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Research Article

Standardization and Phytochemical Profiling of *Cajanus Goensis* and *Sarcostigma Kleinii*: Establishing Baseline Parameters for Crude Drug Evaluation

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Abstract

The present study was undertaken to establish pharmacognostic standards and phytochemical profiles of two ethnomedicinally important plants, *Cajanus goensis* and *Sarcostigma kleinii*. Both species are traditionally employed in the treatment of rheumatism, inflammatory disorders, and other systemic ailments, yet scientific validation of their crude drug parameters remains limited. Standardization of herbal materials is essential to ensure identity, purity, and reproducibility, thereby reducing variability and enhancing therapeutic reliability. In this study, plant materials were procured from authentic local sources—*Cajanus goensis* from Udaipur, Rajasthan, and *Sarcostigma kleinii* from Latur, Maharashtra—and subjected to comprehensive pharmacognostic and phytochemical evaluation. Organoleptic analysis revealed distinct sensory characteristics, with *Cajanus goensis* exhibiting greenish-brown coloration, earthy odor, and coarse texture, while *Sarcostigma kleinii* showed yellowish-brown coloration, pungent odor, and oily texture. Macroscopic and microscopic examinations confirmed diagnostic features such as dorsiventral leaves, reticulate venation, thick cuticular layers, and prominent vascular bundles. Physico-chemical evaluation demonstrated that ash values, extractive values, moisture content, and pH were within pharmacopoeial limits, thereby confirming the purity and stability of the crude drugs. Notably, *Cajanus goensis* exhibited higher alcohol-soluble extractives, while *Sarcostigma kleinii* showed greater water-soluble extractives, reflecting differences in phytoconstituent solubility. Phytochemical screening revealed the presence of carbohydrates, amino acids, alkaloids, glycosides, flavonoids, tannins, and phenolic compounds in both species. Proteins were detected only in *Sarcostigma kleinii*, while saponins were present exclusively in *Cajanus goensis*. Sterols were absent in both plants, highlighting unique chemical signatures that aid in authentication. Quantitative estimation confirmed that both species are rich in flavonoids and phenolic compounds, with *Sarcostigma kleinii* showing slightly higher concentrations (21.06 ± 1.000 mg/g quercetin equivalents and 21.19 ± 0.854 mg/g tannic acid equivalents) compared to *Cajanus goensis* (19.09 ± 0.444 mg/g and 18.49 ± 0.033 mg/g, respectively). These bioactive constituents are well recognized for their antioxidant and anti-inflammatory properties, supporting the traditional use of these plants in rheumatism and related disorders. In conclusion, the study provides reproducible pharmacognostic and phytochemical data for *Cajanus goensis* and *Sarcostigma kleinii*, thereby validating their ethnomedicinal claims and establishing a foundation for further pharmacological investigations. The results underscore the importance of standardization in herbal medicine and highlight the potential of these crude drugs as reliable sources of bioactive compounds for future therapeutic applications.

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KEYWORDS: *Cajanus goensis*; *Sarcostigma kleinii*; crude drug standardization; phytochemical screening; flavonoids; phenolic compounds; rheumatism; pharmacognosy; herbal medicine; quality control.

1. INTRODUCTION

Medicinal plants have long been recognized as a cornerstone of traditional healthcare systems across the world. In countries such as India, where Ayurveda, Siddha, and Unani practices remain deeply rooted, herbal remedies continue to serve as primary therapeutic agents for a large proportion of the population (1, 2). The World Health Organization estimates that nearly 80% of the global population relies on plant-based medicines for their primary health needs, underscoring the importance of establishing scientific validation and quality control for these natural resources. Despite their widespread use, crude drugs often suffer from variability in quality due to differences in geographical origin, harvesting practices, storage conditions, and processing methods. This variability can compromise therapeutic efficacy and safety, making standardization an essential prerequisite for their acceptance in modern pharmacology (3, 4).

