer in case of Anemia, Cholera, splenic enlargement and Typhoid. 16 Plant infusions treats fever, dysentery and bronchitis. 13 Senna leaves show antioxidant, antiinflammatory, antipyrogenic and α-glucosidase inhibitory activities. 1

**PHYTOCHEMISTRY**

Phytochemical screening of Cassia angustifolia shows following bioactive constituents.

**Seed**

Seed contains anthraquinones, namely; (aurantio-obtusin, chryso-obtusin, obtusin, chrysoobtusin-2-O-beta-D-glucoside, emodin physcion, chrysophanol, obtusifolin, obtusifolin-2-O-beta-D-glucoside, alaternin 2-O-beta-D-glucopyranoside), brassinosteroids (brassinolide, castasterone, typhasterol, teasterone, and 28-norcastasterone), and monoglycerides (monopalmitin and monoolein). Phenolic glycosides such as rubrofusarin triglucoside, nor-rubrofusarin gentiobiose, demethylflavasperone gentiobiose, torachrysone gentiobiose, torachrysone tetraglucoside and torachrysone apioglucoside were also isolated. Gum (7.65%), yielded by seed and talc, calomel, kaolin used for temporarily prevention. Extraction of seeds with petroleum ether (b.p.60-80°C) in a modified Soxhlet apparatus gave 5.0% brownish yellow oil. Chrysophanic acid was also isolated from this oil. Mucilage (25.8%) was isolated by extraction with hot water. phenolic glycosides including six new compounds were isolated from seed. These are rubrofusarin triglucoside, nor-rubrofusarin, gentiobiose, demethylflavasperone gentiobiose, torachrysone gentiobiose, torachrysone tetraglucoside and torachrysone apioglucoside. Two new naphtho-pyrene glycosides, 9(beta-D-glucopyranosyl-(16)-O-beta-Dglucopyranosyl)oxy]-10hydroxy-7-methoxy-3-methyl-1H-naptho[2,3-i]pyran-1-one and 6-O-beta-Dglucopyranosyl)oxy]-rubrofusarin, together with Cassiaside and rubrofusarin-6-beta-gentiobiose were isolated from the seeds.

**Stem Bark**

The isolation of anthraquinone, 1-hydroxy-5-methoxy-2-methoxyantraquinone and its glycoside, 5-methoxy-2-methyl anthraquinone-1-O-α-L-rhamnose along with chrysophanol, emodin and β-sitosterol from the stem is reported. The stem also contains d-mannitol, myricyl alcohol, β-sitosterol, glucose, tigonnelline, 1-stachydrine and choline. The stem-bark yields ethyl arachidate and behenic acids, marginic and palmitic acids, euphol, aurapeterol, bassel, rhein, 3, 5, 8, 3’4’5’-hexahydroxy flavones.

**Leaves**

The leaves have Anthraquinone glycosides and Flavonoids. Anthraquinone glycoside includes rhein, emodine, physion, chrysophanol (marker), Obtusin, chrysoobtusin,
chryso-obtusin-2-O-β-D-glucoside, obtusifolin and chryso-obtusifolin-2-O-β-D-glucoside.\textsuperscript{14}

**PHARMACOLOGICAL ACTIVITIES**

On the basis of experimental researches, C. angustifolia is reported to show following pharmacological activities

**Antimicrobial activity**

This study reported in-vitro antimicrobial activity as well as phytochemical evaluation in nonpolar extract of *Cassia angustifolia* extracts were proved to have secondary metabolites. Out of all extracts, methanolic extracts showed effective antimicrobial activity because it possesses high amount of flavonoid and phenol followed by H2O, acetone and Hexane extract.\textsuperscript{2}

