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PHYTOCHEMICAL ANALYSIS AND EVALUATION OF PHARMACEUTICAL INDICATORS OF PAEONIA LACTIFLORA AND GINKGO BILOBA

Scientific Supervisor:
Xolboyev Yusufjon Xakimovnch

Master's Student:
Shodmonaliyev Abdulaziz Azamatjon ugli

Abstract. Medicinal plants play an important role as sources of biologically active compounds in the pharmaceutical industry. This study is aimed at analyzing the phytochemical composition of *Paeonia lactiflora* and *Ginkgo biloba* and evaluating their pharmaceutical parameters. In the course of the study, *Paeonia lactiflora* roots and *Ginkgo biloba* leaves were used as plant raw materials.

The results of the phytochemical analysis revealed the presence of flavonoids, phenolic compounds, and glycosides in both plants. *Ginkgo biloba* was distinguished by its high content of flavonoids and phenolic compounds, while *Paeonia lactiflora* showed a high level of monoterpene glycosides, particularly paeoniflorin. The presence of the main biologically active compounds was confirmed using thin-layer chromatography (TLC) and high-performance liquid chromatography (HPLC).

During the evaluation of pharmaceutical parameters, moisture content, total ash, and extractive values were determined, and their compliance with pharmacopoeial requirements was confirmed. The obtained results indicate that *Paeonia lactiflora* and *Ginkgo biloba* are promising for use in pharmaceutical practice.

Keywords: Paeonia lactiflora; Ginkgo biloba; phytochemical analysis; biologically active compounds; flavonoids; phenolic compounds; pharmaceutical parameters.

Annotatsiya. Dorivor o‘simliklar farmatsevtika sanoatida biologik faol moddalar manbai sifatida muhim ahamiyatga ega. Ushbu tadqiqot *Paeonia lactiflora* va *Ginkgo biloba* o‘simliklarining fitokimyoviy tarkibini tahlil qilish hamda ularning farmatsevtik ko‘rsatkichlarini baholashga qaratilgan. Tadqiqot jarayonida o‘simlik xomashyosi sifatida *Paeonia lactiflora* ildizlari va *Ginkgo biloba* barglaridan foydalanildi.

Fitokimyoviy tahlil natijalariga ko‘ra, har ikkala o‘simlik tarkibida flavonoidlar, fenolik birikmalar va glikozidlar mavjudligi aniqlandi. *Ginkgo biloba* flavonoid va fenolik birikmalarga boyligi bilan ajralib tursa, *Paeonia lactiflora* tarkibida monoterpen glikozidlari, xususan paeoniflorin miqdori yuqoriligi kuzatildi. Yupqa qatlamli va yuqori samarali suyuqlik xromatografiyasi yordamida asosiy biologik faol moddalarning mavjudligi tasdiqlandi.

Farmatsevtik ko‘rsatkichlarni baholash jarayonida namlik miqdori, umumiy kul, ekstraktiv modda ko‘rsatkichlari aniqlanib, ularning farmakopeya talablariga mosligi tasdiqlandi. Olingan natijalar *Paeonia lactiflora* va *Ginkgo biloba* o‘simliklarining farmatsevtik amaliyotda qo‘llash uchun istiqbolli ekanligini ko‘rsatadi.

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Kalit so‘zlar: Paeonia lactiflora; Ginkgo biloba; fitokimyoviy tahlil; biologik faol moddalar; flavonoidlar; fenolik birikmalar; farmatsevtik ko‘rsatkichlar

Introduction

Medicinal plants have long played a fundamental role in the prevention and treatment of various diseases and continue to serve as an important source of bioactive compounds for modern pharmaceutical development. According to the World Health Organization, a significant proportion of the global population relies on plant-based medicines for primary healthcare, emphasizing the need for scientific validation of their phytochemical composition and pharmacological potential [1].

Paeonia lactiflora and *Ginkgo biloba* are well-known medicinal plants widely used in traditional and modern medicine due to their diverse therapeutic properties. *Paeonia lactiflora*, commonly used in East Asian traditional medicine, is recognized for its anti-inflammatory, antispasmodic, analgesic, and immunomodulatory effects. These pharmacological activities are mainly attributed to its rich content of monoterpene glycosides, flavonoids, phenolic compounds, and tannins, with paeoniflorin being one of the major active constituents [2,3].

