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Research

PHYTOCHEMICAL SCREENING PROTOCOL FOR *CHAMPAKA (MICHELIA CHAMPACA* LINN) LEAVES

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Abstract

Michelia champaca Linn commonly known as *Champaka,* is a highly valued medicinal plant in Ayurveda and traditional medicine systems due to its diverse therapeutic properties, including anti inflammatory, antimicrobial, antioxidant, and hepatoprotective activities. The leaves of *Champaka* are known to harbor bioactive secondary metabolites that contribute to these pharmacological effects. In the present study, a preliminary phytochemical screening was carried out to evaluate the chemical profile of *Champaka* leaves using both aqueous and organic solvent extracts. The solvents selected ethanol; methanol, hexane, and chloroform represent a gradient of polarity to ensure a comprehensive extraction of polar, semi polar, and non polar phytoconstituents. Standard qualitative tests were employed to detect the presence of major classes of secondary metabolites, including alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, steroids, phenols, and carbohydrates. The results indicated a distinct distribution of phytochemicals depending on the solvent used. Ethanolic and methanolic extracts showed a rich presence of polar compounds such as alkaloids, flavonoids, tannins, saponins, and glycosides, highlighting their potential contribution to antioxidant and antimicrobial activity. In contrast, hexane and chloroform extracts predominantly contained non-polar constituents like terpenoids and steroids, which are often associated with anti inflammatory and cytoprotective properties.

Keywords: *Michelia champaca*, phytochemical screening, Soxhlet extraction, flavonoids, tannins, saponins, glycosides, terpenoids, steroids, phenols, carbohydrates.

INTRODUCTION

Medicinal plants have long served as a cornerstone of traditional healthcare systems and continue to play a vital role in the discovery and development of novel therapeutic agents. They are known to be rich repositories of diverse bioactive secondary metabolites such as alkaloids, flavonoids, terpenoids, tannins, phenolic compounds, glycosides, and saponins. These phytoconstituents are responsible for a wide range of pharmacological activities, including anti-inflammatory, antioxidant, antimicrobial, antipyretic, and gastroprotective effects[4]. Owing to this chemical diversity, medicinal plants remain an important focus of pharmacognostic and phytochemical research. *Michelia champaca* Linn., commonly known as *Champaka*, is an evergreen aromatic tree belonging to the family Magnoliaceae. In *Ayurveda*, *Champaka* is valued for its multifaceted therapeutic applications and is traditionally employed in the management of *Jwara* (fever), *Kustha* (skin disorders), *Shotha* (inflammation), *Krimi* (parasitic infestations), and various disorders of the digestive system[3]. Different parts of the plant, particularly the leaves, flowers, and bark, are reported to possess medicinal properties attributed to their rich phytochemical composition. Despite its extensive traditional use, systematic scientific evaluation of its phytochemical profile is necessary to substantiate these claims and support its rational utilization. Phytochemical screening serves as an essential preliminary investigative tool to qualitatively assess the presence of major groups of secondary metabolites in plant materials. Such screening not only provides insight into the chemical nature of the plant but also helps in correlating traditional therapeutic uses with potential pharmacological activities. Furthermore, phytochemical profiling forms the basis for selecting appropriate solvents for extraction, isolating active constituents, and designing advanced pharmacological, toxicological, and standardization studies. In the present study, *Champaka* leaves were subjected to extraction using solvents of varying polarity to ensure the efficient recovery of a broad spectrum of phytoconstituents. The use of multiple solvents enhances the likelihood of extracting both polar and non-polar compounds, thereby offering a comprehensive overview of the phytochemical composition of the plant. The qualitative phytochemical evaluation of these extracts aims to identify key bioactive groups present in *Champaka* leaves and to generate baseline data that can support further research, including pharmacological validation, quality control, and standardization of herbal formulations in Ayurvedic practice.

MATERIALS AND METHODS

Plant Material-

Fresh leaves of *Michelia champaca* were collected from [insert location], authenticated, and used for analysis.

Chemicals and Reagents-

Distilled water, ethanol, methanol, hexane, chloroform, Mayer's reagent, Wagner's reagent, $FeCl_3$, HCl, Mg turnings, Salkowski reagent, Molisch reagent, Liebermann–Burchard reagent, Benedict's solution.