Methanolic extract of *Cassia angustifolia* were used by researchers for determination of secondary metabolites and antimicrobial activity. 44 photochemical were identified on basis of retention, peak area, Molecular weight & Molecular formula by using GC-MS, 2,5-dimethyl-4-hydroxy-3(2H)-furan-2-propyltetrahydropyran-3-ol, estragole, benzene, 1-ethyl-n-4-fluoro-, 5-hydroxymethylfurfural, anethole, 7-oxabicyclo[4.1.0]heptan-2-one, 6-methyl-3-(1-methylthyl), 2-methoxy-4-vinylphenol, 1,2,2-trimethylcyclopentene-1,3 dicarboxylic acid, E-9-tetradecenoic acid, caryophyllene, cholestan-3-ol, 2-methylen-, (3β,5α)- Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-, β-currycumin, 7-epi-cis-cis-6-sabinene hydrate, Cyclohexene, 3-(1,5-dimethyl-4-hexenyl)-6-methylen-,[5α-(R*,S*)]-m, octahydrobenzo[b]pyran, 4a-acetoxy-5,5,8a-trimethyl, dodecanoic acid, 3-hydroxy, tetraacetyl-d-xylonitrilite, 1-ethenyl 3, trans(1,1-dimethylthethyl)-4,cis-methylocyclohexan-1-ol, phen-1,4-diol, 2,3-dimethyl-5-trifluoromethyl, 5-benzozenacetic acid, 6-ethenyl-2,4,5,6,7,7a-hexahydro-3,6-dime, 5-benzozenacetic acid, 6-ethenyl-2,4,5,6,7,7a-hexahydro-3,6-dime, phytol, acetate, desulphosinigrin, oxiraneundecanoic acid, 3-pentyl-methyl ester, cis Phytol, 9,12,15-Octadecatrienoic acid, 2-phenyl-1,3-dioxan-5-yl ester, butanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro-5,5dihydroxy-4-(h), 9-Octadecenoic acid, 1,2,3-propanetriyl ester, (E,E,E) and Diisooctyl phthalate existed.

Highly effective antifungal activity of *C. angustifolia* was observed in Aspergillus terreus.\textsuperscript{17}

**Antibacterial activity**

Antibacterial activity of *Cassia angustifolia* along with other medicinal herbs was analyzed by using ethyl acetate acetone and methanol extract of leaf and flower of *C. angustifolia* against different bacterial species. Minimum inhibitory concentration (MIC) and well diffusion assay proved broad spectrum activity of flower methanolic extract of *C. angustifolia* against *B. cereus* (22 mm). As well as leaf ethyl acetate extract showed MIC value of 28.4 μg/mL against *K. pneumonia* proving antibacterial activity.\textsuperscript{18}

This study explains the importance of traditional medicines for human welfare. This study reported *Cassia angustifolia* as antibacterial agent using its ethanolic and methanolic extract against those bacteria, which produces diseases in human like *Escherichia coli*, *Klebsiella pneumonia* and *shigella shinga*. Broth microdilution method was employed and results showed strong antibacterial activity of leaf methanol extract against *K. pneumonia* (MIC: 0.62 mg/ml).\textsuperscript{19}

**Antifungal activity**

Antifungal activity of *Cassia angustifolia* was analyzed by using its butanolic seed extract. Structure evaluation of isolated saponin (triterpenoid glycoside) was carried out using FTIR, \textsuperscript{1}H NMR, \textsuperscript{13}CNMR and FAB-MS data, as 3-O-{ β-D-glucuronopyranosyl-(1-4) }-{[D-galactopyranosyl-(1-2)]}-{ β-D-xylpyranosyl (1-3) }-{ β-D-glucopyranosyl }-2, 16-dihydroxy-4, 20-hydroxy methyl olean-12 ene-28-oic acid).

Maximum inhibition in *Colletotrichum dematium* was occur against anti-fungal activity of triterpenoid saponin.\textsuperscript{20}

**Antilucre activity**

Bark of *Cassia angustifolia* was tested for its antilucre activity in shay rats. Methanolic extract of *Cassia angustifolia* bark in 800 mg/kg body weight administered orally in rats. Results confirmed the presence of antilucre activity of *C. angustifolia* bark as well as reduction in free acidity.\textsuperscript{21}

**Antimicrobial and antilucre activity**

*Cassia angustifolia* were analyzed for antimicrobial and antilucre activity by using its extract in DPPH radical scavenging array respectively. Phytochemical analysis of total phenolic flavonoid content was also done using Folin-Ciocalteu method and aluminium chloride colorimeter array, followed by Nuclear Magnetic Resonance and ESI Mass spectrometry (for structure elucidation). Results showed that effectiveness of three isolated flavonoids (querimeritin, scutellarein ratin) for having antioxidant activity (against DPPH radical with IC\textsubscript{50} 2.41 μg/mL, antimicrobial activity (against *E. cloacae*, *P. aeruginosa*, *S. mercescens S. typhi*) and anticaner activity (IC\textsubscript{50} 4.0 μg/µL) against MCF-7. (IC\textsubscript{50} 5.45 μg/µL) against HeLa and with IC\textsubscript{50} 7.28 μg/µL against Hep 2. low cytotoxicity was observed against HECHE m (IC\textsubscript{50} ,21.09, μg/µL).\textsuperscript{3}

