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## Research Article

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## Phytochemical screening and antimicrobial activity of the plant extracts *Andrographis paniculata* against selected microbes

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### ABSTRACT

**Background:** *Andrographis paniculata* is a medicinal plant with a long history of traditional use in various herbal medicine systems. **Objective:** This study aims to conduct phytochemical screening and antibacterial activity from leaf, stem and root parts of *Andrographis paniculata*. **Methods:** The preliminary screening was done by cold maceration technique using chloroform, butanol, methanol, ethanol and aqueous solvents. This phytochemical screening showed the presence of alkaloids, glycosides, flavonoids, terpenoids, phenols, tannins and saponins. Antibacterial activity was performed by using well diffusion method from leaf, stem and root butanolic extracts of *A. paniculata*. **Results:** Glycosides are abundantly present in leaf, stem and root extract. Whereas, alkaloids and flavonoids are moderately present in leaf, stem and root extract and followed by less presence of tannins, phenols and saponins. The maximum zone of bacterial inhibition was observed in leaf butanolic extracts against of the *E. coli*, for stem butanolic extract against of *B. subtilis* and for root butanolic extract against *B. sphaericus*. **Conclusion:** This study revealed the potential phytochemical constituents and antibacterial activity in *A. paniculata*. The presence of these bioactive substances they use in treatment.

**Keywords:** Phytochemicals, Glycosides, Alkaloids, Flavonoids, Terpenoids, Phenols

### INTRODUCTION

Medicinal plants can offer valuable therapeutic effects; they are not a replacement for modern medical treatments when it comes to serious health conditions. The use of medicinal plants should be approached with caution and ideally under the guidance of a qualified health care professional, especially when taken alongside prescription medications. Most of the world's population depends on medicine derived from plants, which has drawn the interest of researchers to invest new medicines [1]. According to WHO, plants are the best sources for discovering new drugs.

*Andrographis paniculata* belongs to the family acanthaceae. *A. paniculata* is a good source of Andrographiles. Andrographiles are active compounds present in the aerial parts of the plant and has treatment for cold, hypertension, diabetes, cancer, malaria and snake bite [2]. It acts as anticancer [3], anti-diarrheal [4] anti HIV [5], anti hyperglycaemic [6], anti-hepatitis [7], anti-inflammatory [8], antimicrobial [9], antimalarial [10], antioxidant [11], cytotoxic [12], cardiovascular [13], Hepatoprotective [14], sexual dysfunctions [15], immunostimulatory [16].

*Andrographis paniculata* has various pharmacological effects and used as medicinal herb for treating upper gastrointestinal tract, upper respiratory infections, herpes and other chronic diseases [17].

Scientific research continues to explore the potential benefits, safety and mechanisms of action of various medicinal plants, integrating traditional knowledge with modern evidence-based medicine [18]. Phytochemicals provide many potential benefits to human health when introduced into our diet. Consuming a wide variety of plant-based foods such as fruits, vegetables, whole grains, legumes, nuts, and seeds can provide a broad spectrum of phytochemicals that help maintain a balanced diet.

Plants act as anti-microbial compounds due to the presence of secondary metabolites [19]. To overcome the microbial infection problems agents like anti-microbial and resistance towards the infection were used. Anti-microbial activity is a method that prevents the growth of the disease causing microbes. There are different types of anti-microbial agents which play important role in suppression of infections such as anti-fungal, anti-bacterial and anti-viral. Many medicinal plants have been identified as natural anti-microbial compounds for the treatment of bacterial infections [20].

The main purpose of this study is phytochemical screening of leaf, stem and root parts of explant and antibacterial activity of leaf, stem and root butanolic extracts of *Andrographis paniculata*.

## MATERIAL METHODS

### Collection of Plant material

Fresh leaves, stems and roots of *A. paniculata* plants growing in the medicinal harbour of Department of Biotechnology, Kakatiya University, India were collected for experimental purpose. The plant material was thoroughly washed with running tap water to remove dirt and soil and cut the plant into three parts i.e., roots, stem and leaves.

### Preparation of plant extracts

Preliminary phytochemical screening was performed by using cold maceration technique. The powders were extracted with 30ml of butanol, ethanol, methanol, chloroform and aqueous separately. Add 30ml of each solvent to each conical flask containing 3g of shade dried powder in it, next cover with aluminium foil and kept in orbital shaker for 48hrs at 120rpm of 22 °C for 48hrs. The extracts were filtered using whatman filter paper and stored at 4 °C for further biological application. The presence or absence of secondary metabolites in these extracted samples was determined by phytochemical screening protocols [21].