Sample Preparation-

Leaves were washed, shade-dried for 10 days, ground into fine powder, and stored in airtight containers.

Extraction-

- **Aqueous Extraction-** 10 g powder + 100 ml distilled water, heated at 60°C for 30 min, filtered.
- **Organic Solvent Extraction-** 10 g powder extracted with ethanol/methanol in Soxhlet for 24 - 48 hours. Hexane and chloroform extracts were obtained similarly. Filtrates were concentrated.

Materials Needed-

- Fresh *Champaka* leaves
- Distilled water
- **Organic solvents**- Hexane, chloroform, ethanol, methanol
- **Reagents**- Mayer's reagent, Wagner's reagent, HCl, Mg, $FeCl_3$, Benedict's solution, Molisch reagent, Salkowski reagent, Liebermann-Burchard reagents
- Mortar and pestle or grinder

- Soxhlet apparatus or conical flasks (for maceration)
- Test tubes, pipettes, beakers, filter paper

Sample Preparation-

- Wash the leaves thoroughly with distilled water.
- Shade dry at room temperature for 10 days until crisp.
- Avoid direct sunlight.
- Grind the dried leaves into a fine powder.
- Store the powder in an airtight container.

Extraction-

Aqueous Extraction (for polar compounds)-

- Take 10 gms of leaf powder.
- Add 100 ml of distilled water.
- Heat gently for 30 minutes at 60°C.
- Filter the extract and store.

Organic Solvent Extraction (for non polar and mid polar compounds)-

- Take 10 gms of leaf powder.
- Place in Soxhlet apparatus or macerate with 100 ml of ethanol/methanol for 24-48 hours.
- Filter and concentrate using a rotary evaporator or air dry.
- Repeat with hexane and chloroform for non polar compounds.

Phytochemical Tests [1], [2]-

- **Alkaloids- Mayer's Test**- 1 ml of extract + few drops of Mayer's reagent → cream-colored precipitate indicates alkaloids.
- **Wagner's Test**- 1 ml of extract + Wagner's reagent → reddish-brown precipitate indicates alkaloids.
- **Flavonoids- Shinoda Test**- Add Mg turnings + few drops of concentrated HCl → pink/red color indicates flavonoids.
- **Tannins- Ferric Chloride Test**- 1 ml of extract + 2-3 drops of 5% $FeCl_3$ → blue-black or green-black color indicates tannins.
- **Saponins- Froth Test**- Shake 1 ml of extract with 5 ml water → persistent froth indicates saponins.
- **Glycosides- Keller-Kiliani Test (for cardiac glycosides)**- 1 ml of extract + 2 ml glacial acetic acid + few drops of $FeCl_3$ + 1 ml concentrated H_2SO_4 → brown ring at interface indicates glycosides
- **Terpenoids- Salkowski Test**- 1 ml extract + 2 ml chloroform + 2 ml concentrated H_2SO_4 → reddish brown interface indicates terpenoids.
- **Steroids- Liebermann-Burchard Test**- 1 ml extract + few drops acetic anhydride + 1-2 drops concentrated H_2SO_4 → bluish-green color indicate steroids.
- **Phenols- Ferric Chloride Test**- 1 ml extract + 2-3 drops $FeCl_3$ → blue/green color indicates phenols.
- **Carbohydrates- Molisch Test**- 1 ml extract + 2 drops Molisch reagent + add concentrated H_2SO_4 carefully → purple ring indicates carbohydrates.