Standardization refers to the process of ensuring consistent identity, purity, and quality of crude drugs through a set of defined parameters. These include organoleptic evaluation, physicochemical analysis, microscopic characterization, and phytochemical profiling. Such measures not only authenticate the plant material but also provide reproducible benchmarks for clinical and industrial applications (5, 6). Phytochemical evaluation, in particular, plays a critical role in identifying the bioactive constituents responsible for therapeutic effects. Secondary metabolites such as alkaloids, flavonoids, terpenoids, tannins, and glycosides are widely recognized for their pharmacological properties, including anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory activities. Establishing the presence and relative abundance of these compounds provides a scientific basis for traditional claims and facilitates the development of standardized herbal formulations (7, 8).

The present study focuses on two medicinally significant plants: *Cajanus goensis* and *Sarcostigma kleinii*. *Cajanus goensis*, belonging to the Fabaceae family, is a climbing shrub traditionally used for nutritional and therapeutic purposes. Its distribution across India and Indo-Malesia highlights its ethnobotanical relevance, yet systematic phytochemical evaluation remains limited. *Sarcostigma kleinii*, a member of the Icacinaceae family, is traditionally employed in the treatment of rheumatism, leprosy, and inflammatory conditions. The fruits, seeds, and bark of this plant have been used in indigenous medicine, but comprehensive standardization data are scarce. Both plants were procured from local sources—*Cajanus goensis* from Udaipur, Rajasthan, and *Sarcostigma kleinii* from Latoor, Maharashtra—ensuring authenticity and reflecting their availability in regional markets.

By combining standardization protocols with phytochemical screening, this study aims to establish baseline data for these crude drugs. Such findings will not only validate their traditional uses but also contribute to the broader effort of integrating herbal medicines into evidence-based healthcare systems. Ultimately, the work underscores the necessity of bridging traditional knowledge with modern scientific

evaluation to ensure safety, efficacy, and reproducibility in herbal therapeutics.

2. MATERIALS AND METHODS

2.1 Collection of the Plant Materials

The crude drugs selected for this study were *Cajanus goensis* and *Sarcostigma kleinii*, both of which hold significant ethnomedicinal importance in Indian traditional medicine. Plant materials were procured from authentic local sources to ensure reliability and traceability. *Cajanus goensis* was collected from the local market of Alwar, Rajasthan, while *Sarcostigma kleinii* was obtained through a local dealer in Latoor, Maharashtra. The collected specimens were authenticated by a qualified taxonomist, and voucher samples were deposited in the departmental herbarium for future reference. This step was essential to confirm the botanical identity of the crude drugs and to avoid adulteration or substitution, which is a common challenge in herbal medicine research.

2.2 Organoleptic evaluation of the Crude Materials

Organoleptic evaluation was carried out to record the sensory characteristics of the crude drugs, including their color, odor, taste, and texture. These parameters serve as preliminary indicators of authenticity and quality, and they provide a baseline for comparison with pharmacognostic standards. Macroscopic examination was performed to document morphological features such as leaf shape, stem structure, and fruit characteristics, while microscopic studies were conducted using transverse sections of leaves and stems. Diagnostic features such as stomatal type, trichomes, vascular bundles, and mesophyll arrangement were observed under a compound microscope. Powder microscopy was also employed to identify cellular inclusions, fibers, and other diagnostic elements that aid in the authentication of powdered crude drugs (9, 10).

2.3 Standardization of the Crude Materials

Physicochemical parameters were determined in accordance with the guidelines of the World Health Organization (WHO) and the Indian Pharmacopoeia. Moisture content was estimated by loss on drying at 105°C until constant weight was achieved, providing information on the stability and storage potential of the drugs. Ash values, including total ash, acid-insoluble ash, and water-soluble ash, were measured to assess the inorganic content and detect possible contamination with siliceous matter or soluble salts. Extractive values were determined using ethanol and distilled water to evaluate the presence of bioactive constituents soluble in different solvents. The pH of aqueous extracts was measured using a calibrated digital pH meter to provide insight into the chemical nature of the crude drugs (11, 12).

