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Recent advances on senna as a laxative: A comprehensive review

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Abstract

Cassia angustifolia is an ayurvedic herb more popularly known as senna. It is also known as swarnapatri in Sanskrit. It is an FDA approved nonprescription laxative. Due to its laxative property it is used to clear bowel before diagnostic tests such as colonoscopy. Senna is an Arabian name but it is native to Sudan. It is a small herb growing to a height of 2-3 feet. In India it is cultivated in Tamil Nadu, Andhra Pradesh and Karnataka. Its commercial cultivation has recently come up in Kutch (Gujrat) and Jodhpur (Rajasthan). The first systematic examination of the leaves was carried out by Tschirch and Hiepe.

Keywords: *Cassia angustifolia*, laxative, colonoscopy

Introduction

Cassia angustifolia is an ayurvedic herb more popularly known as senna. It is also known as swarnapatri in Sanskrit. It is mainly used as a blood purifier, laxative for relieving constipation and to treat skin diseases. It contains a powerful natural laxative called anthraquinone and is approved by the world health organization (WHO). It is an FDA approved nonprescription laxative. Due to its laxative property it is used to clear bowel before diagnostic tests such as colonoscopy. Senna is an Arabian name but it is native to Sudan. It was brought into used by Arabian physicians for removing capillary congestion. It is a small herb growing to a height of 2-3 feet. In India it is cultivated in Tamil Nadu, Andhra Pradesh and Karnataka. Its commercial cultivation has recently come up in Kutch (Gujrat) and Jodhpur (Rajasthan). It can grow over sand dunes after rainy season and can be maintained as a perennial crop for 2-3 years. Senna consists of the dried leaflets of *Cassia angustifolia* Vahl. Belonging to the family *Leguminosae*. The leaves are golden brown in color after drying. The pod and root of the plant is also used. The first systematic examination of the leaves was carried out by Tschirch and Hiepe.

Taxonomical classification of senna

Botanical Name	<i>Cassia anugstifolia</i>
Kingdom	Plantae
Sub Kingdom	Tracheobionata
Division	Magnoliophyta
Class	Mabnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Caesalpinaceae
Genus	<i>Cassia</i>
Species	<i>angustifolia</i>

Types of senna

The genus senna comprising of 500 species of which 26 species of genus cassia have been reported to contain anthracene derivatives either in the free form or glycosides. Out of these, *Cassia angustifolia* (Indian senna) and *Cassia acutifolia* (Alexandrian senna) are official in different pharmacopoeias, because of laxative activity and also because they are available in large quantities. The other species with known laxative activity are *Cassia fistula*, *Cassia Obovata*, *Cassia dentate*, *Cassia sofara*, *Cassia sieberiana*, *Cassia podocarpa*, *cassia alata*.

Cultivation and harvesting of senna

In India senna are cultivated in around 25000 hectare of land producing about 22500 tonnes of leaves and 7500 tonnes of fruits per annum.

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Senna cultivated in well ploughed, level, rich clayed semi irrigated land. Pulverization of the soil carried out by the use of plough. First sowing is done in February- March while second in October to November. Before planting prepare the land by plugging, harrowing and bring the soil to a fine tilth and apply Benzene hexachloride (10%) or aldrin (5%) at 25kg/hectare with last operation during land preparation which protects the young seedling from the attack of white ants and worms.

Sowing

The seed may be preferably drilled at a distance of 30cm in lines with 1.5 to 2.5 cm depth on well prepared land. Senna largely grown in red loams, alluvial loam and rich clay rise fields. The average pH required range from 7- 8.5. It is very very sensitive to water logging and hence it is grown only in well-drained soil.

Harvesting processing & storage condition

Young senna pod contain high sennosides content. The senna plant produces foliage containing higher sennoside between 50- 90 day of sowing. The picking is done by hand, so that most of the growing tops are removed at harvest. A second picking is taken at 90-100 days and third between 130-150 days. The harvested crop should be spread in a thin layer in open field to reduce moisture. The dry leaf and pod should have a light green to greenish yellow colour.

Yield

On an average it may yield, 2,000 kg of dry leaves and 800-1000 kg of pod per hectare under irrigated and good Management conditions. The yield under rain fed conditions may be about 1000kg/hectare of leaves and 400kg/hectare of pods.

