



"Chitraka (Plumbago Zeylanica Linn.): Exploring The Realms Of Rasayana (Rejuvenation) Potential Of Ayurveda

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Article History	Abstract
Received: Revised: Accepted	<p>The present review explores the possible <i>Rasayana</i> properties of Chitraka, the dried mature root of <i>Plumbago zeylanica</i> Linn., within the framework of Ayurveda. <i>Rasayana chikitsa</i>, an integral component of Ayurvedic medicine, focuses on rejuvenation to achieve optimal physical, mental, and spiritual health. Chitraka, identified as both <i>Kamya Rasayana</i> and <i>Naimittika Rasayana</i> in classical Ayurveda, has been traditionally lauded for its potential in prolonging life and treating specific ailments.</p> <p>The classical appraisal of Chitraka's <i>Rasayana</i> effect, as per <i>Ashtanga Hridaya</i>, aligns with its historical association with enhancing life span and managing haemorrhoids (<i>Arsas</i>), neurodegenerative diseases (<i>vata vyadhi</i>) and skin diseases (<i>Kushta</i> and <i>switra</i>). Recent research delves into the diverse therapeutic potentials of Chitraka, revealing its anti-hemorrhoidal, anti-inflammatory, anti-arthritis, anti-microbial, wound-healing, anti-androgenic alopecia, antioxidant, hepatoprotective, nephroprotective, and anti-tumor effects.</p> <p>This exploration of Chitraka's multifaceted therapeutic potential bridges ancient wisdom with modern scientific scrutiny, showcasing its relevance in addressing a spectrum of health challenges. The review emphasizes the need for continued research to unlock Chitraka's full potential, contributing to the evolving landscape of holistic health practices and fostering the integration of Ayurvedic principles into mainstream healthcare.</p>
CC License CC-BY-NC-SA 4.0	Keywords: <i>Chitraka, Plumbago zeylanica, Rasayana, Plumago rosea</i>

Introduction:

"*Rasayana*" *chikitsa* is one of the eight branches of Ayurveda that focuses on rejuvenation and aims to achieve an optimum life free of ailments in which the individual is in the most superior state of physical, mental, and spiritual health¹. The term "*Rasayana*" comes from two Sanskrit words: "*Rasa*," which means "essence," and

"Ayana," which means "path." Rasayana techniques include dietary advice (*Ahara*), herbal supplements (*Oshadhi*), lifestyle changes (*vihara*), and therapeutic treatments (Panchakarma) to attain these goals². The Ayurveda crude drugs and formulations undergo scrutiny in various aspects like antioxidant effect, free radical scavenging, anti-aging effect, immunomodulatory effect, effect on cognitive functions and metabolic factors etc. to evaluate and elaborate their *Rasayana* activity^{1,2,3}.

Ayurveda mentions the use of *Rasayana* in 3 ways wherein the *Rasayana* therapy to prolong the life span, increase the physical and cognitive abilities as per one's desire is termed *Kamya Rasayana*, the daily habitual intake of milk and ghee and other such *Rasayanas* for their health benefits or *Rasayana* effect is called *Ajasrika rasayana* and *Rasayana* which is specific for the treatment of a particular disease is called *Naimittika Rasayana*¹. *Chitraka* has been classically appraised as a *Kaamya rasayana* and as *Naimittika Rasayana*².

The crude drug termed as "Chitraka" in Ayurveda is identified as the dried mature root of *Plumbago zeylanica* Linn. of *Plumbaginaceae* family⁴. It is a sub-scandent perennial herb or under shrub commonly known as Ceylon Leadwort, or Leadwort in English, *Chitraka* in Hindi, *Chitramula/ Bilichitramoola* in Kannada, *vella koduveli* in Malayalam and *Chittiri Chitraka* in Tamil^{4,5}. The quick therapeutic action of the drug gives it the name "*Chitraka*" meaning the 'spotted one', referring to the leopard that speedily catches its prey just as *Chitraka* rapidly cures diseases⁵.