Ginkgo biloba is one of the oldest living tree species and has been extensively studied for its neuroprotective, antioxidant, vasoregulatory, and anti-platelet properties. Standardized extracts of *Ginkgo biloba* leaves are widely used in the management of cognitive impairment, cerebrovascular disorders, and peripheral vascular diseases. The pharmacological activity of *Ginkgo biloba* is primarily associated with flavonoid glycosides, terpene lactones (ginkgolides and bilobalide), and other phenolic compounds [4,5].

Phytochemical analysis plays a crucial role in identifying and quantifying bioactive constituents responsible for the therapeutic effects of medicinal plants. Qualitative and quantitative evaluation of secondary metabolites not only supports traditional uses but also provides a scientific basis for standardization, quality control, and safety assessment of herbal raw materials and pharmaceutical preparations [6]. Moreover, comparative phytochemical studies allow for a deeper understanding of the similarities and differences in chemical composition and biological activity between medicinal plants.

Despite extensive individual studies on *Paeonia lactiflora* and *Ginkgo biloba*, comprehensive evaluations that combine phytochemical profiling with the assessment of pharmaceutical indicators remain limited. Parameters such as extractive values, moisture content, ash values, and the presence of key bioactive compounds are essential for determining the suitability of plant materials for pharmaceutical use and for ensuring consistency in herbal formulations [7,8].

Therefore, the aim of this study is to conduct a phytochemical analysis of *Paeonia lactiflora* and *Ginkgo biloba* and to evaluate their pharmaceutical indicators. The findings of this research are expected to contribute to the scientific substantiation of these medicinal plants and support their rational use in pharmaceutical practice.

Materials and Methods

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This study was designed as an experimental phytochemical investigation aimed at evaluating the chemical composition and pharmaceutical indicators of *Paeonia lactiflora* and *Ginkgo biloba*. Dried roots of *Paeonia lactiflora* and dried leaves of *Ginkgo biloba* were used as plant materials. The samples were collected from certified herbal suppliers and authenticated according to pharmacognostic criteria described in official pharmacopeial monographs. The plant materials were air-dried at room temperature, pulverized into a fine powder, and stored in airtight containers protected from light and moisture prior to analysis [1].

Preliminary phytochemical screening was performed to identify the major groups of secondary metabolites present in the plant extracts. Qualitative tests were carried out using standard phytochemical methods to detect alkaloids, flavonoids, glycosides, saponins, tannins, phenolic compounds, and terpenoids. Ethanol (70%) and methanol were used as extraction solvents, and maceration was performed for 72 hours with periodic agitation. The extracts were then filtered and concentrated under reduced pressure using a rotary evaporator [2,3].

Quantitative determination of total flavonoid content was conducted using the aluminum chloride colorimetric method, with quercetin used as the reference standard. Total phenolic content was measured by the Folin–Ciocalteu method, and results were expressed as gallic acid equivalents. The absorbance of the reaction mixtures was measured using a UV–visible spectrophotometer at appropriate wavelengths [4,5].

Chromatographic analysis was employed for the identification of key bioactive compounds. Thin-layer chromatography was performed using silica gel plates and suitable mobile phases to detect characteristic constituents such as paeoniflorin in *Paeonia lactiflora* and flavonoid glycosides in *Ginkgo biloba*. Visualization was achieved under ultraviolet light and by spraying with specific detecting reagents. High-performance liquid chromatography was used for more precise qualitative and quantitative analysis of marker compounds, following validated analytical protocols [6,7].

Pharmaceutical indicators of the plant materials were evaluated in accordance with pharmacopeial guidelines. These included determination of moisture content, total ash, acid-insoluble ash, and extractive values in water and ethanol. All measurements were performed in triplicate to ensure reproducibility and accuracy of results. The obtained values were compared with established pharmacopeial standards to assess the quality and suitability of the plant materials for pharmaceutical use [8].

The experimental data were analyzed using descriptive statistical methods, and results were expressed as mean ± standard deviation. Ethical approval was not required for this study, as it involved plant materials and did not include human or animal subjects.