Chemical constituents

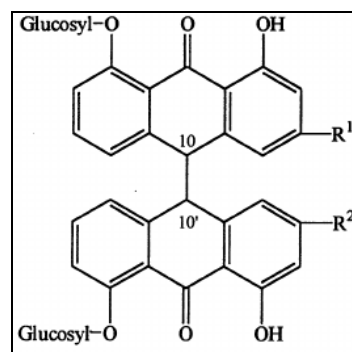
Anthraquinone glycosides: Senna contains two active crystalline glycosides, Sennosides A & B. They could both be degraded by acid hydrolysis to give rise to two molecules of glucose and the aglycones Sennidin A & B. Sennidin A is dextrorotatory & B has no rotation being the mesoform formed by the intra molecular compensation. It also contains sennosides C & D, which are the hetero-dianthrone with the respective aglycones rhein & aloe emodin. Furthermore a series of monoanthrones was shown to be present in smaller amounts such as aloe emodin mono- and diglycosides (aloe-emodin-dianthrone diglycoside, aloe-emodin -8- glucoside, aloe-emodin-anthrone-diglycoside) and, further, rhein mono- and diglycosides (rhein-anthrone-8-glycoside, rhein-8-diglycoside).

Naphthalene glycosides: It also contains a naphthalene glycoside known as tinnevellin glycoside (0.3%).

Miscellaneous: In the fraction of the flavanoid family senna contains the yellow flavanol coloring matters kaempferol (3, 4', 5, 7-trihydroxyflavone), its glucoside (kaempferin) and isorhamnetin, β -sitosterol, calcium oxalate, mucilage, resin, saponins and polysaccharide hydrocolloids are also present.

Basic chemical structure of Sennosides

R1	R2	10-10'	Glycoside
COOH	COOH	Trans	Sennoside A
COOH	COOH	Meso	Sennoside B
CH ₂ OH	COOH	Trans	Sennoside C
CH ₂ OH	COOH	Meso	Sennoside D



Medicinal properties of Senna

The taste of senna is pungent, bitter and sweet having high potency. It is light to digest, dry in nature. After digestion it undergoes into pungent taste. It acts as a mild purgative. This herb is pitta shodhaka and vata anulomaka means remove the pitta from body and remove vata through the anal route. It is used as a laxative for the treatment of constipation & for the evacuation of the bowel prior to the diagnostic tests of the gastrointestinal and colorectal area. The leaves and pods are administered in Ayurveda and Unani systems of medicine as infusion for their purgative properties, combined with carminatives and aromatics. Among Ayurveda compounds, Panch Sakaara Churna is available over-the counter. Other compounds are Shtshakaar Churna and Yashtyaadi Churna. Among Unani compounds, Safoof-e-Mulaiyia and Majoon-e-Senaai are the well-known ones. All these compounds are prescribed as a mild laxative in constipation, abdominal bloating, indigestion, and colic. *Cassia angustifolia* is an ingredient in Nilaavarrai Choornam of Siddha medicine, prescribed as a mild laxative in constipation, distention of the stomach and biliousness.

Uses of Indian Senna

- The dried leaf of Indian Senna is used as a purgative. The powder of the leaf is taken in a dosage of 1-2 g with hot water in conditions of constipation, abdominal distention.
- In skin diseases, the paste of the leaf of *Cassia angustifolia* is applied along with vinegar to the affected part of the body.
- In disease of abdominal worm infestation, rheumatoid arthritis, gout, the powder of Senna leaf is given in a dosage of 1-2 g to induce purgation.
- Ayurveda has advised Virechana (purgation therapy) in the conditions of Hepatomegaly, Splenomegaly and Jaundice to relieve excessive Pitta from the body using the dried leaf or pod of Senna plant.
- Senna leaf or pod, in dried form is stimulates the liver for production of Pitta.
- The leaf of Senna is a blood purifier. It is given daily in a dosage of 500 mg.
- It is used for irritable bowel syndrome, hemorrhoids and weight loss.
- The anthraquinones of this herb can inhibit a variety of bacteria (staphylococci and *Bacillus Coli*) and dermatomyces (*Microsporum audouinii*) etc.

Precaution

- In case a lactating woman takes Senna leaf, it will induce mild purgation in the breast feeding infant.
- The usage of Senna is contraindicated in people suffering from inflammatory colon diseases, severe dysentery.
- Increased dosage of Senna will lead to severe purgation, abdominal cramps and features of dehydration.

- People may suffer from nausea, excessive salivation, increased thirst and dehydration related features after the use of Senna. It is advised to use Senna along with sugar candy, ginger powder, rock salt to minimize the above said conditions.

Contradictions: The herb is not to be administered to the patients with hypersensitivity to senna or senna preparations. Not to be used in cases of intestinal obstructions and stenosis, atony, appendicitis, inflammatory colon diseases (e.g., Crohn's Disease, ulcerative colitis); abdominal pain of unknown origin, severe dehydration state with water & electrolyte depletion. Senna is not recommended for use in children under 12 years of age.

