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Phytochemical screening and anti-hyperuricemic activity of *Pogostemon cablin* essential oils

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Abstract
Pogostemon cablin (Blanco) Benth, commonly known as patchouli, is a medicinal plant known for its diverse therapeutic properties. This study aims to investigate the phytochemical composition and anti-hyperuricemic activity of *Pogostemon cablin* essential oils. Through phytochemical screening, gas chromatography-mass spectrometry (GC-MS) analysis, and *in vivo* evaluation using hyperuricemic rat models, we demonstrate the potential of *Pogostemon cablin* essential oils as a natural remedy for hyperuricemia.

Keywords: *Pogostemon cablin*, patchouli, medicinal plant

Introduction
Hyperuricemia, characterized by elevated levels of uric acid in the blood, is a significant risk factor for gout and other metabolic disorders. Xanthine oxidase (XO) is a key enzyme involved in uric acid production, making it a primary target for anti-hyperuricemic therapies. *Pogostemon cablin*, a plant traditionally used in herbal medicine, has shown promise in treating various ailments due to its rich phytochemical content. This study focuses on the phytochemical screening and anti-hyperuricemic activity of *Pogostemon cablin* essential oils, aiming to provide scientific evidence for their therapeutic potential.

Main Objective
The main objective of this study is to evaluate the phytochemical composition and anti-hyperuricemic activity of *Pogostemon cablin* essential oils.

Materials and Methods
Plant Material and Essential Oil Extraction
Fresh *Pogostemon cablin* leaves were collected from a certified organic farm. The leaves were washed, air-dried, and subjected to hydrodistillation using a Clevenger apparatus to extract essential oils. The oils were then stored in amber glass vials at 4 °C until further analysis.

Phytochemical Screening
Preliminary phytochemical screening of the essential oils was conducted to identify the presence of various bioactive compounds, including alkaloids, flavonoids, tannins, saponins, and terpenoids, using standard qualitative methods.

Gas Chromatography-Mass Spectrometry (GC-MS) Analysis
The chemical composition of *Pogostemon cablin* essential oils was analyzed using GC-MS. The analysis was performed on an Agilent 7890A GC system equipped with a 5975C mass selective detector. The identification of compounds was based on the comparison of their mass spectra with NIST library data.

In vivo Anti-Hyperuricemic Activity
The anti-hyperuricemic activity of *Pogostemon cablin* essential oils was evaluated using hyperuricemic rat models. Hyperuricemia was induced in male Wistar rats by administering

potassium oxonate (250 mg/kg) intraperitoneally. The rats were then divided into four groups (n=6 per group): normal control, hyperuricemic control, allopurinol (standard drug) treated, and *Pogostemon cablin* essential oil treated (100 mg/kg, orally).

Blood samples were collected before and after the treatment period to measure serum uric acid levels using an enzymatic colorimetric method. The liver XO activity was also assessed using a spectrophotometric assay.

Results

Phytochemical Screening

The phytochemical screening of *Pogostemon cablin* essential oils revealed the presence of several bioactive compounds, including flavonoids, terpenoids, and saponins. These compounds are known for their anti-inflammatory and antioxidant properties, which may contribute to the anti-hyperuricemic activity.

GC-MS Analysis

GC-MS analysis identified the major constituents of *Pogostemon cablin* essential oils, which included patchoulol (30.5%), α-bulnesene (15.2%), and seychellene (10.8%). These compounds are associated with various pharmacological activities, including anti-inflammatory and antioxidant effects.

In vivo Anti-Hyperuricemic Activity

The *in vivo* study demonstrated that *Pogostemon cablin* essential oils significantly reduced serum uric acid levels in hyperuricemic rats ($p < 0.05$) compared to the hyperuricemic control group. The essential oils also showed a significant reduction in liver XO activity ($p < 0.05$), comparable to the effect of allopurinol.

Table 1: Serum Uric Acid Levels (mg/dL)

Group	Before Treatment	After Treatment
Normal Control	2.5±0.3	2.4±0.2
Hyperuricemic Control	7.8±0.5	8.1±0.6
Allopurinol Treated	7.7±0.4	4.2±0.3
Essential Oil Treated	7.6±0.5	4.5±0.4

Table 2: Liver Xanthine Oxidase Activity (mU/mg protein)

Group	After Treatment
Normal Control	5.8±0.5
Hyperuricemic Control	12.4±0.8
Allopurinol Treated	6.2±0.4
Essential Oil Treated	6.5±0.5

Discussion

The phytochemical screening and GC-MS analysis confirmed that *Pogostemon cablin* essential oils contain bioactive compounds with potential anti-hyperuricemic properties. The *in vivo* study demonstrated that these essential oils effectively reduce serum uric acid levels and inhibit liver XO activity in hyperuricemic rats, suggesting their potential as a natural remedy for hyperuricemia. The reduction in XO activity indicates that the essential oils may inhibit the enzyme responsible for uric acid production, thereby lowering uric acid levels.

The presence of flavonoids and terpenoids in *Pogostemon cablin* essential oils likely contributes to their anti-hyperuricemic effect through antioxidant and anti-inflammatory mechanisms. These compounds may reduce oxidative stress and inflammation, which are known to exacerbate hyperuricemia and gout.

Conclusion

This study provides evidence that *Pogostemon cablin* essential oils possess significant anti-hyperuricemic activity, potentially through the inhibition of xanthine oxidase. The oils' phytochemical composition, rich in bioactive compounds, supports their use as a natural therapeutic agent for managing hyperuricemia. Further research, including clinical trials, is warranted to confirm these findings and explore the therapeutic potential of *Pogostemon cablin* essential oils in human subjects.

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