Table No-1

Sl No	Phytochemicals	Test	Aqueous Extract	Ethanol Extract	Methanol Extract	Hexane	Chloroform
1.	Alkaloids	Mayer's & Wagner's	+	+	+	–	–
2.	Flavonoids	Shinoda Test	+	+	+	–	–
3.	Tannins	$FeCl_3$ Test	+	+	+	–	–
4.	Saponins	Froth Test	+	+	+	–	–
5.	Glycosides	Keller–Kiliani	+	+	+	–	–

		Test					
6.	Terpenoids	Salkowski Test	–	+	+	+	+
7.	Steroids	Liebermann–Burchard Test	–	+	+	+	+
8.	Phenols	$FeCl_3$ Test	+	+	+	–	–
9.	Carbohydrates	Molisch Test	+	+	+	–	–

DISCUSSION-

The present phytochemical investigation of *Michelia champaca* Linn. leaves demonstrates the presence of a wide spectrum of bioactive secondary metabolites, with their extraction strongly influenced by the nature and polarity of the solvents used. Such qualitative screening serves as a crucial preliminary step in pharmacognostic and Ayurvedic drug research, as it provides insight into the therapeutic potential of the plant and guides further phytochemical and pharmacological studies. The aqueous extract showed positive results for alkaloids, flavonoids, tannins, saponins, glycosides, phenols, and carbohydrates, indicating a predominance of polar phytoconstituents in *M. champaca* leaves. Tannins and phenolic compounds are well known for their antioxidant and astringent properties, supporting the traditional use of Champaka in wound healing and skin disorders. The presence of saponins may contribute to anti-inflammatory, expectorant, and immunomodulatory activities, while glycosides are often associated with cardiotonic and antimicrobial effects. Carbohydrates, though primary metabolites, play an important role in energy metabolism and may enhance the overall bioavailability of other active constituents. Ethanolic and methanolic extracts exhibited the richest phytochemical profiles among all the solvents tested. In addition to polar compounds, both extracts showed the presence of terpenoids and steroids, highlighting the efficiency of mid-polar solvents in extracting a broader range of phytoconstituents. Flavonoids present in these extracts are reported to possess strong antioxidant, anti-inflammatory, hepatoprotective, and antimicrobial activities. Alkaloids, detected consistently in these extracts, are pharmacologically significant due to their analgesic, antipyretic, and antimicrobial properties. The combined presence of phenols, flavonoids, terpenoids, and steroids suggests a possible synergistic effect, enhancing the therapeutic efficacy of ethanolic and methanolic extracts. In contrast, hexane and chloroform extracts were devoid of polar constituents such as alkaloids, flavonoids, tannins, phenols, and carbohydrates, but showed positive reactions for terpenoids and steroids. This selective extraction pattern confirms the lipophilic nature of these compounds. Terpenoids are widely recognized for their anti-inflammatory, antimicrobial, anticancer, and antioxidant activities, whereas steroids are associated with anti-inflammatory and hormone-modulating effects. The presence of these constituents in non-polar extracts indicates their potential role in topical formulations and lipid-based drug delivery systems. From an Ayurvedic perspective, the predominance of tannins, flavonoids, and phenolic compounds correlates with the *tikta* (bitter) and *kashaya* (astringent) rasa of Champaka, which are traditionally associated with *pitta* and *kapha* pacifying actions. The observed phytochemical profile thus provides a scientific rationale for the classical therapeutic applications of *Michelia champaca* in inflammatory conditions, skin diseases, and infections. In conclusion, the qualitative phytochemical screening confirms that *Michelia champaca* leaves are a rich source of both polar and non-polar bioactive compounds. Ethanol and methanol emerged as the most suitable solvents for comprehensive extraction, while hexane and chloroform were effective for isolating lipophilic constituents. These findings lay a strong foundation for advanced studies such as quantitative estimation, chromatographic profiling, bioactivity-guided fractionation, and standardization of Champaka-based Ayurvedic formulations.

CONCLUSION

The present study demonstrates the presence of a wide range of secondary metabolites in *Michelia champaca* leaves. Aqueous extracts were rich in polar compounds such as tannins, saponins, phenols, glycosides, and carbohydrates, whereas ethanol and methanol extracts contained both polar and mid polar compounds including flavonoids, alkaloids, terpenoids, and steroids. Non polar solvents like hexane and chloroform selectively extracted lipophilic constituents such as terpenoids and steroids. The phytochemicals identified may explain the anti inflammatory, antioxidant, and antimicrobial effects of *Champaka* leaves reported in *Ayurveda.* Further

studies, including quantitative analysis and pharmacological evaluation, are recommended to validate these observations and standardize herbal preparations.

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