### Microbial culture and culture conditions

The butanolic leaf, stem and root extract of *A. paniculata* were screened against gram-positive and gram-negative strains. The test organisms were *Escherichia coli*, *Proteus vulgaris*, *Bacillus sphaericus* and *Bacillus subtilis* strains were obtained from Microbiology lab, Department of Biotechnology, Kakatiya University, Warangal. The 24hrs old bacterial strains were prepared by inoculating a loopful of original cultures in nutrients broth and incubate overnight at 37°C. These cultures were maintained at Muller Hinton Agar (MHA) plates at 4 °C for further use.

Agar well diffusion method was performed for screening of antibacterial activity and the antibiotic *streptomycin* (10 µg/ml) was used as standard. The media was prepare and poured at a rate of 15ml each in a petri dish and allowing for solidification for about 5min. A loopful of inoculums was swabbed uniformly onto the media and left them drying. The different concentration of leaf, stem, root extract of (20 µg/ml, 40 µg/ml, 60 µg/ml and 80 µg/ml) and standard (10 µg/ml) was loaded into each well and allowed diffusion of extract. Plates are incubated overnight at 37 °C zone appeared after incubation period and the percent of incubation was determined in millimetres using scale.

### Preliminary phytochemical screening

The presence or absence of phytochemical compounds can be determined by performing certain qualitative tests.

#### Test for alkaloids

##### Mayers test

Few drops of reagent were added to each 1ml of plant extract (leaf, stem, and root). It is dissolved indifferent solvents and it results in the formation of pale or cream coloured precipitate which indicates the presence of alkaloids.



**Figure 1:** Represents parts of *Andrographis paniculata*. (a). Leaves (b). Leaves powder (c). Leaves extract (d) Stem (e). Stem powder (f). Stem extract (g). Root (h). Root powder (i). Root extract.

#### Hagers test

Few drops of Hagers reagent was added to 0.5ml of each plant extract (leaf, stem and root). It is dissolved in different solvents and it results in the formation of yellow colour precipitate indicates the presence of alkaloids.

#### Tannic acid test

Few drops of 10% tannic acid was added to 0.5ml of each plant extract (leaf, stem and root). It is dissolved in different solvents and it results in the formation of buff colour precipitate indicates the presence of alkaloids.

#### Test for flavonoids

##### Alkaline reagent test

1ml of each plant extract (leaf, stem and root) which is dissolved in different solvents and also treated with few drops of NaOH solution, and it results in the formation of yellow colour precipitate and it disappears on addition of dilute acid indicates the presence of flavonoids.

##### Ferric chloride (FeCl<sub>3</sub>) test

Few drops of FeCl<sub>3</sub> was added to the plant extract (leaf, stem, root). It shows black colour precipitate indicates the presence of flavonoids.

#### Test for glycosides

##### Molisch test

1ml of each plant extract (leaf, stem, root) dissolved in different solvents and treated with a few drops of  $\alpha$ - naphthol alcohol and 2ml of concentrated H<sub>2</sub>SO<sub>4</sub> along the walls of the tube. If brown ring appears it indicates the presence of carbohydrates.

##### Conc. H<sub>2</sub>SO<sub>4</sub> test

1ml of con.H<sub>2</sub>SO<sub>4</sub> is added to 1ml of test solution and allows it to stand for 2minutes. Red colour precipitate indicates the presence of glycosides.

**Test for saponins**

**Foam test**

Few drops of each plant extract (leaf, stem, and root) dissolved in different solvents and diluted with distilled water to up to 25 ml and mixed thoroughly for 10 minutes after that it shows a layer of foam which indicates the presence of saponins in the extract.

**Test for phenols**

**FeCl<sub>3</sub> test**

In 2 ml of each plant extract add a few drops of FeCl<sub>3</sub> and its shows blue colour which indicates the presence of phenols.

**Ellagic acid test**

In 3 ml of each plant extract (leaf, stem and root) add few drops of 5% (W/V) of sodium nitrate solution and it shows niger brown precipitate which indicates the presence of phenols in the plant extract.

**Test for tannins**

**FeCl<sub>3</sub> test**

In 2 ml of plant extract (leaf, stem, root) add few drops of FeCl<sub>3</sub> which shows a blue or green colour precipitate indicates the presence of tannin.