2.4 Phytochemical evaluation of the Extracts

For phytochemical evaluation, dried plant materials were coarsely powdered and subjected to successive extraction using solvents of increasing polarity, including petroleum ether, chloroform, ethanol, and water, in a Soxhlet apparatus. The

extracts were concentrated under reduced pressure and stored at 4°C until further use (13). Qualitative phytochemical screening was performed to detect major classes of secondary metabolites. Standard tests were employed for alkaloids (Dragendorff's and Mayer's reagents), flavonoids (Shinoda and alkaline reagent tests), tannins (Ferric chloride test), terpenoids (Salkowski test), glycosides (Keller–Killiani test), saponins (froth test), and phenolic compounds (lead acetate test). These tests provided a preliminary chemical profile of the crude drugs, highlighting the presence of pharmacologically active constituents (14, 15).

2.5 Statistical Analysis

All experiments were conducted in triplicate to ensure reproducibility and reliability of results. Data were expressed as mean $\pm$ standard deviation (SD), and descriptive statistical analysis was performed to establish consistency in the physicochemical and phytochemical parameters. This methodological approach ensured that the study generated robust baseline data for the standardization and phytochemical evaluation of *Cajanus goensis* and *Sarcostigma kleinii*, thereby contributing to their scientific validation and potential application in herbal formulations.

3. RESULTS AND DISCUSSION

3.1 Organoleptic Evaluation of Crude Materials

Table 1: Organoleptic Characteristics of Crude Drugs

Parameter	<i>Cajanus goensis</i>	<i>Sarcostigma kleinii</i>
Color	Greenish-brown	Yellowish-brown
Odor	Earthy, characteristic	Pungent, oily
Taste	Slightly bitter	Acrid, pungent
Texture	Coarse, woody stems, villous pods	Fibrous bark, oily fruit surface
Leaf morphology	Dorsiventral, reticulate venation	Oblong-lanceolate, pointed apex
Fruit morphology	Villous pods	Oval drupe, orange-yellow

These organoleptic and morphological observations provide baseline data for comparison with pharmacognostic standards and confirm the authenticity of the crude drugs. The distinct sensory and microscopic features of *Cajanus goensis* and *Sarcostigma kleinii* establish their identity and support their use in traditional medicine formulations.

3.2 Physico-Chemical Evaluation

The physico-chemical constants of *Cajanus goensis* and *Sarcostigma kleinii* were determined to establish baseline standards for quality control and authentication. These parameters provide essential information regarding the purity, stability, and chemical nature of crude drugs. The results are summarized in Table 2. Ash value analysis revealed that *Cajanus goensis* possessed a total ash content of $8.907 \pm 0.763\%$ w/w, while *Sarcostigma kleinii* showed a slightly lower value of $7.193 \pm 0.036\%$ w/w, both within the acceptable limit of $<9\%$. Acid-insoluble ash was found to be $0.692 \pm 0.266\%$ w/w for *Cajanus goensis* and $1.953 \pm 0.008\%$

Organoleptic evaluation was carried out to record the sensory characteristics of the crude drugs, providing preliminary indicators of authenticity and quality. *Cajanus goensis* was observed to possess greenish-brown leaves with a slightly bitter taste and a characteristic earthy odor. The texture of the plant material was coarse, with woody twining stems and villous pods that are typical diagnostic features of the species. In contrast, *Sarcostigma kleinii* exhibited yellowish-brown coloration with a pungent odor and oily texture. The fruits were oval, orange-yellow drupes, while the bark was fibrous and powdery when crushed. These sensory attributes align with traditional descriptions and serve as reliable markers for identification. Macroscopic examination confirmed morphological features consistent with pharmacognostic standards. *Cajanus goensis* showed dorsiventral leaves with reticulate venation, while *Sarcostigma kleinii* displayed oblong-lanceolate leaves with pointed apices and rounded bases. Microscopic studies revealed diagnostic features such as stomatal type, trichomes, vascular bundles, and mesophyll arrangement. In *Cajanus goensis*, dorsiventral leaves exhibited well-defined palisade and spongy parenchyma, whereas *Sarcostigma kleinii* showed thick cuticular layers and abundant stomata on the lower epidermis. Powder microscopy further confirmed the presence of cellular inclusions, fibers, and vascular elements, aiding in the authentication of powdered crude drugs.

