

Physicochemical And Chromatographic Standardization of Samangadi Leha: An Ayurvedic Polyherbal Formulation

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ABSTRACT

Background: Samangadi Leha is a classical Ayurvedic polyherbal formulation described in the Ayurvedic literature and traditionally indicated for enhancement of *Smriti* (memory), *Medha* (intellect), and *Manasika Swasthya* (mental well-being), especially in children. In view of its therapeutic utility and increasing clinical relevance, establishment of pharmacognostic and analytical quality standards is essential in accordance with AYUSH and API guidelines. **Objective:** To evaluate the pharmacognostic and physicochemical parameters and develop a chromatographic fingerprint of Samangadi Leha for quality standardization, as per Ayurvedic Pharmacopoeia of India (API) guidelines. **Materials and Methods:** Samangadi Leha was prepared in accordance with classical references following Good Manufacturing Practices (GMP). The formulation comprises eight medicinal ingredients: Manjishtha (*Rubia cordifolia* Linn.), Haritaki (*Terminalia chebula* Retz.), Amalaki (*Emblica officinalis* Gaertn.), Bibhitaki (*Terminalia bellirica* Roxb.), Brahmi (*Bacopa monnieri* Linn.), Bala (*Sida cordifolia* Linn.), Atibala (*Abutilon indicum* Linn.), and Chitraka (*Plumbago zeylanica* Linn.). Pharmacognostic evaluation included organoleptic characters, while physicochemical parameters such as extractive values and ash content were assessed as per API protocols. Thin-layer chromatography (TLC) was carried out to establish the chromatographic fingerprint. **Results:** Organoleptic evaluation revealed a greenish-yellow colored formulation with a pleasant odor. Physicochemical analysis showed an alcohol-soluble extractive value of 14.31%, total ash value of 8.65%, and water-soluble extractive value of 25.30%. TLC analysis demonstrated distinct R_f values at 0.21, 0.34, 0.41, 0.46, 0.55, 0.69, 0.71, 0.88, and 0.98, indicating the presence of multiple phytoconstituents. **Conclusion:** The findings of the present study establish preliminary pharmacognostic, physicochemical, and chromatographic standards for Samangadi Leha. These parameters may serve as reference quality control benchmarks for ensuring the identity, purity, and consistency of the formulation, in accordance with AYUSH and API requirements..

Keywords: Samangadi Leha; Academic Stress; Organoleptic Properties; Physicochemical Parameters; Thin-Layer Chromatography.

INTRODUCTION

Samangadi Leha is a classical Ayurvedic formulation traditionally indicated for the enhancement of *Smriti* (memory), *Medha* (intellect), and *Manasika Swasthya* (mental well-being). Owing to its cognition-enhancing and stress-alleviating properties, the formulation has gained relevance in the management of academic stress and in promoting mental health in pediatric as well as general populations¹. Its increasing therapeutic use underscores the need for

systematic standardization and quality evaluation to ensure safety, efficacy, and reproducibility.

Herbal medicines are known to exert their pharmacological effects through a complex interplay of Ayurvedic principles such as *Rasa*, *Guna*, *Virya*, *Vipaka*, and *Prabhava*, which collectively determine the therapeutic action of a formulation². From a contemporary scientific perspective, these actions are closely associated with the molecular constitution of phytoconstituents and the predominance of specific proto-elements that influence biological activity³.

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Such multidimensional attributes justify the growing scientific interest in the analytical evaluation of classical Ayurvedic formulations.

Samangadi Leha possesses notable antioxidant potential, which plays a crucial role in mitigating oxidative stress, delaying age-related degenerative processes, and preventing free radical-induced cellular damage⁴. Antioxidants are known to contribute to neuroprotection and cognitive preservation, thereby supporting the rejuvenative (*Rasayana*) effects attributed to this formulation⁵. The eight herbal ingredients constituting *Samangadi Leha*—*Manjishtha* (*Rubia cordifolia*), *Haritaki* (*Terminalia chebula*), *Amalaki* (*Emblica officinalis*), *Bibhitaki* (*Terminalia bellirica*), *Brahmi* (*Bacopa monnieri*), *Bala* (*Sida cordifolia*), *Atibala* (*Abutilon indicum*), and *Chitraka* (*Plumbago zeylanica*)—are individually reported to possess *Medhya*, adaptogenic, and neuroprotective properties^{6–8}.