**Gelatine test**

In 1 ml of each plant extract (leaf, stem, root) add few drops of 1% gelatine solution in 10% NaCl were added. It forms a white precipitate which indicates the presence of tannins.

**Alkaline reagent test**

In 1 ml of each plant extract (leaf, stem, root) add few drops of NaOH solution, which forms yellow or red colour precipitate indicates the presence of tannins.

**Test for steroids/tri-terpenoids**

**Salkowski test**

In 1 ml of each plant extract (leaf, stem, root) add few drops of conc. H<sub>2</sub>SO<sub>4</sub> which forms lower red colour indicates the presence of steroids whereas, yellow colour indicates the presence of tri-terpenoids.

**Test for quinones**

**Alcoholic KOH test**

In 1ml of each plant extract (leaf, stem, root) add few drops of KOH solution. If colour changes from red to blue indicates the presence of quinones.

**RESULTS**

The preliminary screening of phytochemicals in leaf, stem and roots extracts of *A. Paniculata* showed the abundant presence of glycosides, moderate amount of tannins andalkaloids and followed by flavonoids, quinones, phenols, terpenoids and saponins (Table 1).

**Table 1:** Preliminary screening of Phytochemicals from leaf, stem and root powder extract of *A. Paniculata*

Part of the plant	Phytochemical component	Methanol extract	Butanol extract	Chloroform extract	Ethanol extract	Aqueous extract
Leaf	Alkaloids	+	++	++	-	+
	Flavonoids	+	++	+	-	+
	Glycosides	++	++	++	++	++
	Phenols	+	+	-	+	-
	Tannins	+	++	+	++	++
	Steroids/triterpenoids	+	-	-	+	-
	Quinones	-	-	++	-	++
	saponins					+
Stem	Alkaloids	+	++	++	++	+
	Flavonoids	+	+	+	+	++
	Glycosides	++	++	++	++	++
	Phenols	-	+	-	-	-
	Tannins	+	++	++	++	++
	Steroids/triterpenoids	++	++	-	+	+
	Quinones	+	-	+	-	-
	saponins					+
Root	Alkaloids	+	++	++	+	+
	Flavonoids	+	+	+	+	++
	Glycosides	++	++	+	+	++

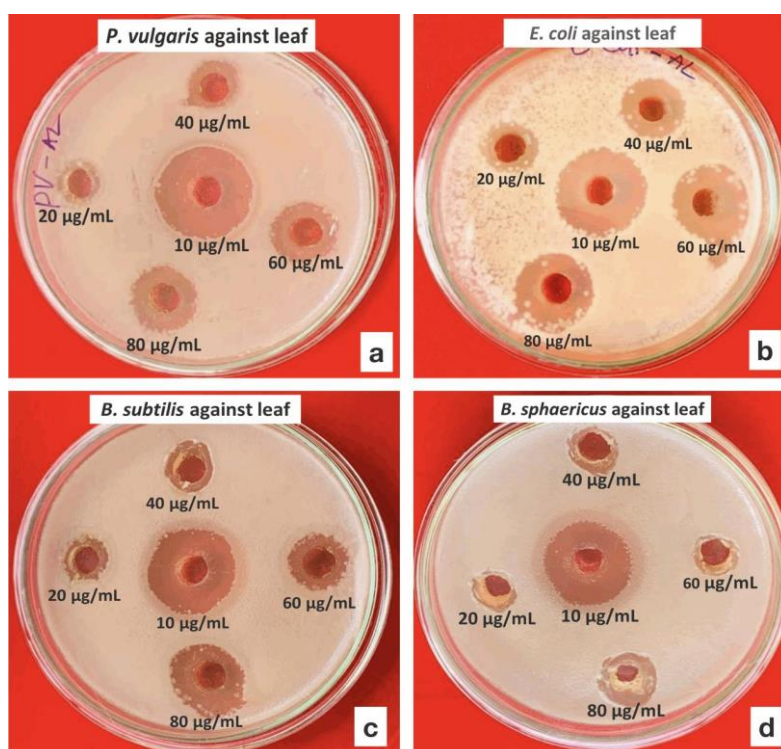
Phenols	-	+	-	+	-
Tannins	++	++	++	++	++
Steroids/triterpenoids	++	++	-	+	+
Quinones	+	-	+	+	-
saponins					-