Special warnings

Patients taking cardiac glycosides, antiarrhythmic medicinal products, medicinal products including QT-prolongation, diuretics, adrenocorticosteroids or liquorice root, have to consult a doctor before taking senna leaves concomitantly.

Like all laxatives, senna leaves should not be taken by patients suffering from fecal impaction and undiagnosed, acute or persistent gastrointestinal complaints, e.g., abdominal pain, nausea & vomiting, unless advised by a doctor, because these symptoms can be a sign of a potential or existing intestinal blockage (ileus).

Use for more than 1-2 weeks requires medical supervision. If stimulating laxatives are taken longer than a brief period of treatment, this may lead to dependence requiring increasing quantities of the medical product, an atonic colon with impaired function and aggravation of the constipation. Senna leaf preparations should only be used if a therapeutic effect cannot be achieved by a change of diet or the administration of bulk forming agents.

Dosage & dosage forms

The maximum daily dose to treat constipation is 15 to 30 mg sennosides. However the correct individual dose is the smallest required producing a comfortable soft-formed motion. The dosage for senna is about 500 mg to 2 gm of the powder of leaf or pod.

Sarivadyasava: It is an ayurvedic liquid medicine used to treat skin diseases, gout, and diabetes.

Ayulax: It is an ayurvedic proprietary medicine used to treat constipation, distention of abdomen.

Kultab tablet: It is a medicine used to treat piles and hemorrhoids.

Pylend tablet: It is a tablet used to treat piles, constipation.

Raktansoo syrup: An ayurvedic proprietary medicine used as blood purifier.

Overdose

The major symptoms are griping pain and severe diarrhea with consequent losses of fluid and electrolyte, which should be replaced.

Pharmacology of senna

Senna leaves and pods show laxative activity. Leaves contain glycosides, sennoside A, B, C and D. Two naphthalene glycosides have been isolated from leaves and pods.

Anthraquinone gives the medicinal action of senna. It appears that the aglycone portion is responsible for its action. The breakdown of the anthraquinone glycosides in the digestive tract can occur in one of two ways. The bowel flora can directly hydrolyze them in a similar way to that of free active aglycone. Alternatively, in the presence of bile and the sugar moiety, the free aglycone can be absorbed into the blood stream and secreted later into the colon.

Antimicrobial activity of senna

The extracts of *Cassia angustifolia* showed anti-microbial activity. Different extracts (ethanol, methanol, petroleum ether and aqueous solutions) of *Cassia angustifolia* plant are extracting out. Antimicrobial efficacy of various extracts was assessed by disc diffusion method against Gram positive bacteria-*Staphylococcus aureus*, Gram negative-*Escherichia coli* and *Pseudomonas aeruginosa* and fungi-*Aspergillus niger*, *Aspergillus flavus*, *Fusarium oxysporum* and *Rhizopus stolonifer*. Phytochemical screening of the extract showed the presence of alkaloids, flavonoids, carbohydrates, proteins, tannins and triterpenoids in *cassia angustifolia*.

Anti-fungal activity of Senna

Senna act as anti-fungal agent and act against D.N.A of *E. Coli* bacteria. Sennosides affect the intestinal tract and induce diarrhea. It has shown that senna produces DNA lesions in *Escherichia coli* cultures and can act as an antifungal agent.

Interactions with medicinal products

Hypokalemia (resulting from long term laxatives abuse) potentiates the action of cardiac glycosides and interacts with antiarrhythmic medicinal products, with medicinal products which induce reversion to sinus rhythm (e.g., quinidine) and with medicinal products inducing QT prolongation. Concomitant use with other medicinal products inducing hypokalemia (e.g., diuretics, adrenocorticosteroids & liquorice root) may enhance electrolyte imbalance.

Pregnancy and Lactation

Pregnancy: There are no undesirable or damaging effects during pregnancy and on the fetus when used at the recommended dosage.

Lactation: Breastfeeding is not recommended as there are insufficient data on the excretion of metabolites in breast milk.

Small amounts of active metabolites (rhein) are excreted in breast milk. However, laxative effect in breast fed babies has not been reported.

Undesirable effects

Hypersensitive reactions (pruritus, urticaria) may occur very rarely. Very rarely senna leaves may produce abdominal pain and spasm and passage of liquid stools, particular in patients with irritable colon. However, these symptoms occur generally as consequence of individual over dosage. In such cases dose reduction is necessary.