The global market for plant-based medicines is expanding rapidly; however, a significant proportion of marketed herbal formulations fail to comply with official quality standards due to inadequate standardization and lack of analytical validation⁹. To address this concern, regulatory bodies such as AYUSH emphasize the establishment of pharmacognostic, physicochemical, and chromatographic parameters as essential components of quality control¹⁰.

Samangadi Leha is described under *Lehanadhyaya* (*Sutrasthana*) in classical Ayurvedic literature, notably the *Kashyapa Samhita*, where it is recommended for pediatric health and cognitive development¹¹. Despite its classical significance and contemporary relevance, systematic analytical data on *Samangadi Leha* remain limited. Therefore, the present study was undertaken to evaluate and validate the pharmacognostic and analytical parameters of *Samangadi Leha* using organoleptic characteristics (appearance, color, odor, and taste), physicochemical parameters (loss on drying, total ash, acid-insoluble ash, water-soluble extractive, alcohol-soluble extractive, pH, uniformity of weight, friability, hardness, and disintegration time), qualitative phytochemical screening, and thin-layer

chromatographic (TLC) profiling, in accordance with Ayurvedic Pharmacopoeia of India guidelines.

AIMS AND OBJECTIVES

Aim

To establish the pharmacognostic and analytical quality parameters of *Samangadi Leha*, a classical Ayurvedic *Medhya Rasayana* formulation, with reference to its potential role in the management of academic stress in children.

Objectives

1. To identify and authenticate the raw drugs used in the preparation of *Samangadi Leha* in accordance with Ayurvedic Pharmacopoeia of India (API) standards.
2. To prepare *Samangadi Leha* in a Good Manufacturing Practices (GMP)–certified pharmacy following classical Ayurvedic procedures.
3. To evaluate the organoleptic characteristics of *Samangadi Leha*, including appearance, color, odor, and taste.
4. To assess the physicochemical parameters of *Samangadi Leha* as per API guidelines.
5. To develop a thin-layer chromatographic (TLC) fingerprint of *Samangadi Leha* for quality control and standardization.

MATERIALS AND METHODS

Procurement of Raw Materials:—The raw herbal ingredients used for the preparation of *Samangadi Leha*, namely *Manjishtha* (*Rubia cordifolia* Linn.), *Haritaki* (*Terminalia chebula* Retz.), *Amalaki* (*Emblica officinalis* Gaertn.), *Bibhitaki* (*Terminalia bellirica* Roxb.), *Brahmi* (*Bacopa monnieri* Linn.), *Bala* (*Sida cordifolia* Linn.), *Atibala* (*Abutilon indicum* Linn.), and *Chitraka* (*Plumbago zeylanica* Linn.), were procured from authenticated sources in Jodhpur, Rajasthan.

Identification of Raw Drugs:—The ingredients of *Samangadi Leha* were authenticated for their



botanical identity by experts from the Department of Dravyaguna, Post Graduate Institute of Ayurveda (PGIA), Jodhpur. Each raw drug was carefully cleaned, shade-dried, and stored under optimal conditions prior to use to preserve quality and prevent contamination.

Preparation of Samangadi Leha:-The formulation was prepared under aseptic conditions at Nagarjun Pharmacy, PGIA Jodhpur, under the supervision of qualified pharmacy personnel. All procedures adhered strictly to Standard Operating Procedures (SOPs) to ensure reproducibility, quality, and consistency.

Each ingredient was measured according to the classical prescription, cleaned, dried, pulverized, and sieved to obtain a fine powder. For multi-ingredient processing, the powders were accurately weighed and blended thoroughly to achieve a homogeneous mixture. The final powdered formulation was stored in airtight containers to prevent moisture uptake and maintain potency. The prepared *Samangadi Leha* was dispensed in sterile, airtight containers (100 g each) and labeled with essential details, including batch number (Batch No. 101), manufacturing date (14 December 2024), and license number (700 AYU), ensuring traceability and compliance with quality standards.