Plumbago zeylanica attains a height of 0.5 to 2 m. It has simple, alternate leaves that are 8cm long and 3 cm broad, ovate in shape, Subacute tip, entire margin, glabrous, petiole narrow, amplexicaul at the base and often dilated into stipule like auricle. The inflorescence is seen as terminal raceme in elongate spikes⁶. Fruit is an oblong five-furrowed capsule containing a single seed. Fruit is green colored, with sticky hairs when young and becomes dark brown when mature⁶. The stem is somewhat woody, spreading, terete, striate, glabrous. The root is the useful part and is available as stout, cylindrical, friable, straight unbranched or slightly branched with or without secondary roots, with uniform and smooth texture. The roots are light- yellow when fresh and become reddish brown on drying. The roots have a strong and characteristic odor with an acrid and bitter taste.⁶

Classical appraisal of rasayana (rejuvenative) effect of Chitraka -⁷ According to Ashtanga Hridaya, the root of *Chitraka* is to be shade dried and powdered. Intake of this powder⁷ regularly for a month is to bestow *rasayana* properties when taken along with suitable adjuvant like *sarpi* (ghee), *madhu-sarpi* (honey and ghee), *payas* (milk) or even with water⁷.

Rasayana action of chitraka in various disease conditions⁷-The root powder of *Chitraka* is said to act as *rasayana* in chronic *Vata vyadhi* when administered with sesame oil as *anupana* (*vehicle*). *Chitraka* root powder has been suggested to be consumed with cow's urine for the *rasayana* effect on dermatological issues. Similarly with buttermilk (*takra*) for the *rasayana* action in chronic hemorrhoidal conditions (*Arsas*).

Research updates of probable mechanism action of Rasayana action of Chitraka

- 1. Research updates on Anti-hemorrhoidal effect of Chitraka**¹⁰- Ayurveda medicine helms *Chitraka* as the drug of choice in treatment of hemorrhoids (*Arsas*)⁸ thereby paving way for analysis of plausible mechanism of action through network pharmacology and in-silico studies. A study highlights Cell migration, proliferation, motility, and apoptosis have been attributed as possible mechanism of action. The phytochemicals of *Plumbago zeylanica* have seen to bind with the key target proteins, such as PIK3CA, EGFR, PRKCA, VEGFA, MMP-9 and NOS2 which have a major role in the management of hemorrhoids
- 2. Anti-inflammatory effect of Plumbago zeylanica in acute inflammatory animal models**^{11,12}- The external application of root paste of *Plumbago zeylanica* once every day significantly reduced carrageenan-induced paw edema in in male Wistar rats. The present study also proved that *Plumbago zeylanica* root paste application did not show any dermal toxicity in experimental study in rabbits¹¹. Administration of *Plumbago zeylanica* in acute models of inflammation like Carrageenan induced rat paw edema and acetic acid induced peritonitis in mice significantly proves the anti-inflammatory effect of *Chitraka*. The present study also states that the combination of *Plumbago zeylanica* with *Phyllanthus emblica* had anti-inflammatory effect comparable to aspirin in Carrageenan induced rat paw edema model in mice¹². A study shows that Plumbagin, a naphthoquinone compound in the roots *Plumbago zeylanica* L., showed anti-inflammatory effects on activated microglia in macrophages¹³. Plumbagin significantly downregulated the expression of many cytokines including IL-1 α , G-CSF, IL-12 p40/p70, MCP-5, MCP-1, and IL-6. Thus it can be inferred that Plumbagin has potency in attenuating multiple pro-inflammatory agents indicates its potential to be used for neurodegenerative diseases¹³.
- 3. Anti-arthritic effect of Plumbago zeylanica**¹⁴- According to a study plumbagin, derived from *Plumbago zeylanica*, is a highly efficient in treatment for rheumatoid arthritis. The purpose of this study was to

determine how Plumbagin (5-hydroxy-2-methyl-1,4-naphthoquinone), affected the proliferation of T cells produced by Con A in the spleen cells of DBA/1 mice with collagen-induced arthritis. The findings demonstrate that in arthritic mice, plumbagin enhanced the Con A-induced T cell proliferation and the generation of interleukin-2¹⁴. Additionally, it was discovered that the spleen cell culture supernatants treated with plumbagin had lower increased levels of IFN- γ ¹⁴.

