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HEPATOPROTECTIVE POTENTIAL OF CHIRAYTA (*SWERTIA CHIRAYITA*) (ROXB. EX. FLEM. H. KARST) IN YAKRIT ROGA: AN INTEGRATED AYURVEDIC AND MODERN PERSPECTIVE

Dr Barkha Thakur¹, Dr Pratibha Baghel², Dr Manjula Mishra³, Dr Pankaj Mishra⁴,
Dr Sujata K. Shamkuwar⁵

¹Assistant Professor, Department of Dravyaguna Vigyan, Govt Ayurvedic College, Jabalpur, MP

²Associate Professor, Department of Kriya Sharir, Govt Ayurvedic College, Jabalpur, MP

³Associate Professor, Department of Rachna Sharir, Govt Ayurvedic College, Jabalpur, MP

⁴Associate Professor, Department of Dravyaguna Vigyan, Govt Ayurvedic College, Jabalpur, MP

⁵Assistant Professor, Department of Prasutantra Evum Stree Rog, Govt Ayurvedic College, Jabalpur, MP

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Abstract

Yakrit Roga represents an important area for interdisciplinary research because the liver performs essential functions in digestion, metabolism, transformation of substances, and maintenance of physiological homeostasis. Ayurveda approaches disorders affecting bodily metabolism through concepts such as Agni, Pitta, Dosha-Dushya Samurchana, Srotodushti, and the functional integrity of individual organs. Kiratatikta, botanically identified as *Swertia chirayita* (Roxb.) The present review examines its possible relevance to Yakrit Roga through an interpretation of its Rasa Panchaka, classical therapeutic associations, pharmacognostical characteristics, and available pharmacological evidence. Tikta Rasa, Laghu and Ruksha Guna, Sheeta Virya, and Katu Vipaka form the commonly reported pharmacodynamic profile of Kiratatikta. These attributes provide a traditional basis for discussing its possible influence on Pitta-Kapha disturbances, impaired digestive processes, and conditions involving metabolic imbalance. Modern investigations of *S. chirayita* have reported antioxidant activity and protective effects in experimental models of chemically induced liver injury. Proposed mechanisms include preservation of endogenous antioxidant defences, attenuation of lipid peroxidation, modulation of inflammatory responses, and possible effects on xenobiotic-metabolising enzymes. The relationship between Ayurvedic pharmacodynamics and these modern findings is interpretative and requires systematic validation.

Keywords: Kiratatikta, *Swertia chirayita*, Yakrit Roga, Rasa Panchaka, Tikta Rasa, Pitta, hepatotoxicity, hepatoprotection, Ayurveda, Dravyaguna.

Introduction

The liver is a major metabolic organ responsible for nutrient processing, bile production, regulation of several biochemical pathways, and the biotransformation of drugs and other foreign substances. Its continuous exposure to metabolites, medicines, and environmental chemicals makes it susceptible to injury through oxidative stress, mitochondrial dysfunction, inflammatory responses, and disruption of cellular integrity. Hepatotoxicity may arise from medicinal agents, toxic chemicals, metabolic disorders,

infections, and other pathological conditions. The identification of agents capable of preventing or reducing hepatic injury remains an important area of biomedical research.

Ayurveda approaches physiological and pathological processes through a framework that includes Dosh, Dhatu, Mala, Agni, Srotas, and the functional relationships between different organs. Yakrit is recognised as an important organ in the Ayurvedic understanding of bodily metabolism and Pitta-related physiology. Nevertheless, Yakrit Roga should not be interpreted as a single modern diagnosis. Conditions such as drug-induced liver injury, viral hepatitis, fatty liver disease, cholestasis, and cirrhosis have distinct causes and pathological processes.

Within this framework, the study of medicinal plants traditionally associated with bitter taste, digestive functions, fever, and Pitta-related disorders may offer useful directions for pharmacological investigation. Kiratatikta is particularly relevant because its traditional pharmacodynamic profile can be analysed through Rasa Panchaka rather than relying exclusively on modern descriptions of its chemical constituents.