### Antibacterial activity

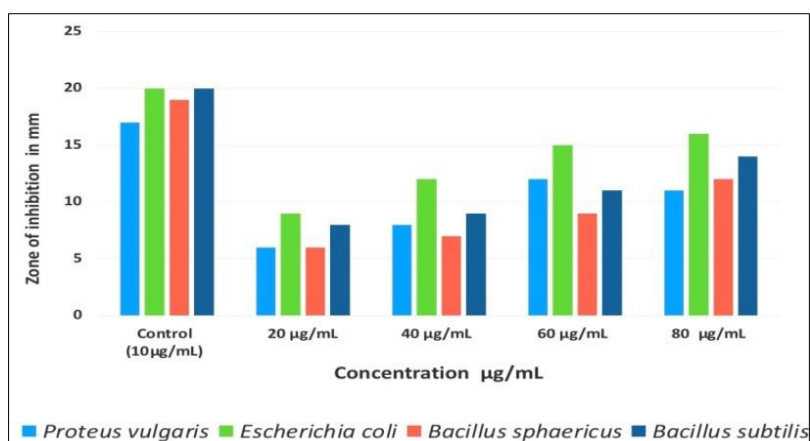
The anti-bacterial activity of leaf, stem and root butanolic extract of *A. paniculata* evaluated against gram-positive (*Bacillus subtilis* and *Bacillus sphaericus*) and gram-negative (*Escherichia coli* and *Proteus vulgaris*) bacteria by measuring the zone of inhibition (fig 2, 3, 4 and 5).

### Anti-bacterial activity for leaf butanolic extract

The anti-bacterial activity of leaf butanolic extract (20 µg/ml, 40 µg/ml, 60 µg/ml and 80 µg/ml) and the control streptomycin (10 µg/ml) was evaluated (fig 2 and graph 1). The butanolic leaf extract showed maximum zone of inhibition at 80 µg/ml when compare to other concentrations. As the plant concentration increase, zone of inhibition also increase. The maximum anti-bacterial activity has showed against of *E. coli* at (80 µg/ml) concentration (fig 2 and graph 1).



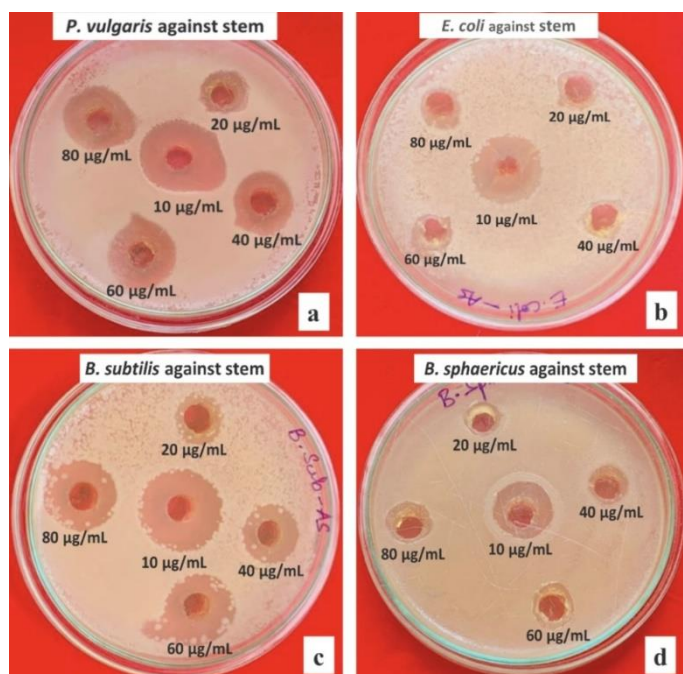
**Figure 2:** Antibacterial activity of butanolic leaf extracts against different bacterial strains (a). Zone of inhibition against *P. vulgaris* (b). Zone of inhibition against *E. coli* (c). Zone of inhibition against *B. subtilis* (d). Zone of inhibition against *B. sphaericus*