Chronic use may lead to disorders in water equilibrium and electrolyte metabolism. Diarrhea may especially cause potassium depletion, which may lead to cardiac disorders and muscular asthenia, particularly where cardiac glycosides, diuretics, adrenocorticosteroids or liquorice root are being taken at the same time. Chronic use may result in albuminuria and haematuria. Furthermore, chronic use may cause pigmentation of the intestinal mucosa (*pseudomelanosis coli*),

which usually recedes when patient stops taking the preparation. Yellow or red-brown (pH dependent) discoloration of urine by metabolites, which is not clinically significant, may occur during the treatment. IgE mediated allergy, asthma, and rhino conjunctivitis have been reported after occupational exposure to senna product

Pharmacological properties

Pharmacodynamic properties: Senna is an anthranoid type stimulating laxative. The laxative effect is due to the action of sennosides and their active metabolite, rhein-anthrone, in the colon. There are two different mechanism of action:

1. An influence on the motility of the large intestine: The laxative effect is realized by the inhibition of water and electrolyte absorption from the large intestine, which increases the volume and pressure of the intestinal contents. This will stimulate colon motility resulting in propulsive contractions.

2. An influence on secretion processes: Stimulation of active chloride secretion increases water and electrolyte content of the intestine. These changes in active electrolyte transport are dependent on calcium in serosal surface.

The laxative action of Senna is partially via stimulation of colonic fluid and electrolyte secretion, and this secretion is mediated by stimulation of endogenous prostaglandin E₂ formation.

Pharmacokinetic properties: The β -O-linked glycosides (sennosides) are neither absorbed in the upper gut nor split by human digestive enzymes. They are converted by the bacteria of the large intestine into the active metabolite (rhein-9-anthrone).

In contact with oxygen, rhein anthrone is oxidized into rhein and sennidins which are found in the blood, mainly in the form of glucuronides and sulphates. After oral administration of sennosides, 3-6% of the metabolites are excreted in urine; some are excreted in bile. Most of the sennosides (90%) are excreted in feces as polymers (polyquinones) together with 2-6% of unchanged sennosides, sennidins, rheinanthrone & rhein. In human pharmacokinetic studies with senna pods powder (20 mg sennosides), administered orally for 7 days, a maximum concentration of rhein (100mg/ml) was found in the blood. An accumulation of rhein is not observed.

Active metabolites, e.g., rhein pass in small amounts (0.01% of the total amount ingested by mother) into breast milk. In nursing mothers, the active principles may appear in the milk but in insufficient quantities to induce diarrhea in the breast fed infants

Carcinogenesis: Carcinogenic activity in the colon following long-term administration of anthracene drugs has not been fully clarified. Study findings are controversial regarding the correlation between the administration of anthracene drugs and the frequency of carcinomas in the colon.

Melanosis coli: Prolonged use of Senna may lead to melanosis coli. Precursors of the melanic substance in melanosis coli may be derived from anthranoid laxatives.

Safety profile of senna

Sennosides displayed no toxicity when tested at doses up to 500 mg/Kg in dogs for 4 weeks and up to 100 mg/Kg in rats for 6 months. There was no evidence of any toxic effects on fetus in rats or rabbits after oral treatment with sennosides.

Furthermore, there was no effect on postnatal development of young rats, on rearing behavior of dams or on male and female fertility.

Senna extracts analysis data

S. No.	Parameters	Limits*
Descriptions		
1.	Color	Yellowish Brown
	Odor	Characteristic
	Taste	Bitter and characteristic
2.	PH (1% w/v in water)	7-9
3.	Total Sennoside content (%w/w)	NLT 2.5
4.	Moisture content (%w/w)	NMT 5
5.	Water Soluble Extractives (%w/w)	NMT 70
6.	Total Ash (%w/w)	NMT 35
7.	Acid Insoluble Ash (%w/w)	NMT 3
8.	Particle Size (passed through 30#)	NLT 95
9.	Bulk Density (g/cm ³) (50 tapping)	NLT 0.45
10.	Loss on Drying (%w/w)	NMT 5
Microbial Analysis		
11.	Total Bacterial Count(cfu/g)	NMT 5000
	Total Yeast / Mould Count(cfu/g)	NMT 100
	Enterobacteriaceae Count(cfu/g)	NMT 100
	Escherichia coli(cfu/g)	Absent
	Salmonella species(cfu/g)	Absent
	Staphylococcus aureus(cfu/g)	Absent
	Pseudomonas aruginosa(cfu/g)	Absent
Heavy Metals		
12.	Arsenic	NMT 10 ppm
	Cadmium	NMT 0.3 ppm
	Lead	NMT 10 ppm
	Mercury	NMT 1 ppm

Conclusion

Senna play a vital role as their economic value is beyond dispute. Senna is rich source of sennosides, glycosides and other nutrients and can provide a solution to the problem of malnutrition and other diseases to a great extent. The efficacy of senna preparation has been evaluated in clinical trial in the treatment of constipation and for bowel cleansing before radiological investigations or colonoscopy.

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