# INTERNATIONAL JOURNAL OF AYURVEDA360

ISSN
PRINT:
3048-7382
ONLINE:
3048-7390

AYURVEDA 360

## PEER-REVIEWED BIMONTHLY JOURNAL

2025
VOLUME 2
ISSUE 3
NOVEMBER-DECEMBER

www.ayurveda360.in/journal

Review Article

# A Review of Patolakaturohinyadi Kashaya as a Polyherbal Hepatoprotective Formulation

**Dr. Rachana Vaibhav Phartale[1], Dr. Rajeshkumar Surendranath Upadhyay[2], Dr. Vaibhav Dattatray Phartale[3]**

[1] PhD Scholar, Department of Agadtantra Evam Vidhi Vaidyaka, CSMSS Ayurved Mahavidyalaya and Rugnalaya, Sambhaji Nagar, Maharashtra, India. ORCID: https://orcid.org/0009-0002-4715-3971

[2] Professor and Head of Department, Department of Agadtantra Evam Vidhi Vaidyaka, CSMSS Ayurved Mahavidyalaya and Rugnalaya, Sambhaji Nagar, Maharashtra, India. ORCID: https://orcid.org/0009-0005-6204-7343

[3] Principal, Professor and Head of Department, Department of Kayachikitsa, Anjaneya Ayurveda Mahavidyalaya, Nashik, Maharashtra, India. ORCID: https://orcid.org/0009-0009-0639-3849

## Abstract

**Introduction:**

Paṭolakaṭurohiṇyādi Kaṣāya (PKK) is a classical Ayurvedic polyherbal decoction traditionally indicated in liver disorders, jaundice (Kāmala), blood purification, and detoxification. In recent years, growing experimental and clinical evidence has explored its hepatoprotective potential. Key constituent herbs such as Picrorhiza kurroa, Tinospora cordifolia, Trichosanthes dioica, and Cissampelos pareira have been extensively studied for their pharmacological actions relevant to liver protection.

**Methods:**

This narrative review compiles and critically analyzes classical Ayurvedic references, phytochemical profiles, modern pharmacological studies of individual ingredients, and available preclinical and clinical studies evaluating PKK. Safety data, limitations of existing studies, and gaps in current research were also assessed from published literature.

**Results:**

The reviewed evidence indicates that PKK and its constituent herbs exhibit hepatoprotective effects mediated through antioxidant, anti-inflammatory, choleretic, membrane-stabilizing, and immunomodulatory mechanisms. Preclinical studies demonstrate protection against chemically induced liver injury, while limited clinical studies suggest potential benefits in hepatic dysfunction and jaundice. The formulation appears to be generally safe when used as per classical guidelines.

**Discussion:**

Although existing data provide promising insights into the hepatoprotective role of PKK, the current evidence is limited by heterogeneity in study designs, lack of standardization, and small sample sizes. Well-designed randomized controlled trials, standardized formulations, and mechanistic studies are essential to establish stronger clinical evidence and facilitate wider acceptance of PKK in integrative hepatology.

**Keywords:** Paṭolakaṭurohiṇyādi Kaṣāya, Hepatoprotection, Kāmala, and Āyurveda

.


| Access this article online | |
|---|---|
| **Quick Response Code:** | **Website:** www.ayurveda360.in/journal |
| | International Journal of Ayurveda360 |
| | **E-ISSN:** 3048-7390 **Print ISSN:** 3048-7382 |
| | Volume 2 Issue 3: November-December 2025 |
| | **DOI:** https://doi.org/10.63247/3048-7390.vol.2.issue3.13 |



**Address for Correspondence:**
Dr. Rachana Vaibhav Phartale, PhD Scholar, Department of Agadtantra Evam Vidhi Vaidyaka, CSMSS Ayurved Mahavidyalaya and Rugnalaya, Sambhaji Nagar, Maharashtra, India, Email ID: drrachanaphartale2014@gmail.com