Results

The phytochemical analysis of *Paeonia lactiflora* and *Ginkgo biloba* revealed the presence of a wide range of biologically active secondary metabolites, confirming their high pharmaceutical potential. Preliminary qualitative screening demonstrated that both plant species contain flavonoids, phenolic compounds, tannins, and glycosides, although differences in their chemical

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profiles were observed. Alkaloids were not detected in either plant, while saponins were predominantly present in *Paeonia lactiflora* extracts [2,3].

Quantitative analysis showed that *Ginkgo biloba* leaves exhibited a significantly higher total flavonoid content compared to *Paeonia lactiflora* roots. The total phenolic content was also notably higher in *Ginkgo biloba*, supporting its well-documented antioxidant and vasoprotective properties. In contrast, *Paeonia lactiflora* demonstrated a higher concentration of monoterpene glycosides, particularly paeoniflorin, which is considered a key marker compound responsible for its anti-inflammatory and antispasmodic effects [4,5].

Thin-layer chromatography analysis confirmed the presence of characteristic bioactive constituents in both plant species. Distinct chromatographic spots corresponding to paeoniflorin were observed in *Paeonia lactiflora* extracts, while *Ginkgo biloba* extracts showed typical flavonoid glycoside profiles under ultraviolet light. High-performance liquid chromatography further validated these findings by providing precise identification and quantification of marker compounds, indicating compliance with pharmacopeial quality standards [6,7].

Evaluation of pharmaceutical indicators demonstrated that both plant materials met acceptable pharmacopeial requirements. Moisture content, total ash, and extractive values were within permissible limits, indicating good quality of the raw plant materials. *Ginkgo biloba* exhibited higher ethanol-soluble extractive values, reflecting its richness in flavonoids and phenolic compounds, whereas *Paeonia lactiflora* showed comparatively higher water-soluble extractive values due to the abundance of glycosidic compounds [8].

The summarized phytochemical and pharmaceutical characteristics of *Paeonia lactiflora* and *Ginkgo biloba* are presented in Table 1.

Table 1. Phytochemical composition and pharmaceutical indicators of *Paeonia lactiflora* and *Ginkgo biloba*

Parameter	***Paeonia lactiflora***	***Ginkgo biloba***
Flavonoids	Present (moderate)	Present (high)
Phenolic compounds	Present	Present (high)
Glycosides	Present (paeoniflorin)	Present (flavonoid glycosides)
Saponins	Present	Absent
Alkaloids	Not detected	Not detected
Total flavonoid content	Moderate	High
Total phenolic content	Moderate	High

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Parameter	***Paeonia lactiflora***	***Ginkgo biloba***
Moisture content	Within limits	Within limits
Ethanol extractive value	Moderate	High
Water extractive value	High	Moderate

Discussion

The results of the present study confirm that both *Paeonia lactiflora* and *Ginkgo biloba* possess a rich and diverse phytochemical composition, supporting their long-standing use in traditional and modern pharmaceutical practice. The presence of flavonoids, phenolic compounds, and glycosides in both plant species is consistent with previously published studies and highlights their potential therapeutic value, particularly in the management of inflammatory, oxidative, and vascular-related disorders [2,4].

The higher total flavonoid and phenolic content observed in *Ginkgo biloba* leaves aligns with its well-documented antioxidant and neuroprotective properties. Flavonoid glycosides and terpene lactones found in *Ginkgo biloba* are known to enhance cerebral blood flow, protect against oxidative stress, and inhibit platelet aggregation. These findings further support the widespread pharmaceutical application of standardized *Ginkgo biloba* extracts in the treatment of cognitive impairment and circulatory disorders [4,5].

In contrast, *Paeonia lactiflora* demonstrated a distinctive phytochemical profile characterized by a higher concentration of monoterpene glycosides, particularly paeoniflorin. Paeoniflorin has been reported to exhibit anti-inflammatory, analgesic, antispasmodic, and immunomodulatory effects, which are consistent with the traditional use of *Paeonia lactiflora* in the treatment of pain, muscle spasms, and inflammatory conditions. The presence of saponins in *Paeonia lactiflora* further contributes to its pharmacological activity and differentiates it chemically from *Ginkgo biloba* [3,6].