4. **Anti-microbial effect of Plumbago zeylanica¹⁵**- The phytoconstituents extracted from root of *Plumbago zeylanica* like Plumbagin and neoisoshinanolone and 1-epineo-isoshinanolone through serial dilution method have shown anti-microbial effect against bacteria and fungi.
5. **Wound healing effect of Plumbago zeylanica¹⁶**- The external application of root extracts of *Plumbago zeylanica* in excision and incision wound models in Lewis wister albino rats shows promising wound healing effects.
6. **Extract of Plumbago zeylanica in preventing androgenic alopecia¹⁷**- A study highlights that cellular senescence of hair follicle Dermal Papillae cells leads to up-regulation of SRD5A2 gene expression, and this could be the reason for androgenic alopecia the most common form of male hair loss. The study further explores the effect of extracts of *Plumbago zeylanica* and its major phytochemical “plumbagin” in preventing the senescence of dermal papillae. The study puts forth that *Plumbago zeylanica* could be useful in preventing androgenic alopecia as it enhances the growth of Dermal Papillae cells, thereby down-regulating SRD5A2 expression.
7. **Antioxidant effect of Plumbago zeylanica¹⁸** –A study shows the effect of the alcoholic and aqueous extract of *Plumbago zeylanica* root and Plumbagin in various experimental models of anti oxidant effect like ferric reducing/antioxidant power (FRAP), radical scavenging of 1,1-diphenyl-2-picryl hydrazyl (DPPH) and 2,2'-azobis-3-ethylbenzthiazoline-6-sulfonic acid (ABTS), lipid peroxidation in rat liver mitochondria induced by different agents, and estimating phenolic and flavonoid content. The results show that in FRAP/DPPH assays, boiled ethanolic extracts were the most effective, while in the ABTS assay boiled aqueous extracts were the most efficient. Both the extracts also significantly inhibited lipid peroxidation induced by cumene hydroperoxide, ascorbate-Fe (2+) and peroxy nitrite and contained high amounts of polyphenols and flavonoids. To examine the mechanisms of action in detail, antioxidant and pulse radiolysis studies with plumbagin were conducted. The hydroxyl (.OH), alkyl peroxy (CCl(3)OO.), linoleic acid peroxy (LOO.), and glutathyl (GS.) radicals generated a phenoxy radical upon reaction with plumbagin. The study highlights the profound antioxidant effect of both alcoholic and aqueous extract of *P.zeylanica* and Plumbagin thereby attributing it to the various therapeutic effects of *Plumbago zeylanica*.
8. **Hepatoprotective effect of purified root of in animal model¹⁹**-An elevated concentration of biochemical markers SGOT, SGPT, alkaline phosphatase, total bilirubin, direct bilirubin, and serum creatinine. and histopathological degenerative changes were seen in animals treated with paracetamol indicating severe hepatic damage. The treatment of these animals with decoction of both the species of *Citraka* (*Plumbago rosea* L. and *Plumbago zeylanica* L.) showed significant reduction in the serum markers and regenerative changes in the histopathological specimens pointing towards its effectiveness as a hepatoprotective drug.
9. **Nephroprotective effect of Chitraka²⁰**- An experimental study in cisplatin induced renal injury in experimental animals (Swiss albino rats) showed that there was evident increase in kidney weight (due to the renal cell injury caused by inflammation), high values of creatinine, urea and uric acid in serum, elevated concentration of malondialdehyde (MDA) and decreased level of catalase and glutathione peroxidase in kidney tissue of the experimental animals. The hydroalcoholic extract of *Plumbago zeylanica* produced significant reversal of cisplatin induced changes in the kidney as indicated by measured biochemical parameters (kidney weight, serum urea and creatinine) at higher dose of 400 mg/kg b.w. The study attributes the nephroprotective effect to the profound antioxidant effect of *Chitraka*.
10. **Anti-tumor effect of Plumbago rosea²¹**- The alcoholic root extract of *Plumbago rosea* was studied on experimental mouse tumors, S-180 solid tumor and Ehrlich ascites carcinoma in vivo for exploring the anti-tumor effect. The findings suggest that, while *Plumbago rosea* Extract may have a weak anticancer effect, it could be an excellent option for usage in conjunction with radiation to improve tumor survival.

