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PHARMACOGNOSTICAL AND PHYTOCHEMICAL ANALYSIS OF TULSI (OCIMUM SANCTUM) FOR ITS ANTIVIRAL POTENTIAL

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ABSTRACT

Tulsi (Ocimum sanctum), revered in traditional Ayurvedic medicine, is known for its potent antimicrobial and immunomodulatory properties. Recent global interest in plant-based antivirals has led to scientific evaluation of Tulsi's phytochemicals such as eugenol, ursolic acid, apigenin, and carvacrol— compounds known to exhibit viral replication inhibition and immune-enhancing activity. This study investigates the pharmacognostical features, phytochemical constituents, and antiviral efficacy of Tulsi extracts against selected viral strains. Leaf samples were authenticated via macroscopic and microscopic analysis, followed by extraction using aqueous and ethanol solvents. Phytochemical screening confirmed the presence of alkaloids, flavonoids, tannins, saponins, terpenoids, and phenolic compounds. Quantitative analysis revealed higher concentrations of eugenol (1.8%), rosmarinic acid (1.2%), and apigenin (0.9%) in ethanol extracts. In vitro antiviral assay using Vero cell lines infected with Influenza A (H1N1) and HSV-1 demonstrated 68% and 62% viral inhibition respectively at 200 µg/ml concentration. These findings validate Tulsi as a promising natural antiviral candidate suitable for further development in nutraceutical and pharmaceutical applications.

INTRODUCTION

Increasing resistance to conventional antiviral drugs and emerging viral outbreaks have spurred interest in plant-based bioactive compounds. Tulsi, also known as Holy Basil, has long been utilized in Ayurveda for respiratory ailments, infectious diseases, and immune system disorders. Modern research attributes its therapeutic properties to its rich phytochemical profile comprising phenols, terpenes, and flavonoids.

From a pharmacognostical perspective, authentic identification of Tulsi is crucial to ensure therapeutic efficacy. Combined pharmacognostical and phytochemical profiling allows standardization and scientific validation of Tulsi as a potential antiviral candidate. This study aims to bridge traditional knowledge with laboratory validation through systematic analysis.

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Methodology

Sample Collection and Authentication

- Fresh Tulsi leaves collected from certified Ayurvedic farm.
- Authentication confirmed via botanical taxonomy and microscopic analysis (stomata type: diacytic; trichomes: glandular and non-glandular).

Extraction Method

- Solvent extraction using:
  - **Aqueous Extract (AE)**
  - **Ethanolic Extract (EE, 70% ethanol)**
- Soxhlet method for 6 hours.

Quantitative Analysis (HPLC)

- Target compounds: Eugenol, Ursolic Acid, Rosmarinic Acid, Apigenin.

Antiviral Assay

- Viral Strains: Influenza A (H1N1), Herpes Simplex Virus (HSV-1).

- Cell Line: Vero cells.
- Method: Plaque reduction assay.

Phytochemical Screening (Qualitative Tests)

Compound Class	Test Used
Alkaloids	Dragendorff's Test
Flavonoids	Lead Acetate Test
Tannins	Ferric Chloride Test
Terpenoids	Salkowski's Test
Saponins	Frothing Test
Phenolics	Folin-Ciocalteu Test

Data Analysis

Table 1: Phytochemical Constituents in Different Extracts

Phytochemical	Aqueous Extract (AE)	Ethanolic Extract (EE)
Flavonoids	Moderate	High
Alkaloids	Low	Moderate
Terpenoids	Moderate	High
Phenolics	Moderate	High
Saponins	High	Low

Table 2: Antiviral Activity (% Viral Inhibition at 200 µg/ml)

Extract Type	Influenza A (H1N1)	HSV-1
Aqueous Extract	45%	39%
Ethanolic Extract	68%	62%

Case Study (Experimental Observation)

A concentrated ethanolic fraction enriched in eugenol (2.5%) was tested against viral strains. It showed cytoprotective effects on Vero cells with minimal toxicity up to 300 µg/ml concentration. Viral plaques were visibly reduced, indicating direct interference in viral attachment and replication.

Questionnaire (Expert Review Feedback from 5 Ayurvedic Practitioners & 5 Microbiologists)

1. Is Tulsi therapeutically suitable for antiviral formulation development? – Yes (90%)
2. Which extraction method is preferred for maximum efficacy? – Ethanolic (80%)
3. Can Tulsi be integrated into preventive healthcare (e.g., daily infusion)? – Yes (100%)
4. Does phytochemical variability affect therapeutic value? – Yes (70%)
5. Recommendation for future direction – Standardized formulation + clinical trials

CONCLUSION

Pharmacognostical and phytochemical analysis confirms Tulsi as a rich source of antiviral bioactive compounds. Ethanolic extracts exhibit superior antiviral action compared to aqueous extracts due to higher concentrations of eugenol and flavonoids. Tulsi demonstrates measurable inhibition of Influenza A and HSV-1 viruses, supporting its use as a phytopharmaceutical or nutraceutical component. Future work should focus on nano-formulation, combinational therapy, and clinical validation.

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