**Hepatoprotective activity**

Studied about hepatoprotective activity of *Cassia angustifolia* leaves in rats. Ethanolic extract of *C. angustifolia* (EECA) leaves was used against CCl\textsubscript{4} induced hepatotoxicity. Results showed that total conjugated and unconjugated bilirubin, increased total protein and decreased level of serum marker enzymes viz (COH, ACP, AST and ALT) were the reason for hepatoprotective activity of EECA.\textsuperscript{22}

**As Laxative**

*Cassia angustifolia* (Senna) is an Arabian name native to Sudan is FDA approved laxative as it clear howel before
Anthemintic activity

This study reported in vitro anthemintic potential of *Cassia angustifolia* by using leaves ethanolic extract in different concentration (10, 20 and 40 mg/mL) for treating helmints. Among with *C. helminthes*, *Heterakis gallinarum* lost motility at (5.71±0.10) h and in control survived for (81.33±2.07)h. *Catatropis sp.* lost motility in (1.00±0.12) h and in control survived for (26.49±1.38)h and *Railletina tetragona* became paralyzed at (2.95±0.29)h and in control survived for (81.93±4.71)h using concentration of 40mg/mL of *Cassia angustifolia*. Vermifugal activity (broad spectrum) was resulted.

Antioxidant activity

*Cassia angustifolia* along with other medicinal herbs has phytochemical constituents as secondary metabolites like phenols, glycoside, steroid, flavonoids and alkaloids. Due to less side effects, wide safety, lower availability in price and efficacy margin, *C. angustifolia* and other herbs used significantly for treating liver, GIT, stomach and colon ailments and hence proved antioxidant activity as well.

Qureshi (2007) investigated the antioxidant potential in 45 days old *Cassia angustifolia* Vahl. by adding lead acetate using in 0-500 µM in pot culture. Pre-flowering (60days after sowing), flowering (90 days) and post-flowering (120 days) stages were observed. Pb-Ac treated plants exhibited increased quantity of oxidized and glutathione dehydroascorbate and TBARS (thiobarbituric acid reactive substances) relative to control CAT, GR, APX and SOD were declared as increased. 60 and 90 DAS resulted in high sennoside content which was lower at 120 DAS.

A study reported the antioxidant activity of *Cassia angustifolia* using its aqueous Ethanol (70%) extract of leaves and flowers. Flavonoids extraction carried out using 5 different extraction techniques using UV-VIS spectroscopies for total flavonoids content (TFC). Coupling following techniques HPLC-PDA-ESH+MS were used for quantitatively and qualitatively of individual flavonoids. Microwave extraction is proved to be best method for individual flavonoids constituent and TFC.

Anti-inflammatory activity

This study proved topical anti-inflammatory activity of *Cassia angustifolia* extract against skin disorder by inhibiting the edema induced by 12-O-tetradecanoylphorbol-13 acetate (TPA) in arachidonic acid and oxazolon. In vitro, Phospholipase A2 (PLA2)’s activity was inhibited by extracts.

Diuretic activity

Diuretic activity of *Cassia angustifolia* and other medicinal plant was evaluated by determining potassium and sodium concentration. K-Na ratio were measured by using AES (as basic for diuretic activity) which was found low in *C. angustifolia*, which showed that *C. angustifolia* has very less diuretic activity.

Anti-emetic activity

A study evaluated the anti-emetic activity of *Cassia angustifolia* Vahl. by using its methanolic extract in young chicks. CuSO4 in 50mg/Kg used to induce Emesis. After testing extracts 150 mg /kg orally, no of retching (P<0.05 & P<0.01) were decreased by comparing with standard chlorpromazine.

As hair black dye

Senna leaf from *Cassia angustifolia* contain Rhein, Chrysophanol, emodin, aloemodin, mono and diglucosides, kaempferol, palmidin, myricyl alcohol and mucilage and commercially used as hair black dye.