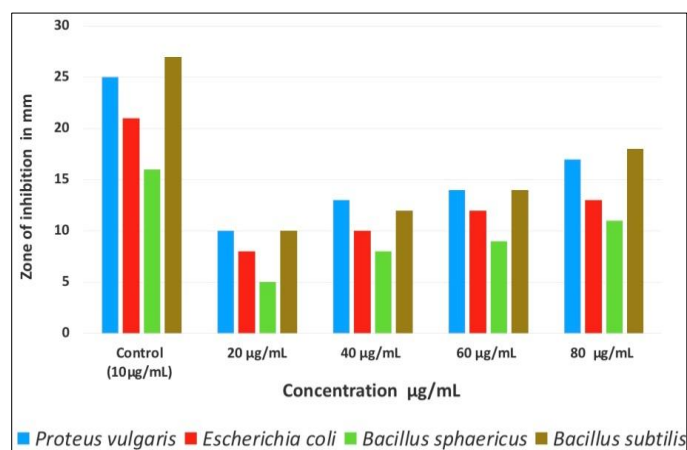
**Graph 1:** Zone of inhibition for butanolic leaf extract of *A. paniculata*.

### Anti-bacterial activity for butanolic stem extract

Anti-bacterial activity of stem butanolic extract (20 µg/ml, 40 µg/ml, 60 µg/ml and 80 µg/ml) and control streptomycin (10 µg/ml) was evaluated. It is similar to leaf extract were maximum zone of inhibition showed at 80 µg/ml comparing to other concentration. Stem butanolic extract has showed maximum antimicrobial activity by *B. subtilis* (80 µg/ml) concentration (fig 3 and graph 2).



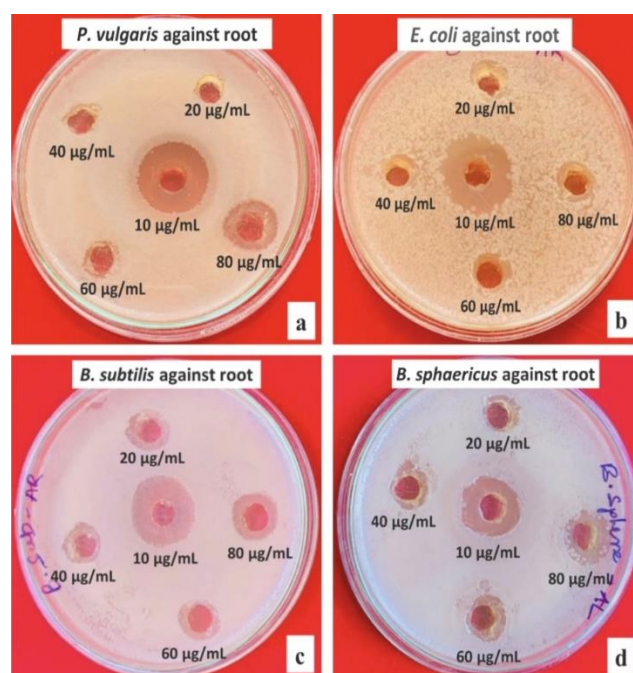
**Figure 3:** Antibacterial activity of butanolic stem extracts against different bacterial strains (a). Zone of inhibition against *P. vulgaris* (b). Zone of inhibition against *E. coli* (c). Zone of inhibition against *B. subtilis* (d). Zone of inhibition against *B. sphaericus*



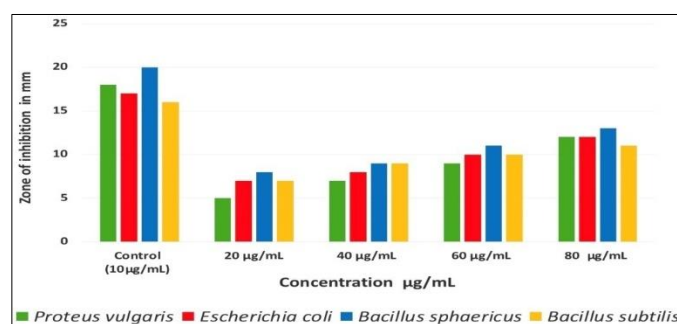
**Graph 2:** Zone of inhibition for butanolic stem extracts of *A. paniculata*

### Anti-bacterial activity for butanolic root extract

Anti-bacterial activity of root butanolic extract (20 µg/ml, 40 µg/ml, 60 µg/ml and 80 µg/ml) and control streptomycin (10 µg/ml) was evaluated. It is similar to leaf and stem extract were maximum zone of inhibition showed at 80 µg/ml comparing to other concentration. Root butanolic extract showed maximum antimicrobial activity by *B. sphaericus* (80 µg/ml) concentration (fig 4 and graph 3).