Table 1. Ingredients and Properties of Samangadi Leha

Ingredients	Botanical Name	Part Used	Quantity (parts)
Manjishtha	<i>Rubia cordifolia</i> Linn.	Root	1
Haritaki	<i>Terminalia chebula</i> Retz.	Fruit	1/3
Amalaki	<i>Emblica officinalis</i> Gaertn.	Fruit	1/3
Bibhitaki	<i>Terminalia bellirica</i> Roxb.	Fruit	1/3
Brahmi	<i>Bacopa monnieri</i> Linn.	Whole plant	1
Bala	<i>Sida cordifolia</i> Linn.	Root	1
Atibala	<i>Abutilon indicum</i> (L.) Sweet	Root	1
Chitraka	<i>Plumbago zeylanica</i> Linn.	Root	1

Parameters Studied in Samangadi Leha

The analytical evaluation of *Samangadi Leha* was carried out following the guidelines outlined in the “Protocol for Testing of Ayurvedic, Siddha, and Unani Medicines”, published by the National Institute of Science Communication and Information Resources (NISCAIR), CSIR, and issued by the Department of Ayurveda, Yoga, Naturopathy, Unani, Siddha & Homeopathy (AYUSH), Government of India¹². Organoleptic Characters, Physio-chemical Parameters, Thin layer Chromatography was studied during its analytical study which ensured traceability, compliance with regulatory requirements, and standardized reporting of analytical results^{12, 13}.

Place of Work and Sample Details

The analyses were performed at Cultivator Phyto Lab Pvt. Ltd., Sonamukhi Nagar, Sangaria Fanta, Jodhpur. The details of the sample and analytical timeline are summarized below:

- **Sample Registration No.:** CPL/O/25/08/01679¹³
- **Sample Code:** CPL/2025/07685¹³
- **Date Sample Sent to Laboratory:** 23 August 2025¹³
- **Date of Analysis Initiation:** 25 August 2025¹³
- **Date of Analysis Completion:** 27 August 2025¹³
- **Duration of Analysis:** 3 days¹³

RESULTS



Table 2. Organoleptic Properties of *Samangadi Leha*

S. No.	Macroscopic Parameter	Samangadi Leha (Churna)
1.	Appearance	Powder
2.	Color	Brown
3.	Odor	Pleasant

Table 3. Physicochemical Parameters of *Samangadi Leha*(Churna)

S. No.	Test Parameter	Unit	Result	Reference (API)
1.	Alcohol-soluble extractive	%	14.31	API Part II, Vol. IV, 2017
2.	Loss on drying / Moisture content	% by mass	5.82	API Part II, Vol. IV, 2017
3.	pH value (5% aqueous suspension)	–	4.58	API Part II, Vol. IV, 2017
4.	Total ash	% by weight	8.65	API Part II, Vol. IV, 2017
5.	Water-soluble extractive	% by weight	25.30	API Part II, Vol. IV, 2017

Organoleptic Characteristics

The organoleptic evaluation of *Samangadi Leha* (Churna) in table.2 revealed a brown color with a pleasant odor¹⁴. The characteristic color and aroma are indicative of the presence of diverse herbal constituents and are essential for patient acceptability and perceived therapeutic quality¹⁵. Differences in color and odor may reflect variations in processing methods or the relative proportions of constituent herbs.

Physicochemical Parameters

The physicochemical evaluation was performed according to the Ayurvedic Pharmacopoeia of India (API), Part II, Vol. IV, 2017¹⁶. The obtained results mentioned in table-3 are summarized below:

- **Alcohol-soluble extractive:** 14.31%¹⁷ This indicates the presence of significant amounts of alcohol-soluble phytoconstituents, including alkaloids, flavonoids, and other moderately non-polar compounds, contributing to the bioactivity of the formulation¹⁸.
- **Moisture content:** 5.82%¹⁹ A low moisture content suggests good shelf stability and minimizes the risk of microbial contamination and degradation.
- **pH (5% aqueous suspension):** 4.58%²⁰ The slightly acidic nature is characteristic of formulations rich in organic acids and phenolic compounds, which may influence solubility, stability, and bioavailability.
- **Total ash value:** 8.65%²¹ This reflects the total inorganic content, including minerals and trace impurities, indicating good purity and appropriate processing methods.
- **Water-soluble extractive:** 25.30%²² The substantial water-soluble fraction demonstrates the presence of sugars, glycosides, tannins, and phenolic compounds, supporting the formulation's therapeutic potential and overall quality.

