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In Vitro Evaluation of Antihypertensive Potential of *Cynanchum acidum* (Roxb.) - An Ayurvedic and Experimental Study

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Abstract: ***Hypertension continues to burden public health, often managed through long-term drug therapy that brings its own limitations. Classical Ayurvedic texts describe clinical patterns that resemble elevated blood pressure, linking them to disturbances of Vāta and Pitta, as well as vitiation of Rakta and obstruction of channels. Cynanchum acidum, a plant cited in traditional practice for circulatory and inflammatory conditions, has not been adequately examined in controlled laboratory settings for this purpose. The present work outlines an in vitro experimental design to assess the antihypertensive potential of the compound through phytochemical profiling, angiotensin-converting enzyme inhibition, and antioxidant assays. Hydroalcoholic extracts are subjected to standard screening procedures, and their activity is compared with established references under statistical evaluation. By placing biochemical findings alongside Ayurvedic pharmacodynamics attributes, the study seeks to bridge traditional reasoning with contemporary mechanisms, such as modulation of the renin-angiotensin system and oxidative stress pathways. The anticipated observations may provide preliminary scientific support for the plant's classical indications and enable further in vivo validation and clinical exploration.***

Keywords: Hypertension, Cynanchum acidum, ACE inhibition, Antioxidant activity, Hydro alcoholic extract, In-vivo validation

1. Introduction

Hypertension is an issue that individuals must manage over an extended period. This is also a reason why individuals develop heart conditions, experience strokes, and suffer from kidney failure. Many adults globally suffer from hypertension, and it remains poorly managed despite the availability of numerous medications. The problem is that these drugs can create dependency in individuals, and they are costly. We must discover improved methods for managing hypertension.

Ayurveda addresses conditions akin to hypertension. They refer to them as Raktagata Vāta, Sirāgata Vāta, Raktadushti, and Hṛdrogas. These conditions entail disruptions in Vāta and Pitta blood, the heart, and the body's pathways. Ayurveda employs treatments for hypertension that possess qualities such as Vātānulomana, Raktaprasādana, Hṛdya, and Rasāyana. A plant known as Cynanchum acidum is a member of the Apocynaceae family. It has been utilized for a while to address issues related to inflammation and blood flow. It remains uncertain if it can aid with hypertension since it hasn't been evaluated in a lab. This study aims to determine whether Cynanchum acidum can effectively assist with hypertension through various methods while also analyzing the outcomes in line with Ayurvedic concepts. Hypertension is an issue, and we must discover new methods to address it; thus, this study on Cynanchum acidum holds significance for individuals with hypertension

2. Review of Literature

2.1 Ayurvedic Review

2.1.1 Concept of Hypertension in Ayurveda

1) No direct reference to hypertension, but correlation with:
- Raktagata Vāta
- Sirāgata Vāta
- Raktadushti
- Hṛdroga

2) Pathogenesis involves:
- Vāta prakopa
- Pitta anubandha
- Rakta dushti
- Srotorodha

2.1.2 Ayurvedic Pharmacology of *Cynanchum acidum*
- **Rasa:** Tikta, Kashāya
- **Guna:** Laghu, Rūkṣa
- **Virya:** Śīta
- **Vipāka:** Katu
- **Doṣaghnata:** Vāta-Pitta śāmaka
- **Karma:** Raktaprasādana, Śothahara, Hṛdya (probable)

2.2 Modern Review

2.2.1 Hypertension – Pathophysiology
- Renin–Angiotensin–Aldosterone System (RAAS)
- Angiotensin-Converting Enzyme (ACE)
- Endothelial dysfunction
- Oxidative stress

2.2.2 Role of ACE Inhibition in Hypertension

- ACE converts Angiotensin I to Angiotensin II
- Inhibition leads to vasodilation and BP reduction

2.2.3 Previous Studies on *Cynanchum* Species

- Reported antioxidant, anti-inflammatory, and cardioprotective activities
- Lack of specific studies on *Cynanchum acidum* and hypertension

3. Rationale of the Study

- Traditional Ayurvedic indications suggest cardiovascular benefits
- Absence of scientific validation for antihypertensive activity
- In vitro studies offer ethical, economical, and mechanistic insights
- Alignment with ICMR–CCRAS focuses on the validation of classical medicinal plants

4. Aim and Objectives

4.1 Aim

To evaluate the antihypertensive potential of *Cynanchum acidum* through in vitro experimental models.

4.2 Objectives

1) To authenticate and extract *Cynanchum acidum*.
2) To perform phytochemical screening.
3) To assess ACE inhibitory activity in vitro.
4) To evaluate antioxidant activity.
5) To interpret findings based on Ayurvedic principles.

5. Materials and Methods

5.1 Study Design

Experimental, in vitro laboratory-based study.

5.2 Drug Authentication

- Botanical identification by an expert taxonomist
- Voucher specimen deposition

5.3 Preparation of Extract

- Drying and powdering
- Hydroalcoholic extraction (70% ethanol)
- Concentration and storage

5.4 Phytochemical Screening

Standard qualitative tests for:

- Alkaloids
- Flavonoids
- Tannins
- Saponins
- Phenolics
- Glycosides

5.5 In Vitro Antihypertensive Evaluation

5.5.1 ACE Inhibition Assay

- Substrate: Hippuryl-Histidyl-Leucine
- Standard: Captopril
- IC_{50} determination

5.5.2 Antioxidant Assays

- DPPH radical scavenging assay
- FRAP assay
- Nitric oxide scavenging assay

5.6 Statistical Analysis

- Data expressed as Mean ± SD
- One-way ANOVA
- Significance at $p < 0.05$

6. Expected Results

- Significant ACE inhibitory activity
- Presence of bioactive phytoconstituents
- Strong antioxidant potential
- Validation of Ayurvedic antihypertensive claims

7. Discussion

- Correlation of ACE inhibition with **Vāta śamana**
- Antioxidant activity with **Pitta śamana**
- Overall **Raktaprasādana and Hṛdya effect**

8. Conclusion

The study is expected to establish *Cynanchum acidum* as a potential natural antihypertensive agent, supporting its traditional Ayurvedic use and providing a scientific foundation for further in vivo and clinical research.

Ethical Considerations

- No animal or human involvement
- Laboratory safety protocols followed
- Compliance with institutional ethics committee norms

9. Scope for Further Research

- In vivo antihypertensive studies
- Toxicity and safety evaluation
- Standardization and formulation development
- Clinical trials

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