**Figure 4:** Antibacterial activity of butanolic root extracts against different bacterial strains (a). Zone of inhibition against *P. vulgaris* (b). Zone of inhibition against *E. coli* (c). Zone of inhibition against *B. subtilis* (d). Zone of inhibition against *B. sphaericus*



**Graph 3:** Zone of inhibition for butanolic root extracts of *A. paniculata*

### DISCUSSION

Phytochemical analysis of *A. paniculata* leaf, stem and root extract were conducted using different solvents such as butanol, methanol, ethanol, chloroform and aqueous extract. This phytochemical analysis resulted in the presence of alkaloids, flavonoids, terpenoids, glycosides, phenols, saponins, tannins, quinones. The analysis shows that glycosides are abundant in butanolic extract (Table 1). The highest anti-bacterial for leaf butanolic extract showed against *E. coli* at 80 µg/ml concentration, followed by *B. subtilis*, *B. sphaericus* and *P. vulgaris* (fig 2 and graph 1) and similar findings were reported in leaf extracts of *Baekkea frutescens*<sup>[22]</sup>. Our results coincided with results reported by shakil ahmed<sup>[23]</sup> in leaf extracts of *A. paniculata* which showed more presence of glycosides and phenols in aqueous and ethanol extracts.

Analysis revealed that the butanolic extract of the stem contained more glycosides showing similarities with the results reported by Shakil Ahmed<sup>[23]</sup> glycosides, flavonoids and saponins were abundant in aqueous and ethanol. Stem butanolic extract showed maximum antimicrobial activity against *B. subtilis* at 80µg/ml concentration, followed by *P. vulgaris*, *E. coli* and *B. sphaericus* and similar work

reported in stem extracts of *Nerium indicum* *Solanum khasianum* and *Hibiscus rosasinensis* [24, 25].

The analysis reveals that butanolic extract of root contains more tannins and less amount of phenols and saponins coordinated with results reported by Senguttavan [26], shows abundant amount of glycosides, phenols, steroids, tannins, terpenoids in root methanolic extracts of *Hypochaeris radicata*. The maximum zone of inhibition for root butanolic extract showed against *B. sphaericus* at 80 µg/ml concentration, followed by *P. vulgaris*, *E. coli* and *B. subtilis* and similar findings reported in root extract of *Berberis vulgaris* [27].

## CONCLUSION

The preliminary phytochemical screening of different parts of the plant such as leaf, stem and root of *A. paniculata* showed the various phytochemical compounds present in it. In qualitative analysis we examined presence of various phytochemical compounds such as alkaloids, flavonoids, glycosides, phenols, terpenoids, quinones, saponins and tannins. The current study showed that various butanolic plant extracts of leaf, stem and root derived from *A. paniculata* had strong antibacterial activity against gram-positive and gram-negative bacteria. These discoveries were also useful in evaluating suggestions made on the use of these plants medicinal properties to treat a variety of illnesses and in leading to the development of new medications.

## Consent for publication

All the authors read and agreed that the manuscript be published in its present form.

## Availability of data and material

Data and materials related to the present work will be made available on request by the corresponding author

## Competing interests

Authors declare that there is no conflict of interest of any kind.