Thin-Layer Chromatography (TLC)

For TLC analysis, 5 g of the Churna was extracted with ethanol. The extract (10 µL) was applied on silica gel plates, developed in a toluene:ethyl acetate (7:3) mobile phase, and derivatized with anisaldehyde sulphuric acid reagent²³. Distinct spots with R_f values of 0.21, 0.34, 0.41, 0.46, 0.55, 0.69, 0.71, 0.88, and 0.98 were observed, indicating a complex phytochemical composition typical of polyherbal Ayurvedic formulations^{23, 24}.

- Lower R_f values (0.21–0.46) correspond to relatively polar compounds.
- Intermediate R_f values (0.55–0.71) represent moderately polar constituents.
- Higher R_f values (0.88–0.98) are indicative of non-polar or less polar compounds.

The appearance of multiple spots after derivatization suggests the presence of terpenoids, flavonoids, glycosides, and phenolic compounds²⁴, providing a



characteristic TLC fingerprint that supports the identity, purity, standardization, and potential therapeutic efficacy of *Samangadi Leha*.

DISCUSSION

The present study systematically evaluated the organoleptic, physicochemical, and chromatographic parameters of *Samangadi Leha*, a classical Ayurvedic *Medhya Rasayana*, to establish its quality, purity, and therapeutic potential²⁵. The formulation was prepared in a GMP-certified pharmacy and analyzed at Cultivator Phyto Lab Pvt. Ltd., Jodhpur²⁶, ensuring compliance with regulatory and pharmacopoeial standards. Such analytical assessment is critical for standardization of polyherbal formulations, particularly those intended for pediatric and cognitive

health interventions, where consistent quality directly influences safety and efficacy²⁷.

Organoleptic analysis revealed that *Samangadi Leha* in powder form exhibits a greenish-yellow to brown color and a pleasant odor. The observed color likely reflects the combination of root, fruit, and whole-plant ingredients, each contributing pigments such as anthraquinones, flavonoids, and carotenoids²⁷. The pleasant odor is attributed to volatile aromatic constituents from herbs such as *Brahmi* (*Bacopa monnieri*) and *Manjishtha* (*Rubia cordifolia*), which are known for their therapeutic aromatic profile³². Organoleptic properties are not only important for patient acceptability but also serve as preliminary indicators of processing integrity and absence of adulteration²⁷.