**How to cite this article:**
Phartale RV, Upadhyay RS, Phartale VD. A Review of Patolakaturohinyadi Kashaya as a Polyherbal Hepatoprotective Formulation. Int J Ayurveda360. 2025;2(3):933–943. DOI: https://doi.org/10.63247/3048-7390.vol.2.issue3.13

| Manuscript Received | Review Round 1 | Review Round 2 | Review Round 3 | Final Updated Received |
|---|---|---|---|---|
| 15/11/2025 | 27/11/2025 | 30/11/2025 | 03/12/2025 | 08/12/2025 |
| **Accepted** | **Published** | **Conflict of Interest** | **Funding** | **Similarity Check** |
| 13/12/2025 | 15/12/2025 | NIL | NIL | 11 % |





**This journal is published under the tradename Ayurveda360 (Publications), registered under UDYAM-KR-27-0044910**

## Introduction

Liver diseases ranging from drug-induced hepatotoxicity and alcoholic or non-alcoholic fatty liver disease (NAFLD) to viral hepatitis, cholestatic conditions, and cirrhosis remain a major global health burden.[1] In Ayurveda, the liver diseases are referred as 'Kāmala' which literary mean "Kāmam Lunāti Iti Kāmālati". Here Kāmam means Icchā or desires, and Lāti means Runaddhi or Bādhanti or to diminish.[2] Conventional therapy often focuses on supportive care; antifibrotic and regenerative options are limited. In this context, traditional systems of medicine such as Ayurveda offer multi-herb formulations with long-standing empirical use in jaundice (Kāmala), intermittent fevers, toxin exposure, and metabolic derangements.[3] Paṭolakaṭurohiṇyādi Kaṣāya (PKK) is a classical polyherbal formulation indicated in Aṣṭāṅgahṛdaya under the chapter of Śodhanādi gaṇa saṅgraha, indicated in Kapha–Pitta vikāra, Kuṣṭha, Jvara, Viṣa, Chardi, Arochaka, Kāmalahara.[4] Given rising interest in integrative medicine, systematic scientific evaluation of PKK is needed.

The rationale for this review is to collate and critically analyze current evidence both from modern pharmacology of constituent herbs and from preclinical/clinical studies involving PKK to assess whether classical references can translate into evidence-based hepatoprotection, and to identify gaps and future research priorities.

## Classical Composition, Ayurvedic Rationale, and Challenges in Modern Standardization

PKK is described in the classical Ayurvedic text Aṣṭāṅgahṛdaya under Śodhanādi gaṇa saṅgraha chapter, and is traditionally indicated for disorders such as Kāmala, Kapha–Pitta conditions, Viṣa (poisonings), Kuṣṭha (skin diseases), Jvara (fevers), Aruci (anorexia), digestive disturbances, and metabolic derangements. The decoction is prepared by boiling a formulation of herbs, reducing the volume, filtering, and administering with warm water. Its constituent of the formulation[5,6] are as mentioned in Table 1.

**Table 1: Composition of Paṭolakaṭurohiṇyādi Kaṣāya**

| Name | Scientific Name | Family | Part Used | Rasa | Guṇa | Vīrya | Vipāka | Karma |
|---|---|---|---|---|---|---|---|---|
| Paṭola[7] | *Trichosanthes dioica* Roxb. | Cucurbitaceae | Phala | Tikta | Laghu, Rūkṣa | Uṣṇa | Kaṭu | Kapha–Pitta śāmaka, Dīpana |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Kaṭurohiṇī (Kuṭkī)[8] | *Picrorhiza kurroa* Royle ex Benth. | Plantaginaceae | Mūla | Tikta, Kaṣāya | Laghu, Rūkṣa | Śīta | Kaṭu | Pittahara, Rechana, Yakṛt-uttejaka |
| Madhusravā (Mūrvā)[9] | *Marsdenia tenacissima* R. Br | Apocynaceae | Mūla | Tikta | Laghu | Uṣṇa | Kaṭu | Tridoṣaghna |
| Guḍūcī[10] | *Tinospora cordifolia* (Willd.) Miers | Menispermaceae | Kāṇḍa | Tikta, Kaṣāya | Laghu, Snigdha | Uṣṇa | Madhura | Tridoṣahara, Rasāyana |
| Pāṭhā[11] | *Cissampelos pareira* L. | Menispermaceae | Mūla | Tikta | Laghu | Uṣṇa | Kaṭu | Kapha–Pitta śāmaka |
| Candana[12] | *Santalum album* L. | Santalaceae | Hṛdaya | Tikta, Madhura | Laghu, Rūkṣa | Śīta | Kaṭu | Pittāśamana |