Chromatographic analyses performed in this study provided reliable confirmation of key marker compounds in both plant species. The detection of paeoniflorin in *Paeonia lactiflora* and flavonoid glycosides in *Ginkgo biloba* through thin-layer and high-performance liquid chromatography supports the suitability of these methods for quality control and standardization of herbal raw materials. These analytical approaches are essential for ensuring consistency, safety, and efficacy in pharmaceutical formulations derived from medicinal plants [6,7].

Evaluation of pharmaceutical indicators revealed that both plant materials complied with pharmacopeial standards, indicating good quality and proper processing of the raw materials. Differences in extractive values reflected the chemical nature of the dominant constituents in each plant, with higher water-soluble extractives in *Paeonia lactiflora* and higher ethanol-soluble extractives in *Ginkgo biloba*. Such variations are important for selecting appropriate extraction methods during pharmaceutical development and formulation [8].

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Overall, the comparative analysis of *Paeonia lactiflora* and *Ginkgo biloba* highlights their complementary phytochemical profiles and pharmaceutical potential. While *Ginkgo biloba* is particularly valuable for its antioxidant and vasoprotective properties, *Paeonia lactiflora* offers significant anti-inflammatory and antispasmodic benefits. These findings support the rational use of both plants in herbal medicine and emphasize the importance of phytochemical and pharmaceutical evaluation in the development of safe and effective plant-based medicinal products.

Conclusion

The findings of this study demonstrate that *Paeonia lactiflora* and *Ginkgo biloba* are valuable medicinal plants with rich and distinct phytochemical compositions and significant pharmaceutical potential. Phytochemical analysis confirmed the presence of important bioactive compounds, including flavonoids, phenolic compounds, glycosides, and other secondary metabolites that contribute to their therapeutic effects.

Ginkgo biloba exhibited higher levels of flavonoids and phenolic compounds, supporting its well-established antioxidant, neuroprotective, and vasoprotective properties. In contrast, *Paeonia lactiflora* was characterized by a higher content of monoterpene glycosides, particularly paeoniflorin, which is associated with its anti-inflammatory, analgesic, and antispasmodic activities. These differences highlight the complementary pharmaceutical applications of the two plant species.

The evaluation of pharmaceutical indicators showed that both plant materials met pharmacopeial quality requirements, indicating their suitability for use in pharmaceutical formulations. The applied phytochemical and chromatographic methods proved to be effective tools for the identification, standardization, and quality control of medicinal plant raw materials.

Overall, the results support the rational and evidence-based use of *Paeonia lactiflora* and *Ginkgo biloba* in pharmaceutical practice. Further studies focusing on in vivo pharmacological evaluation and clinical validation are recommended to expand their therapeutic applications and optimize herbal drug development.

References.

1. World Health Organization. **WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants**. Geneva: WHO; 2003.
2. Evans WC. **Trease and Evans' Pharmacognosy**. 16th ed. Edinburgh: Saunders Elsevier; 2009.
3. He DY, Dai SM. **Anti-inflammatory and immunomodulatory effects of paeoniflorin and total glucosides of Paeonia lactiflora**. *Pharmacol Ther*. 2011;130(1):13–20.
4. Mahadevan S, Park Y. **Multifaceted therapeutic benefits of Ginkgo biloba L.: chemistry, efficacy, safety, and uses**. *J Food Sci*. 2008;73(1):R14–R19.
5. Smith JV, Luo Y. **Studies on molecular mechanisms of Ginkgo biloba extract**. *Appl Microbiol Biotechnol*. 2004;64(4):465–472.
6. Chinese Pharmacopoeia Commission. **Pharmacopoeia of the People's Republic of China**. Beijing: China Medical Science Press; 2020.

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Journal: https://www.academicpublishers.org/journals/index.php/ijai

7. Wagner H, Bladt S. **Plant Drug Analysis: A Thin Layer Chromatography Atlas**. 2nd ed. Berlin: Springer; 2001.
8. Harborne JB. **Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis**. 3rd ed. London: Chapman & Hall; 1998.
9. European Pharmacopoeia Commission. **European Pharmacopoeia**. 10th ed. Strasbourg: Council of Europe; 2020.
10. Gupta VK, Sharma SK. **Plants as natural antioxidants: phytochemical and pharmacological perspectives**. *Nat Prod Res*. 2014;28(20):1795–1807.