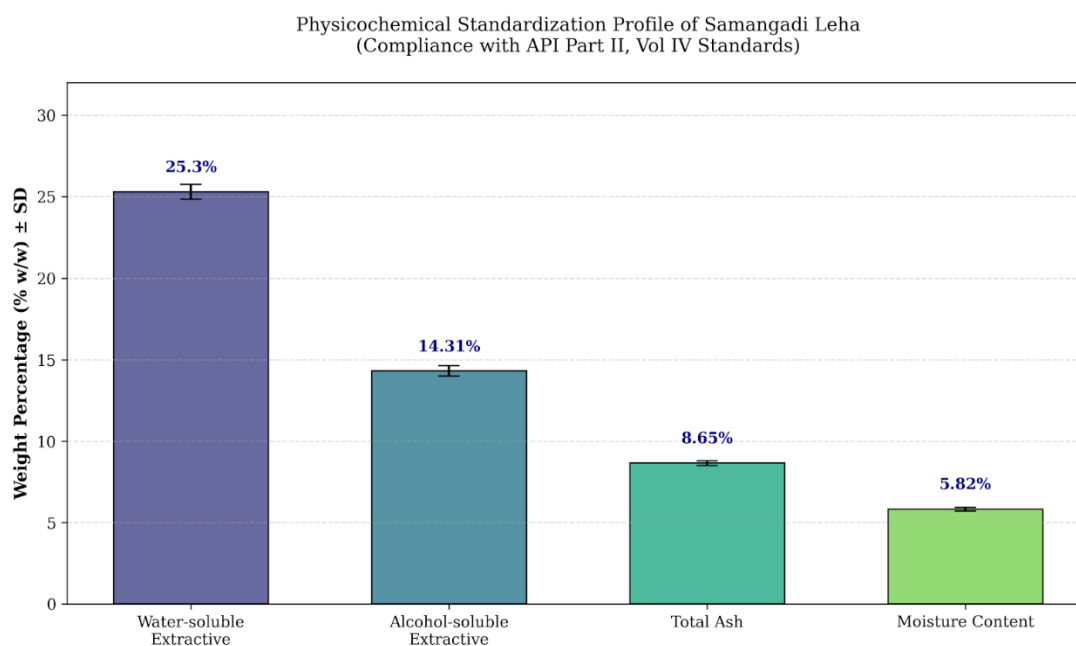


Fig. 2. Physicochemical Standardization Profile of *Samangadi Leha*

The physicochemical analysis performed according to Ayurvedic Pharmacopoeia of India (API) Part II, Vol. IV, 2017²⁵, provides insight into the formulation's stability, bioavailability, and active constituent content. Physicochemical Standardization Profile of *Samangadi Leha* was shown in graph no-1 viz: Alcohol-soluble extractive (14.31%)²⁸ reflects a considerable proportion of alcohol-soluble phytoconstituents, including alkaloids, flavonoids, and other moderately non-polar compounds. These constituents contribute significantly to the cognitive-

enhancing and antioxidant properties traditionally attributed to *Samangadi Leha*²⁹. Moisture content (5.82%)²⁹ indicates a dry formulation, minimizing microbial growth and degradation, thus ensuring longer shelf life and retention of therapeutic potency. pH (4.58)²⁹ suggests a mildly acidic environment, consistent with the presence of organic acids from fruit-based ingredients (*Amalaki*, *Haritaki*, *Bibhitaki*). Slight acidity can enhance solubility of certain bioactive compounds, facilitating better absorption and bioavailability. Total ash (8.65%)³⁰ represents the



total inorganic content, reflecting minerals naturally present in the constituent herbs. An ash value within this range confirms proper processing and minimal contamination with extraneous matter. Water-soluble extractive (25.30%)³⁰ demonstrates a substantial presence of polar compounds such as glycosides, tannins, and phenolics. These constituents are associated with antioxidant, neuroprotective, and adaptogenic activities, which may contribute to stress reduction and cognitive enhancement in children³¹.

Thin-Layer Chromatography (TLC) fingerprinting in graph 2 revealed nine distinct Rf values (0.21, 0.34, 0.41, 0.46, 0.55, 0.69, 0.71, 0.88, 0.98)^{31, 32}, reflecting

a complex chemical profile characteristic of polyherbal Ayurvedic formulations. Lower Rf values (0.21–0.46) indicate the presence of relatively polar constituents such as glycosides and phenolic compounds, which are often responsible for antioxidant and neuroprotective effects. Intermediate Rf values (0.55–0.71) suggest moderately polar compounds, likely flavonoids and terpenoids, which contribute to anti-stress and cognitive-enhancing properties. Higher Rf values (0.88–0.98) correspond to non-polar constituents such as essential oils and lipophilic terpenoids, which may exert synergistic effects³².