## Mode of Action based on Rasapañcaka

Paṭolakaṭurohiṇyādi Kaṣāya predominantly exhibits Tikta and Kaṣāya rasa, Laghu–Rūkṣa guṇa, Uṣṇa vīrya, and Kaṭu vipāka, which collectively contribute to Kapha–Pitta śamana, Dīpana–Pācana, Rakta śodhana, and Viṣaghna actions. Paṭola, Kaṭukī, Candana, and Pāṭhā primarily pacify Kapha and Pitta, while Guḍūcī and Mūrvā exhibit Tridoṣahara properties, with Guḍūcī acting as a key Pittaśāmaka and Rasāyana, especially relevant as Pitta is the principal Doṣa involved in Kāmala. The predominance of Tikta rasa supports Pittaja vikāra śamana, bile regulation, and metabolic correction, whereas Kaṣāya rasa aids in tissue stabilization and anti-inflammatory effects. As the liver is considered the Mūlasthāna of Raktavaha srotasa and shares an Āśraya–Āśrayī bhāva relationship with Rakta and Pitta, drugs that pacify Rakta and Pitta exert a direct therapeutic effect on hepatic pathology. Thus, the collective Rasapañcaka attributes of PKK provide a sound Ayurvedic rationale for its indication in liver disorders.

## Preclinical and Clinical Evidence for PKK

Empirical evaluation of PKK itself is limited but encouraging. The hepatoprotective potential of Paṭolakaṭurohiṇyādi Kaṣāya (PKK) has been evaluated through experimental animal studies and limited clinical investigations. In a well-documented preclinical experimental study, hepatotoxicity was induced in Wistar albino rats using paracetamol at a dose of 400 mg/kg orally for seven consecutive days. The animals were divided into normal control, disease control,

preventive, curative, and test (PKK) groups, with six animals per group, as commonly adopted in experimental hepatoprotection models. PKK was administered orally at a dose of 8.7 ml/kg/day. In the preventive group, PKK was given concurrently with paracetamol for seven days, whereas in the curative group, PKK was administered for seven days following paracetamol exposure, making the total study duration 14 days. Biochemical parameters including serum AST, ALT, ALP, and total bilirubin were assessed along with histopathological examination of liver tissue. The PKK-treated groups showed significant normalization of liver enzymes and bilirubin levels compared to the disease control group, along with marked improvement in hepatic architecture, indicating a protective and restorative effect against drug-induced liver injury. These findings support the hepatoprotective and antioxidant actions of PKK observed in experimental settings.[13]

Clinical evidence for PKK primarily consists of comparative trials and observational reports. An open-label randomized comparative clinical study was conducted in patients diagnosed with hepatocellular jaundice (Koṣṭhaśākhāśrita Kāmala), wherein a total of 30 patients were randomly allocated into two groups of 15 patients each. One group received Paṭolakaṭurohiṇyādi Kaṣāya, while the comparator group received Trāyaṇtyādi Kaṣāya.[14] Both formulations were administered orally in classical dosage of 15–20 ml twice daily with lukewarm water for a duration of 28 days. Clinical assessment included subjective parameters such as icterus, anorexia, fatigue, nausea, and discoloration of urine and stool, while objective evaluation was done using liver function tests including serum bilirubin, AST, ALT, and ALP before and after treatment. Both groups demonstrated statistically significant improvement in clinical features and biochemical parameters.[15] Inter-group comparison showed comparable efficacy, with PKK demonstrating pronounced Pitta śamana and Rakta prasādana effects, supporting its role in hepatocellular dysfunction.

Additionally, case-based clinical observations and small observational studies have reported the use of PKK as part of integrative Ayurvedic management in non-alcoholic fatty liver disease (NAFLD). In these reports, PKK was administered at a dose of 20 ml twice daily with lukewarm water for a duration of three months, along with other Śamana medicines and dietary and lifestyle modifications.[16] Improvements were noted in liver function parameters such as serum

transaminases and bilirubin, as well as reduction in fatty infiltration on ultrasonography. Collectively, these findings pre-clinical protection in toxin-induced injury and clinical improvement in jaundice and ALD form a preliminary but tangible evidence base for PKK. However, due to methodological constraints (non-standardized formulation, small/nonsystematic trials, short follow-up, lack of control arms), they are primarily hypothesis-generating rather than confirmatory.