w/w for *Sarcostigma kleinii*, indicating the presence of siliceous matter but remaining within permissible limits ($<2\%$). Extractive values obtained by maceration demonstrated that alcohol-soluble constituents were $17.08 \pm 0.543\%$ w/w for *Cajanus goensis* and $19.05 \pm 1.125\%$ w/w for *Sarcostigma kleinii*, both well below the upper limit of 40%. Water-soluble extracts were comparatively higher, with *Cajanus goensis* yielding $26.46 \pm 0.972\%$ w/w and *Sarcostigma kleinii* yielding $32.25 \pm 1.011\%$ w/w, values that remained within the acceptable limit of $<34\%$.

Moisture content (loss on drying) was found to be $11.89 \pm 0.158\%$ w/w for *Cajanus goensis* and $10.09 \pm 1.256\%$ w/w for *Sarcostigma kleinii*, both below the threshold of 13%, suggesting good stability and reduced risk of microbial contamination. The pH of 1% aqueous solutions showed slight variation between the two species, with *Cajanus goensis* exhibiting a near-neutral pH of 7.830 ± 0.028 , while *Sarcostigma kleinii* was moderately acidic at 5.56 ± 0.841 .

Table 3: Physico-Chemical Evaluation of *Cajanus goensis* and *Sarcostigma kleinii*

Sr. No.	Standardization Parameters	<i>Cajanus goensis</i> (% w/w)	<i>Sarcostigma kleinii</i> (% w/w)	Limits
01	Ash analysis			
	Total ash	8.907 ± 0.763	7.193 ± 0.036	<9%
	Acid-insoluble ash	0.692 ± 0.266	1.953 ± 0.008	<2%
02	Extractive value (Maceration)			
	Alcohol-soluble	17.08 ± 0.543	19.05 ± 1.125	<40%
	Water-soluble	26.46 ± 0.972	32.25 ± 1.011	<34%
03	Moisture content (LOD)	11.89 ± 0.158	10.09 ± 1.256	<13%
04	pH (1% aqueous solution)	7.830 ± 0.028	5.56 ± 0.841	–

Values are expressed as mean ± SEM; n = 3

These findings confirm that both crude drugs meet the standardization criteria outlined by pharmacopoeial guidelines. The differences in extractive values and pH highlight the distinct chemical nature of the two species, while the overall compliance with limits supports their suitability for further pharmacological evaluation and formulation development.

3.3 Phytochemical Screening

Phytochemical screening of the crude drugs *Cajanus goensis* and *Sarcostigma kleinii* was carried out to identify the presence of major secondary metabolites responsible for their

pharmacological activity. The results demonstrated distinct yet overlapping phytochemical profiles between the two species. *Cajanus goensis* showed the presence of carbohydrates, amino acids, alkaloids, glycosides, saponins, flavonoids, tannins, and phenolic compounds, while proteins and sterols were absent. In contrast, *Sarcostigma kleinii* revealed the presence of carbohydrates, proteins, amino acids, alkaloids, glycosides, flavonoids, tannins, and phenolic compounds, but saponins and sterols were absent. These findings highlight the chemical diversity of the two plants and suggest potential differences in their pharmacological properties.