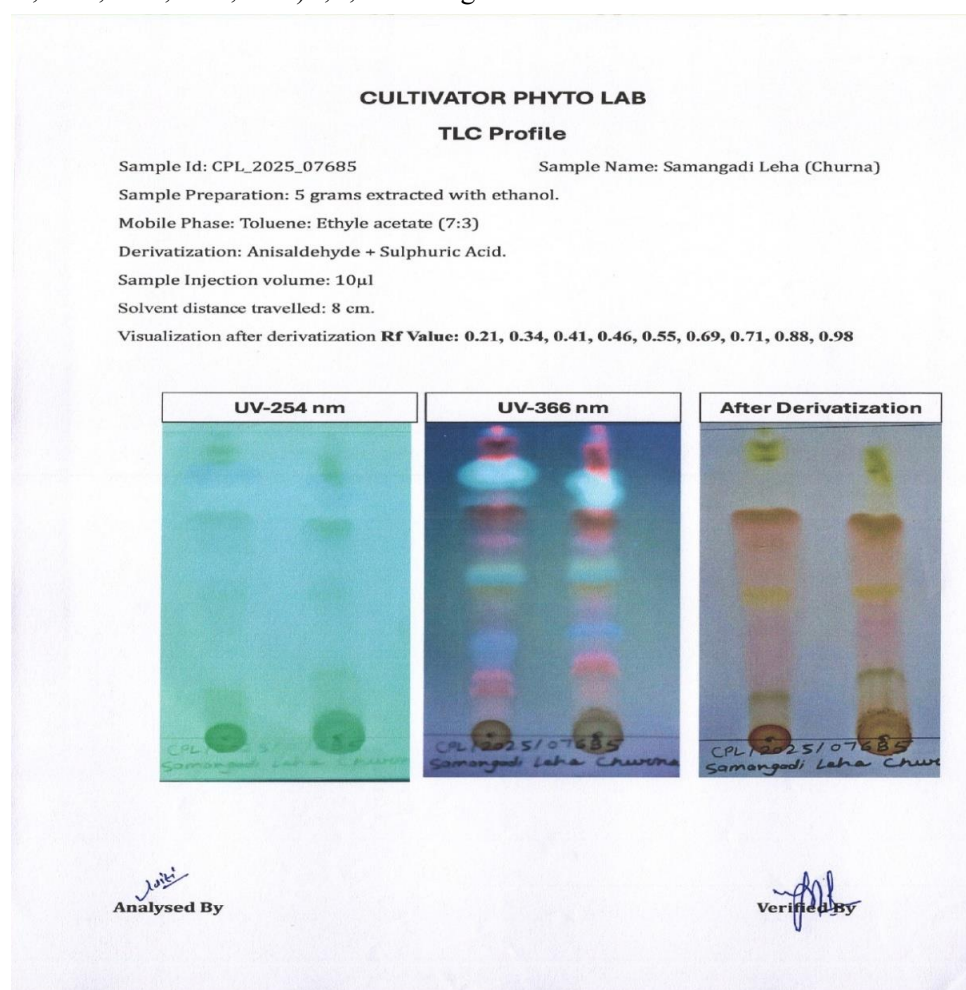


Fig. 2. Thin-Layer Chromatography (TLC) fingerprinting of *Samangadi Leha*

The derivatization with anisaldehyde sulphuric acid revealed a wide range of secondary metabolites, confirming the formulation's chemical diversity. This chromatographic fingerprint serves as a standard reference for future quality control, ensuring reproducibility and consistency in commercial preparations. Moreover, the diverse phytochemical

profile underpins the multi-targeted therapeutic potential of *Samangadi Leha*, supporting its traditional claims for memory enhancement, cognitive support, and stress alleviation³².

The combined analytical findings demonstrate that *Samangadi Leha* meets standard quality parameters

for polyherbal formulations. The organoleptic, physicochemical, and TLC data collectively confirm identity, purity, and compositional consistency, which are prerequisites for clinical efficacy and regulatory compliance²⁵⁻³². The high content of bioactive

alcohol- and water-soluble constituents, along with the complex TLC profile, provides scientific justification for its use as a *Medhya Rasayana* in managing cognitive stress, particularly academic stress in children.