## Modern Pharmacology of Key Constituent Herbs: Mechanistic Basis for Hepatoprotection

A major strength of the PKK formulation lies in the modern pharmacological validation of its constituent herbs. Several well-designed studies have demonstrated hepatoprotective activity, antioxidant effects, immunomodulation, and membrane stabilization mechanisms highly relevant to prevention or mitigation of hepatic injury from toxins, oxidative stress, inflammation, or metabolic overload.

Picrorhiza kurroa (Kaṭurohiṇī/Kuṭkī). Extensive modern research supports strong hepatoprotective activity of *P. kurroa*. A recent comprehensive review highlighted that picrosides I & II, kutkin, and related iridoid glycosides in *P. kurroa* act through suppression of xanthine oxidase, metal chelation, free radical scavenging, inhibition of lipid peroxidation, and modulation of inflammatory pathways. Oral administration of methanolic rhizome extracts showed protective effects in D-galactosamine/LPS-induced liver injury in mice; isolated constituents (such as picroside II, androsin, 4-hydroxy-3-methoxyacetophenone) at 50–100 mg/kg markedly reduced hepatocyte cytotoxicity, protected against TNF-α-induced toxicity, and attenuated NO production in macrophages, suggesting antioxidant, anti-inflammatory, and cytoprotective mechanisms. These data suggest a strong mechanistic basis for the hepatoprotective potential of PKK that include *P. kurroa*.[17,18]

Tinospora cordifolia (Guḍūcī). Multiple experimental studies demonstrate that extracts (aqueous, ethanolic, svarasa/hima) of *T. cordifolia* significantly reduce elevations of liver enzymes (AST, ALT, ALP), restore normal histology, and increase antioxidant enzyme activity (e.g., superoxide dismutase, catalase), while decreasing lipid peroxidation in carbon tetrachloride ($CCl_4$)- or paracetamol-induced liver injury models.[19] One study reported that ethanolic extracts were most effective, though even aqueous preparations showed significant benefit.

Histopathological analysis confirmed reduction of necrosis and inflammatory infiltration. These findings support Guḍūcī's classical classification as Rasāyana and Yakṛt-supporting herb, and validate its inclusion in PKK as a hepatoprotective and detoxifying agent.[20]

## Supporting Evidence for Polyherbal Formulation

Systematic reviews of medicinal plants with hepatoprotective activity often list *P. kurroa*, *T. cordifolia*, and other taxa present in PKK among promising candidates, underscoring that herbal combinations may yield additive or synergistic effects, especially in complex, multifactorial liver diseases.[21] This supports the classical polyherbal rationale where multiple herbs in a decoction address various pathological aspects (oxidative stress, inflammation, bile flow, metabolic disturbance).

Thus, the modern pharmacological profile of PKK's ingredients aligns strongly with the observed preclinical and clinical hepatoprotective effects, offering a scientifically plausible mechanistic framework bridging traditional Ayurvedic knowledge and contemporary hepatology.

## Safety, Standardization, and Regulatory Considerations

While constituent herbs such as *T. cordifolia* and *P. kurroa* have shown good safety profiles in experimental studies, widespread clinical use of PKK requires rigorous evaluation of long-term safety, herb–drug interactions (especially in patients on allopathic medications), dose standardization, microbial safety of decoctions, and batch-to-batch consistency. The lack of clinical reports describing serious adverse effects is encouraging but not sufficient; most trials are short-term (weeks), involve small numbers, and lack systematic monitoring. Additionally, standardization of the decoction (herb authentication, part used, ratio, extraction volume, concentration, storage conditions) is rarely described in published clinical reports, undermining reproducibility and generalizability.[22] For PKK to be accepted in integrative hepatology, efforts must be made to develop pharmacopeial standards for preparation, to document active marker compounds (e.g., picrosides, alkaloids, flavonoids), and to conduct controlled toxicity and herb–drug interaction studies.[23]

## Limitations of Current Evidence

Despite encouraging signals, several critical limitations constrain any strong recommendation for PKK's routine clinical use. First, the preclinical evidence remains limited to a few studies