The Ayurvedic rationale for examining Kiratatikta in liver-related disorders therefore requires two complementary enquiries. First, what do its Rasa, Guna, Virya, Vipaka, and Karma suggest about its traditional therapeutic action? Second, do experimental observations provide any support for particular biological effects that might be relevant to hepatic injury?

The present article addresses these questions while distinguishing classical Ayurvedic descriptions, interpretative clinical reasoning, and experimentally investigated pharmacological mechanisms.

Drug identification and Ayurvedic nomenclature

Kiratatikta is commonly associated with *Swertia chirayta* (Roxb.) H. Karst., belonging to the family Gentianaceae. The official Ayurvedic pharmacopoeial drug is described as the dried whole plant. The plant is an erect, branched herb, generally found in temperate Himalayan regions. Its dried material consists of varying proportions of roots, stems, leaves, flowers, fruits, and seeds, and is characterised by a pronounced bitter taste.

The names Kirata, Kiratatikta, and related variants occur in Ayurvedic materia medica. The use of vernacular names requires care because the same common name may be applied to different botanical species. In particular, Bhunimba is used inconsistently across medicinal plant sources and may also refer to *Andrographis paniculata*. Consequently, the botanical identity of the material must be confirmed rather than inferred from the trade name alone.

For pharmacological research, the raw drug should be authenticated by a qualified botanist, and a voucher specimen should be deposited in a recognised herbarium. Such authentication is essential when attempting to correlate traditional Ayurvedic properties with experimentally observed effects.

Classical Ayurvedic references to Kiratatikta

Classical references should be interpreted according to the purpose for which a drug is described. Inclusion in a Gana or Mahakashaya indicates a recognised place within a therapeutic classification; inclusion in a formulation indicates a particular application within a larger medicinal combination. Neither automatically establishes a specific indication for every disease involving the liver.

References in the Charaka Samhita

The Charaka Samhita online index records Kiratatikta in relation to Tikta Skandha and in a number of formulations and therapeutic contexts. These include Kiratatikta-related decoctions for fever, its use in selected dietary and medicinal preparations, and formulations discussed in the management of particular digestive and Pitta-associated disorders.

The references are relevant because they demonstrate that the plant is not merely a contemporary herbal supplement; it has a place within a wider classical therapeutic framework. Its inclusion in compound preparations also illustrates the importance of Anupana, formulation, and the clinical context in which a drug is used.

The interpretation should nevertheless remain precise. A reference to Kiratatikta in a formulation for a particular condition does not mean that the isolated plant has been established as a treatment for all disorders sharing one modern pathological feature.

References in other Ayurvedic classifications

Secondary compilations of classical drug classifications report Kiratatikta in the Aragvadhadi Gana of the Sushruta Samhita and related classifications in later Ayurvedic materia medica.

Rasa Panchaka of Kiratatikta

Rasa Panchaka provides a traditional method of analysing the likely action of a Dravya through five interrelated attributes: Rasa, Guna, Virya, Vipaka, and Prabhava. It is particularly useful for developing an Ayurvedic interpretation of a medicinal plant because it connects the sensory and qualitative characteristics of a substance with its proposed physiological and therapeutic effects.

The following profile is commonly reported for Kiratatikta in Ayurvedic materia medica.

Parameter	Property of Kiratatikta	Traditional interpretation
Rasa	Tikta	Associated with Kapha-Pitta pacification and traditional Deepana-Pachana interpretations
Guna	Laghu, Ruksha	Light and dry qualities; traditionally considered relevant to Kapha and Meda-related imbalance
Virya	Sheeta	Cooling potency; traditionally associated with the alleviation of certain Pitta-related manifestations
Vipaka	Katu	Post-digestive effect traditionally associated with Kaphahara action and aspects of metabolic processing
Karma	Commonly described as Pitta-Kaphahara; other actions depend on the source	Requires interpretation in the context of the indication and formulation

1. Tikta Rasa: the primary basis of interpretation

Tikta Rasa is the most characteristic attribute of Kiratatikta. In Ayurvedic pharmacodynamics, bitter substances are traditionally associated with Kapha-Pitta pacification, Deepana-Pachana in appropriate contexts, and particular effects on bodily tissues and secretions. Tikta Rasa is also discussed in classical descriptions of medicinal substances used in certain febrile, inflammatory, and Pitta-associated conditions.