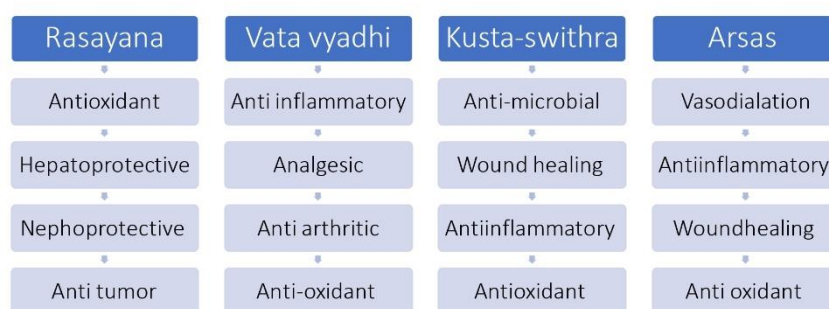
Discussion:

In exploring the anti-hemorrhoidal effects¹⁰ of *Chitraka*, network pharmacology and in-silico studies elucidate potential mechanisms of action, linking the phytochemicals in *Plumbago zeylanica* to key target proteins involved in managing hemorrhoids. This exemplifies how Ayurveda treatments and remedies, as in the case of *Chitraka*, can be subjected to rigorous scientific scrutiny, revealing their molecular underpinnings. The anti-

inflammatory^{11,12,13} and anti-arthritic¹⁴ effects of Chitraka, validated through animal models, provide evidence for its potential application in conditions characterized by inflammation and immune dysregulation. As an ethnomedicinal practice the root paste of *Plumbago zeylanica* is applied externally for management of skin diseases. The anti-inflammatory^{11,12,13}, anti-microbial¹⁵ and wound healing¹⁶ properties further underscore its multifaceted therapeutic potential in skin diseases.

The antioxidant effect¹⁸ of Chitraka, substantiated by experimental models, aligns with Ayurvedic principles of Rasayana, as antioxidants play a crucial role in combating oxidative stress, a key factor in aging and various diseases. Studies prove that overdose of acetaminophen accounts for one of the most common causes of acute liver failure. The hepatoprotective effect¹⁹ of Chitraka can be utilized for protection against liver toxicity induced by acetaminophen, the most popular antipyretic and analgesic as proven in studies. The hepatoprotective¹⁹ and nephroprotective²⁰ effects of Chitraka highlight its potential in safeguarding vital organs from damage, offering a holistic perspective on its therapeutic utility. This aligns with Ayurvedic principles that emphasize the interconnectedness of bodily systems in maintaining overall health. The study on *Plumbago rosea* suggests a potential anti-tumor effect, indicating a role for Chitraka in the realm of cancer research²¹. While the anticancer effect may be considered weak, the possibility of using it in conjunction with other therapies presents an interesting avenue for future investigations.

Fig 1. Chitraka therapeutic utility as Rasayana generally and in diseases



Conclusion:

In conclusion, this narrative review seeks to underscore the need for continued exploration of Chitraka's Rasayana potential, both through traditional practices and contemporary scientific methodologies. The convergence of ancient wisdom and modern research opens avenues for integrating Ayurvedic principles into mainstream healthcare, providing a comprehensive approach to well-being. As *Chitraka (Plumbago zelanica)* continues to reveal its multifaceted therapeutic properties, further research is warranted to unlock its full potential and contribute to the evolving landscape of holistic health practices.

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