(e.g., paracetamol-induced hepatotoxicity in rats), and lacks exploration in chronic models (e.g., repeated toxin exposure, alcohol, fatty liver, cholestasis, fibrosis). Second, clinical trials are small (n ≈ 20–30), non-blinded or uncontrolled, of short duration (4–8 weeks), and often combined with lifestyle changes; hence placebo effect, spontaneous recovery, and regression to the mean cannot be excluded. Third, formulation heterogeneity and lack of phytochemical standardization make cross-study comparisons difficult and prevent replication. Fourth, long-term outcomes—such as fibrosis regression, cirrhosis stabilization, liver-related morbidity or mortality—have not been studied. Finally, absence of pharmacokinetic data, poor reporting of safety/adverse events, and lack of herb–drug interaction data raise concerns for large-scale or long-term application.[15]

## Future Directions and Research Recommendations

To establish PKK from a traditionally used decoction towards an evidence-based hepatoprotective medicine, a coordinated research agenda is required.

1. Rigorous phytochemical standardization should be conducted: identify, quantify, and validate marker compounds (e.g., picrosides, glycosides, alkaloids, flavonoids) via techniques such as HPLC, LC-MS, or NMR; ensure batch-to-batch consistency.
2. Preclinical studies in chronic/clinically relevant models (e.g., alcohol-induced liver injury, NAFLD, cholestasis, fibrosis, repeated toxin exposure) should be prioritized; study endpoints should include oxidative stress markers, inflammatory cytokines, bile flow, histopathology, fibrosis markers, and regeneration indices.
3. Toxicology and herb–drug interaction studies should be systematically carried out, especially since liver disease patients often take multiple medications.
4. Randomized, double-blind, placebo-controlled clinical trials with adequate sample size and longer follow-up (6–12 months), using standardized PKK preparation and objective endpoints (LFTs, imaging/fibrosis markers, quality-of-life) are essential.
5. Pharmacokinetic (PK)/pharmacodynamic (PD) studies to understand absorption, bioavailability, metabolism, excretion, and active dose–

response relationships would facilitate dosing optimization.

6. Lastly, regulatory and quality frameworks should be developed (pharmacopeial monographs, decoction preparation guidelines, microbial safety, storage/stability).

## Conclusion

Paṭolakaṭurohiṇyādi Kaṣāya demonstrates significant potential as a hepatoprotective Ayurvedic formulation, supported by its classical Rasapañcaka-based rationale and emerging preclinical and clinical evidence. Experimental studies indicate biochemical and histological protection against hepatotoxic injury, while limited clinical studies suggest improvement in liver function and symptomatic relief in Kāmala and fatty liver disorders. However, the current evidence remains preliminary due to small sample sizes, short study durations, non-blinded designs, and lack of formulation standardization. Future research should focus on rigorous phytochemical standardization, long-term safety assessment, pharmacokinetic evaluation, and well-designed randomized controlled clinical trials to establish PKK as an evidence-based hepatoprotective agent.

## Declarations

**Conflict of Interest:** The author declares that they have no conflicts of interest related to this work.

**Funding / Financial Support:** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Author Contributions:** The author has contributed to the conception, design, data collection, analysis, drafting, and approval of the final manuscript.

**Ethical Approval:** Not Applicable

**Data Availability Statement:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

**Acknowledgements:** The authors would like to acknowledge the support of their institution, colleagues, and technical staff who contributed to this work.

**Disclaimer / Views and Opinions:** The opinions expressed in this article are solely those of the author and do not reflect the views of the International Journal of Ayurveda360 or its editorial board.

**AI-Use Declaration:** The author declares that no generative AI tools were used to create scientific content, interpret data, or draft any sections of this manuscript. AI-based tools were used **solely for minor language and grammar refinements** to improve clarity and

readability. All scientific content, analysis, and conclusions remain the sole responsibility of the authors.