Its relevance to Yakrit Roga should be approached through these traditional principles rather than by equating bitterness directly with liver detoxification. The Ayurvedic rationale is that a drug possessing Tikta Rasa may be considered where the clinical presentation and Dosha involvement are compatible with its properties.

In modern pharmacology, the bitterness of *S. chirayta* is associated with bitter secoiridoid constituents, including amarogentin and related compounds. Research into these compounds has explored several biological activities. However, the traditional category of Tikta Rasa and the chemical identity of bitter molecules represent different explanatory systems. The presence of bitter compounds does not, by itself, prove a particular Ayurvedic action or clinical benefit.

2. Laghu Guna: relevance to digestive function

Laghu Guna denotes lightness and is traditionally associated with substances that do not possess the heavy, obstructive qualities attributed to Guru Dravyas. In a clinical interpretation, Laghu Guna may be considered relevant when digestive heaviness or Kapha-associated features form part of the overall presentation.

For Yakrit Roga, this property may contribute to the traditional rationale for selecting a drug within a broader plan directed at impaired digestion or metabolic disturbance. However, Laghu Guna should not be interpreted as proof that Kiratatikta increases hepatic clearance or improves a particular metabolic pathway. Such outcomes require independent pharmacological investigation.

3. Ruksha Guna: the importance of clinical context

Ruksha Guna refers to dryness. In classical reasoning, Ruksha substances may reduce certain Kapha-associated qualities, but they may also aggravate Vata or be unsuitable in conditions characterised by excessive dryness or depletion.

This distinction is important because the same drug may not be appropriate for every person with a liver disorder. A patient with poor nutritional status, marked weakness, or signs of tissue depletion cannot be assumed to benefit from a drug merely because it is Tikta and Ruksha.

The traditional pharmacodynamic profile should therefore be applied according to the patient's constitution, Dosha involvement, strength, digestive state, and the overall clinical presentation. It should not be used as a substitute for assessing the cause and severity of liver disease.

4. Sheeta Virya: the Pitta-related rationale

Sheeta Virya denotes cooling potency. Within Ayurvedic reasoning, this quality is associated with the pacification of certain Pitta-dominant manifestations. This provides a possible traditional rationale for considering Kiratatikta in selected presentations in which Pitta-related features are prominent.

5. Katu Vipaka: post-digestive action

Katu Vipaka describes the post-digestive effect assigned to the drug in Ayurvedic pharmacodynamics. It is traditionally associated with particular effects on Kapha and aspects of bodily metabolism.

In the context of Yakrit Roga, Katu Vipaka may contribute to the classical rationale for selecting Kiratatikta where Kapha-associated digestive or metabolic features are considered important.

6. Prabhava and the limits of inference

Prabhava refers to a specific or distinctive action that cannot be adequately explained by the other properties alone.

From Rasa Panchaka to Yakrit Roga: a reasoned Ayurvedic interpretation

The potential relevance of Kiratatikta to Yakrit Roga is better understood by examining the broader Ayurvedic pathophysiological framework than by attempting to assign a direct one-to-one correspondence between an Ayurvedic property and a modern laboratory marker.

Agni and metabolic function

Agni occupies a central position in Ayurvedic explanations of digestion and transformation. Disturbances in Agni are discussed in relation to improper digestion, altered metabolic processing, and the development of pathological conditions.

Kiratatikta's traditional association with bitter taste and selected Deepana-Pachana applications provides a basis for investigating its role in clinical situations where digestive disturbances accompany other symptoms.

Pitta and Yakrit

Yakrit is traditionally discussed in relation to Pitta, and the organ has a significant place in Ayurvedic descriptions of bodily transformation. Kiratatikta's commonly reported Sheeta Virya and Pitta-Kaphahara action therefore provide a traditional rationale for investigating its use in selected Pitta-associated conditions.

This interpretation must not be extended to claim that all cases of jaundice or hepatotoxicity are Pitta disorders of the same type. Jaundice may arise from haemolysis, hepatocellular injury, or obstruction of bile flow, and each requires appropriate diagnosis. The Ayurvedic assessment must also be distinguished from the modern aetiological diagnosis.