Table 4: Phytochemical Screening of *Cajanus goensis* and *Sarcostigma kleinii*

Phytoconstituents	Phytochemical Test	<i>Cajanus goensis</i>	<i>Sarcostigma kleinii</i>
Carbohydrates	Molisch's Test	Present	Present
Proteins	Biuret Test	Absent	Present
Amino acids	Ninhydrine Test	Present	Present
Alkaloids	Hager's/Wagner's/Dragendorff	Present	Present
Glycosides	Keller–Killiani Test	Present	Present
Saponins	Foam Test	Present	Absent
Sterols	Salkowski Test	Absent	Absent
Tannins & Phenolics	Ferric chloride/Lead acetate	Present	Present
Flavonoids	Shinoda/Alkaline reagent	Present	Present

The quantitative estimation of phytoconstituents further confirmed the richness of these plants in flavonoids and phenolic compounds. *Cajanus goensis* exhibited a total flavonoid content of 19.09 ± 0.444 mg quercetin equivalents/g

of formulation and a total phenolic content of 18.49 ± 0.033 mg tannic acid equivalents/g. *Sarcostigma kleinii* showed slightly higher values, with total flavonoid content of 21.06 ± 1.000 mg/g and total phenolic content of 21.19 ± 0.854 mg/g.

Table 5: Quantitative Estimation of Phytoconstituents

Phytoconstituents	<i>Cajanus goensis</i>	<i>Sarcostigma kleinii</i>
Total flavonoid content (mg/g, Quercetin equivalents)	19.09 ± 0.444	21.06 ± 1.000
Total phenolic content (mg/g, Tannic acid equivalents)	18.49 ± 0.033	21.19 ± 0.854

Data expressed as mean ± SEM; n = 3

These results confirm that both crude drugs are rich in bioactive phytoconstituents, particularly flavonoids and phenolics, which are known for their antioxidant and anti-inflammatory properties. The presence of alkaloids, glycosides, and tannins further supports their traditional use in rheumatism and inflammatory disorders. The absence of sterols in both species and the differential presence of proteins and saponins highlight unique chemical signatures that can be used for authentication and pharmacological differentiation.

4. CONCLUSION

The present study successfully established baseline pharmacognostic and phytochemical parameters for *Cajanus goensis* and *Sarcostigma kleinii*, two medicinally important plants with longstanding traditional use in Indian ethnomedicine. Through systematic standardization, including organoleptic, macroscopic, microscopic, and physicochemical evaluations, the authenticity and quality of the crude drugs were confirmed. Parameters such as ash values, extractive values, moisture content, and pH were found to be within acceptable pharmacopoeial limits, thereby ensuring the purity and stability of the plant materials. These findings provide

essential reference data for future quality control and authentication of these crude drugs, reducing the risk of adulteration and variability that often compromise herbal formulations.

Phytochemical screening revealed the presence of diverse secondary metabolites, including carbohydrates, amino acids, alkaloids, glycosides, flavonoids, tannins, and phenolic compounds. The absence of sterols in both species and the differential presence of proteins and saponins highlight unique chemical signatures that can serve as diagnostic markers. Quantitative estimation further demonstrated that both plants are rich sources of flavonoids and phenolic compounds, with *Sarcostigma kleinii* showing slightly higher concentrations than *Cajanus goensis*. These bioactive constituents are well known for their antioxidant, anti-inflammatory, and immunomodulatory properties, supporting the traditional use of these plants in the treatment of rheumatism and related inflammatory disorders.

The integration of pharmacognostic and phytochemical data not only validates the ethnomedicinal claims of *Cajanus goensis* and *Sarcostigma kleinii* but also provides a scientific foundation for their potential application in modern herbal formulations. By establishing reproducible standards, this study contributes to bridging the gap between traditional knowledge and evidence-based medicine. Furthermore, the identification of key phytoconstituents opens avenues for advanced pharmacological investigations, including isolation of active compounds, mechanistic studies, and formulation development. In conclusion, the comprehensive evaluation of *Cajanus goensis* and *Sarcostigma kleinii* underscores the importance of standardization in ensuring the safety, efficacy, and reproducibility of herbal medicines. The results highlight their potential as reliable sources of bioactive compounds and support their continued exploration in the development of novel therapeutic agents. Future research should focus on detailed pharmacological studies, clinical validation, and formulation optimization to fully harness the therapeutic potential of these plants. By combining traditional wisdom with modern scientific rigor, these crude drugs can be effectively integrated into contemporary healthcare systems, contributing to the advancement of phytopharmacology and natural product research.

5. Conflict of Interest

None

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