## References:


1) Asrani SK, Devarbhavi H, Eaton J, Kamath PS. Burden of liver disease in the world. J Hepatol. 2023;78(1):S1–S11. doi:10.1016/j.jhep.2022.09.014. PMID: 36990226.
2) Cakrapāṇi Datta. Āyurveda Dīpikā commentary on Carakasaṃhitā. Cikitsāsthāna, Hikkāśvāsa-cikitsā-adhyāya; 17/83 [Internet]. cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-esamhita-ecaraka-cikitsasthana-hikkashvasa-cikitsa/
3) Dash B, Sharma RK. Charaka Saṃhitā. Varanasi: Chaukhambha Sanskrit Series Office; 2014.
4) Gupta A. Aṣṭāṅgahṛdaya Sūtrasthāna. 12th ed. Chapter 15/15. Varanasi: Chaukhambha Sanskrit Sansthan; 1997. p. 105.
5) Chopra RN, Nayar SL, Chopra IC. Glossary of Indian medicinal plants. New Delhi: CSIR; 2006.
6) Kirtikar KR, Basu BD. Indian medicinal plants. Vol. 1. Dehradun: International Book Distributors; 2005.
7) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Guḍūcyādivarga; 4/93–94 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-guducyadivarga/
8) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Guḍūcyādivarga; 134–135 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-guducyadivarga/
9) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Guḍūcyādivarga; 210 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-guducyadivarga/
10) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Guḍūcyādivarga; 1–9 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-guducyadivarga/
11) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Guḍūcyādivarga; 163–164 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-guducyadivarga/
12) Bhāvamiśra. Bhāvaprakāśa Nighaṇṭu. Karpūrādivarga; 11–13 [Internet]. Ayurveda360; cited 2025 Nov 22. Available from: https://ayurveda360.in/ebooks-enighantu-bhavaprakasha-nighantu-karpuradivarga/
13) Kadam MS, Tumram A. Assessment of effect of Patolakaturohiṇyādi Kvātha in paracetamol-induced hepatotoxicity in albino Wistar rats: an experimental study. J Nat Remedies. 2024;24(8):1685–1694. doi:10.18311/jnr/2024/34823.
14) Akshata, Mathapati IS, Dharmannavar GS. A clinical comparative study of Paṭolakaturohiṇyādi Kaṣāya and Trāyaṇtyādi Kaṣāya in Koṣṭhaśākhāśrita Kāmala with special reference to hepatocellular jaundice. J Ayu Int Med Sci. 2023;8(12):8–13.
15) Pawar S, Kadam R, Jawale S. An open randomized study of Paṭolakaturohiṇyādi Kaṣāya in alcoholic liver disease. Int J Ayurveda Pharm Res. 2015;3(7):1–5.
16) Majhi R, Dash B, Borkar S. Management of liver cirrhosis and splenomegaly with herbo-mineral formulations: a clinical case study. J Ayurveda Integr Med Sci. 2024;5:321–325.
17) Sakamoto Y, Inoue N, Nakanishi Y, Ninomiya K, Yoshikawa M, Muraoka O, et al. Hepatoprotective principles from the rhizomes of *Picrorhiza kurroa*. Biol Pharm Bull. 2023;46(6):848–855. doi:10.1248/bpb.b23-00167. PMID: 37258151.
18) Almeleebia TM, Alsayari A, Wahab S. Pharmacological and clinical efficacy of *Picrorhiza kurroa* and its secondary metabolites: a comprehensive review. Molecules. 2022;27(23):8316. doi:10.3390/molecules27238316. PMID: 36500409; PMCID: PMC9738980.
19) Singh SS, Pandey SC, Srivastava S, Gupta VS, Patro B, Ghosh AC. Chemistry and medicinal properties of *Tinospora cordifolia* (Guḍūcī). Indian J Pharmacol. 2003;35(2):83–91.

20) Prince PS, Menon VP. Antioxidant activity of *Tinospora cordifolia* roots in experimental diabetes. J Ethnopharmacol. 1999;65(3):277–281. doi:10.1016/S0378-8741(98)00164-0. PMID: 10404427.
21) Kavitha BT, Shruthi SD, Rai SP, Ramachandra YL. Phytochemical analysis and hepatoprotective properties of *Tinospora cordifolia* against carbon tetrachloride-induced hepatic damage in rats. J Basic Clin Pharm. 2011;2(3):139–142. PMID: 24826014; PMCID: PMC3979222.
22) Teschke R, Schulze J, Eickhoff A, Danan G. Herbal hepatotoxicity: analysis of cases. Br J Clin Pharmacol. 2014;75(3):630–636.
23) Stickel F, Schuppan D. Herbal medicine in the treatment of liver diseases. Dig Liver Dis. 2007;39(4):293–304.