Dosha-Dushya Samurchana and disease variability

Ayurveda explains disease development through interactions among Dosha, Dushya, Srotas, Agni, and other pathological factors. From this perspective, Yakrit-related manifestations may differ according to the dominant Dosha, the tissues and channels involved, disease duration, and the strength of the patient.

Kiratatikta should therefore not be presented as universally indicated for every condition affecting the liver. Its traditional properties may provide a rationale in selected presentations, but the suitability of a particular medicine depends on the full clinical assessment and the formulation in which it is administered.

Pharmacognostical and phytochemical profile

Botanical and pharmacognostical identification

The official drug consists of the dried whole plant of *Swertia chirayita* (Roxb.) H. Karst., family Gentianaceae. The dried material is generally brownish or yellowish-brown and contains fragments of the root, stem, leaves, flowers, fruits, and seeds. Its pronounced bitterness is an important organoleptic characteristic.

Authentication is particularly important because medicinal plants may be sold under similar vernacular names. A research study that fails to establish botanical identity cannot reliably connect its results to the traditional Ayurvedic drug.

Major phytochemical groups

The reported chemical constituents of *S. chirayta* include secoiridoid glycosides, xanthonenes, flavonoids, and other secondary metabolites. Swertiamarin, amarogentin, sweroside, and gentiopicroside are among the compounds reported in the phytochemical literature.

These compounds provide a basis for investigating the biological activities of the plant. However, the amount of each compound depends on the plant's origin, developmental stage, processing, extraction method, and storage conditions.

Chemical standardisation should therefore be undertaken before experimental results from different preparations are compared. The presence of a compound associated with a biological effect does not establish that it occurs at an effective concentration in every commercial preparation.

Modern pharmacological evidence relevant to hepatoprotection

Antioxidant defence and lipid peroxidation

Oxidative stress is a recognised contributor to several forms of hepatic injury. Reactive oxygen species can damage cellular lipids, proteins, and nucleic acids, while excessive lipid peroxidation can compromise cellular membranes.

Experimental studies involving *S. chirayta* have reported changes in oxidative stress-related parameters in chemically induced liver injury models. These findings suggest that antioxidant activity may contribute to its observed effects under experimental conditions.

The preservation of glutathione and endogenous antioxidant enzymes, together with reduced lipid peroxidation, offers a plausible mechanism for further investigation. Nevertheless, the specific molecular pathways involved and their importance in humans remain uncertain.

Changes in liver-associated biochemical markers

In experimental hepatotoxicity research, serum ALT and AST are commonly used as indicators of hepatocellular injury. Other measurements, such as bilirubin, ALP, oxidative stress markers, and liver histology, can help characterise the response to an intervention.

S. chirayta have reported improvements in selected biochemical parameters and liver tissue changes in experimental models. Such results support further research but do not establish that the plant prevents progression to liver failure or improves long-term outcomes in humans.

Inflammatory pathways

Inflammatory processes can amplify hepatic injury following exposure to certain toxins. The reported biological activities of plant-derived compounds provide a rationale for studying whether constituents of *S. chirayta* influence inflammatory signalling.

However, general anti-inflammatory activity cannot be taken as proof of a specific anti-inflammatory mechanism in the liver. Further work is required to identify the relevant mediators, concentrations, and reproducible effects.

Xenobiotic metabolism and CYP2E1

Some forms of drug-induced liver injury involve the formation of reactive metabolites. In paracetamol toxicity, CYP2E1 contributes to the formation of N-acetyl-p-benzoquinone imine (NAPQI), which is normally detoxified primarily through glutathione conjugation.

Recent research has explored interactions between compounds from *S. chirayta* and CYP2E1. These findings provide a hypothesis for future research rather than proof that *chirayta* prevents paracetamol toxicity in humans.

Any effect on drug-metabolising enzymes must also be evaluated for safety because enzyme modulation may alter the effects of concomitant medicines.

Integrative interpretation: Ayurvedic properties and modern hypotheses

The relationship between Rasa Panchaka and modern hepatoprotective research is best presented as a set of hypotheses that can be investigated, rather than as a claim of direct equivalence.