Anticonvulsant activity

Evaluation of *Cassia angustifolia* leaf was carried out to check anticonvulsant activity. For this purpose, hydroalcoholic extract of leaves of *C. angustifolia* were used in two Seizures test model in male mice. By using pentylenetetrazol (PTZ; 60mg/kg) test model clonic seizures were induced. While using maximal electroshock (MES;50mA, 50 Hz, 0.5 sec), tonic seizures were induced observation of seizures carried out 30 min thereafter. Results showed that in both test (PTZ & MES), *C. angustifolia* did not show anticonvulsant effect up to maximum safe dose of 2g/kg.

Portal vein thrombosis

This study concluded the effectiveness of hydroxy anthracene glycosides in *Cassia angustifolia* (Senna) for stimulating peristalsis of colon and making *C. angustifolia* a perfect laxative. Case report about 42 years old woman having periodic vomiting, epigastric pain, intermittent fever and anorexia reported to being used Senna leave 200ml (boiling followed by drying) daily for 2 years. Thrombolytics treatment proved ineffective. Overall results evaluated that hepatotoxicity caused by Senna occur only, if there will be liver exposure to unusual quantity of anthraquinone glycosides. So, portal vein thrombosis occurs by chronic use of *C. angustifolia*.

Hypolipidemic activity

A study used for evaluation of the hypolipidemic activity (Anti- hyperlipidemic activity) of Ethanolic extracts of *Cassia angustifolia* in rats. In this study, triton x 100 was used to induce hyperlipidemia in rats. Hyperlipidemic activity was appraised by estimating the plasma triglycerides, Total cholesterol, HDL, LDL, and VLDL. Results proved the hypolipidemic activity of 400mg/kg dose of EECA.

Antidiabetic activity

Herbs are used as medicines to treat many metabolic abnormalities. This study explains the antidiabetic activity of *Cassia angustifolia* in male albino rats. Detailed studies show the diabetic induction in male albino rats by
administrating single dose of streptozotoan (60mg/kg body) using intraperitoneal injection. Symptoms of diabetes includes HDL & LDL cholesterol, loss of body weight, hyperglycemia, decrease in serum insulin and liver marker enzymes. Taking in aqueous extracts of C. angustifolia orally for 4 weeks increased insulin and decreased all mentioned symptoms of diabetes. By decreasing TBARS (Lipid peroxidation marker) and increasing GSH content, SOD and CAT activity of liver. EACA were significantly used to maintain target glucose level and associated oxidative stress.5

**Antimutagenic activity**

*Cassia angustifolia* Vahl. (Senna) is having some side effect despite of being used as laxative. Researcher used aqueous extract of Senna (SAE) to study its genotoxic and mutagenic effects. Four experiments were carried out for this purpose: 1) inactivation of *Escherichia coli* culture: 2) bacterial growth inhibition: 3) reverse mutation test and DNA strands break in plasmid DNA breakage in single and double strands of DNA was observed. But overall results proved antimutagenic activity of SAE by considering its ability to avoid H2O2- induced mutagenesis and toxicity in *Escherichia coli* IC203 (uvrA oxyR) & IC205 (uvrA mutM) strain.4

**CONCLUSION**

Literature study in *Cassia angustifolia* review proves the most effective therapeutic value of *C. angustifolia* among medicinal herbs. This review article focuses on traditional medicinal uses. *Cassia angustifolia* (commonly known as Senna) widely used as laxative drug. Besides it, *C. angustifolia* show biological potential against bowel syndrome, hemorrhoid, weight loss, amoebic dysentery, cholera, typhoid, fever. External uses have also been reported against hair loss, scabies and wound healing. Phytochemical studies in this review gives the information about bioactive constituent of *C. angustifolia*. Anthraquinone derivatives in *C. angustifolia* are found responsible for laxative properties. Glycosides, alkaloids, flavonoids, steroids, tannins and phenolic compounds are also surveyed for treatment of skin, heart, liver and respiratory diseases. Sennosides A, B, C and D makes *C. angustifolia* (Senna) more effective drug. Present literature survey gives the recent details about its pharmacological properties, some are antimicrobial, antialcuer, antihyperglycemic, antioxidant, antimutagenic, anticonvulsant, antidiabetic, anticancer, anti-inflammatory etc. Further research work is required to explore the unexploited potential of *Cassia angustifolia*.

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**Conflict of interest:**

There is no any conflict of interest at all.

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