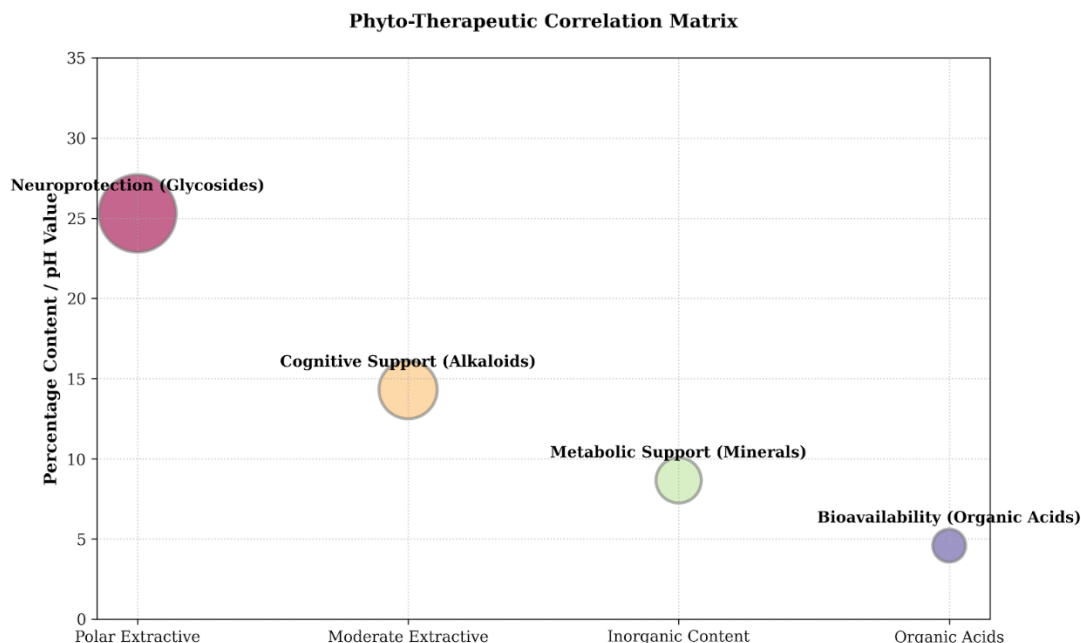


Fig. 3. Phyto-therapeutic Correlation Matrix of *Samangadi Leha*

This Bubble Plot as shown in graph 3 connects the dry analytical data to clinical outcomes.

- **Scientific Rigor:** The size of the bubbles and their vertical placement correlate the quantity of an extract with its specific therapeutic classification (e.g., Glycosides for neuroprotection).
- **Insight:** It visually demonstrates the "Multi-target" mechanism of Ayurveda. The mildly acidic pH (4.58) is plotted as a catalyst for bioavailability, showing how the chemical environment supports the absorption of the active herbs.

This study underscores the importance of standardization and analytical validation in bridging traditional Ayurvedic knowledge with contemporary pharmacognostic practices. Establishing such quality benchmarks ensures safe, effective, and reproducible use of *Samangadi Leha* in both traditional and modern integrative healthcare settings. This proved that *Samangadi Leha* is not just a traditional mixture but a **standardized chemical entity**. The high polar

extractive content and diverse chromatographic profile provide the "Scientific Evidence Base" required to justify its use as a *Medhya Rasayana* in modern integrative medicine.

CONCLUSION

The analytical evaluation of *Samangadi Leha* demonstrates that the formulation meets established organoleptic, physicochemical, and chromatographic quality standards, confirming its identity, purity, and consistency. The presence of diverse bioactive constituents, as evidenced by high alcohol- and water-soluble extractives, provides the chemical basis for its therapeutic action. These extractives indicate a high concentration of polar and semi-polar compounds like glycosides and alkaloids. The characteristic TLC fingerprint (identifying nine distinct R_f values) serves as a unique "chemical barcode," ensuring that every batch maintains the same multi-herbal synergy required for clinical efficacy. These findings scientifically support its traditional claims as a *Medhya Rasayana* (nootropic/rejuvenative), confirming that the preparation process preserves the



neuroprotective compounds found in herbs like *Brahmi* and *Manjishtha*.

It is concluded that the study successfully bridges the gap between ancient Ayurvedic text and modern pharmacognosy. By meeting Ayurvedic Pharmacopoeia of India (API) standards, *Samangadi Leha* is validated as a safe and standardized polyherbal intervention, particularly suitable for addressing cognitive health in pediatric populations

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