Ayurvedic attribute	Traditional interpretation	Modern research question
Tikta Rasa	Traditionally associated with Pitta-Kapha pacification and selected Deepana-Pachana applications	Which constituents account for bitterness, and do standardised preparations produce reproducible biological effects?
Laghu Guna	Traditionally associated with lightness and selected digestive applications	Does the preparation influence any measurable metabolic or physiological outcome?
Ruksha Guna	Traditionally associated with dryness and reduction of certain Kapha-associated qualities	How do dose, formulation, and patient characteristics affect tolerability and safety?
Sheeta Virya	Traditionally associated with the pacification of selected Pitta-related manifestations	Are specific anti-inflammatory or antioxidant effects reproducible in validated models?

Ayurvedic attribute	Traditional interpretation	Modern research question
Katu Vipaka	Traditionally associated with post-digestive effects and aspects of Kapha regulation	Do controlled studies identify changes in any relevant metabolic or biochemical outcome?

This comparison demonstrates how traditional pharmacodynamic descriptions can generate research questions. It does not demonstrate that the Ayurvedic attributes themselves cause the modern pharmacological effects.

The distinction is important for scientific integrity. A hypothesis may be reasonable and worthy of investigation without being established as fact.

Discussion

Kiratatikta offers an instructive example of how Ayurvedic materia medica can guide the selection of a medicinal plant for modern investigation. Its characteristic bitter taste, traditionally described Rasa Panchaka, and presence in classical therapeutic classifications provide a foundation for examining its possible role in selected Pitta-associated and digestive conditions.

The Ayurvedic argument should not be restricted to the statement that Kiratatikta is bitter and therefore useful in liver disease. A more meaningful interpretation considers the interaction of Tikta Rasa, Laghu-Ruksha Guna, Sheeta Virya, and Katu Vipaka, together with Dosha involvement, Agni, the patient's condition, and the therapeutic context.

Tikta Rasa and Sheeta Virya provide a traditional rationale for examining the plant in selected Pitta-associated presentations, while Laghu and Ruksha Guna may be relevant to certain Kapha-associated patterns. Katu Vipaka contributes to the broader pharmacodynamic interpretation. These properties must be considered together rather than treated as isolated explanations of a particular clinical effect.

The modern evidence adds a separate line of investigation. Experimental studies have reported protective effects in chemically induced liver injury models, including changes in biochemical parameters, antioxidant defences, and liver tissue architecture. Research into individual compounds and possible enzyme interactions has further expanded the range of mechanisms that can be investigated.

The two perspectives are complementary in the sense that Ayurvedic principles can help frame questions about traditional use, whereas experimental pharmacology can test specific biological outcomes. They are not interchangeable, and modern laboratory findings should not be retroactively presented as proof that a classical text described the same mechanism.

Future research should combine accurate botanical authentication, reproducible pharmacognostical and phytochemical characterisation, dose-response studies, toxicological evaluation, and controlled clinical trials. Studies should also distinguish between the isolated herb, standardised extracts, individual constituents, and classical formulations.

Conclusion

Kiratatikta (*Swertia chirayita*) has a meaningful place in Ayurvedic materia medica and offers a useful subject for research at the intersection of Dravyaguna and modern hepatopharmacology. Its commonly reported Rasa Panchaka—Tikta Rasa, Laghu and Ruksha Guna, Sheeta Virya, and Katu Vipaka—provides a traditional framework for interpreting its potential relevance to selected Pitta-Kapha and digestive presentations.

The relevance of these properties to Yakrit Roga should be understood as a reasoned Ayurvedic interpretation, not as proof that Kiratatikta treats every form of liver disease. Modern experimental

findings suggest possible antioxidant, cytoprotective, and anti-inflammatory effects, together with potential interactions with xenobiotic-metabolising pathways. An evidence-based understanding of Kiratatikta requires respect for both the specificity of classical Ayurvedic concepts and the standards of modern pharmacological research. Proper authentication, accurate classical referencing, chemical standardisation, and well-designed clinical studies are necessary before its role in hepatotoxicity can be defined with confidence.

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