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## REFERENCES

1. Wijesekera RO. Plant-derived medicines and their role in global health. In the medicinal plant Industry 2017 Jul 12 (pp. 1-18). Routledge.
2. Perry LM, Metzger J. Medicinal plants of east and southeast Asia: attributed properties and uses. MIT press; 1980
3. Kumar RA, Sridevi K, Kumar NV, Nanduri S, Rajagopal S. Anticancer and immunostimulatory compounds from *Andrographis paniculata*. Journal of ethnopharmacology. 2004 Jun 1;92(2-3):291-5.
4. Kumar RA, Sridevi K, Kumar NV, Nanduri S, Rajagopal S. Anticancer and immunostimulatory compounds from *Andrographis paniculata*. Journal of ethnopharmacology. 2004 Jun 1;92(2-3):291-5.
5. Jadhav AK, Karuppaiyl SM. *Andrographis paniculata* (Burm. F) Wall ex Nees: antiviral properties. Phytotherapy Research. 2021 Oct;35(10):5365-73.
6. Subramanian R, Asmawi MZ, Sadikun A. In vitro  $\alpha$ -glucosidase and  $\alpha$ -amylase enzyme inhibitory effects of *Andrographis paniculata* extract and andrographolide. Acta Biochimica Polonica. 2008 May 29;55(2):391-8.
7. Kumar S, Singh B, Bajpai V. *Andrographis paniculata* (Burm. f.) Nees: Traditional uses, phytochemistry, pharmacological properties and quality control/quality assurance. Journal of Ethnopharmacology. 2021 Jul 15;275:114054.
8. Ji LL, Wang Z, Dong F, Zhang WB, Wang ZT. Andrograpanin, a compound isolated from anti-inflammatory traditional Chinese medicine *Andrographis paniculata*, enhances chemokine SDF-1 $\alpha$ -induced leukocytes chemotaxis. Journal of cellular biochemistry. 2005 Aug 1;95(5):970-8.
9. Hossain S, Urbi Z, Karuniawati H, Mohiuddin RB, MohQrimida A, Allzrag AM, Ming LC, Pagano E, Capasso R. *Andrographis paniculata* (burm. F.) wall. Ex nees: an updated review of phytochemistry, antimicrobial pharmacology, and clinical safety and efficacy. Life. 2021 Apr 16;11(4):348.
10. Hassan WR, Basir R, Ali AH, Embi N, Sidek HM. Anti-malarial and cytokine-modulating effects of andrographolide in a murine model of malarial infection. Trop. Biomed. 2019 Sep 1;36(3):776-91.
11. Lin FL, Wu SJ, Lee SC, Ng LT. Antioxidant, antioedema and analgesic activities of *Andrographis paniculata* extracts and their active constituent andrographolide. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives. 2009 Jul;23(7):958-64.
12. Sharifuddin Y, Parry EM, Parry JM. The genotoxicity and cytotoxicity assessments of andrographolide in vitro. Food and chemical toxicology. 2012 May 1;50(5):1393-8.
13. Yoopan N, Thisoda P, Rangkadilok N, Sahasitawat S, Pholphana N, Ruchirawat S, Satayavivad J. Cardiovascular effects of 14-deoxy-11, 12-didehydroandrographolide and *Andrographis paniculata* extracts. Planta medica. 2007 Jun;73(06):503-11.
14. Chua LS. Review on liver inflammation and antiinflammatory activity of *Andrographis paniculata* for hepatoprotection. Phytotherapy Research. 2014 Nov;28(11):1589-98.
15. Hossain MS, Urbi Z, Sule A, Rahman KM. *Andrographis paniculata* (Burm. f.) Wall. ex Nees: a review of ethnobotany, phytochemistry, and pharmacology. The Scientific World Journal. 2014 Oct;2014.
16. Jantan I, Ahmad W, Bukhari SN. Plant-derived immunomodulators: an insight on their preclinical evaluation and clinical trials. Frontiers in plant science. 2015 Aug 25;6:655.
17. Nyeem MA, Mannan MA, Nuruzzaman M, Kamrujjaman KM, Das SK. Indigenous king of bitter (*Andrographis paniculata*): A review. Journal of Medicinal Plants Studies. 2017;5(2):318-24.
18. Vankudoth Suvarchala1, Chirumamilla Pavani2, Dharavath Sunitha Bai1 and Taduri Shasthree. Qualitative and Quantitative Determination of Phytochemical Contents of *Muntingia calabura*. Research Journal of Chemistry and Environment 2022 May 26 (5): 8-15.
19. Keita K, Darkoh C, Okafor F. Secondary plant metabolites as potent drug candidates against antimicrobial-resistant pathogens. SN Applied Sciences. 2022 Aug;4(8):209.

20. Iwu MW, Duncan AR, Okunji CO. New antimicrobials of plant origin. Perspectives on new crops and new uses. ASHS Press, Alexandria, VA. 1999;457:462.
21. Ramakrishna D, Suvarchala V, Chaitanya G, Shasthree T. Preliminary phytochemical screening of a medicinally important cucurbit *Citrulluscolocynthis* (L.) Schard. Res J Chem Environ. 2019 Nov;23(11):41-55.
22. Razmavar S, Abdulla MA, Ismail SB, Hassandarvish P. Antibacterial activity of leaf extracts of *Baeckeafrutescens* against methicillin-resistant *Staphylococcus aureus*. BioMed research international. 2014 Jan 1;2014.
23. Polash SA, Saha T, Hossain MS, Sarker SR. Investigation of the phytochemicals, antioxidant, and antimicrobial activity of the *Andrographis paniculata* leaf and stem extracts. Advances in Bioscience and Biotechnology. 2017;8(05):149-62.
24. Naqvi BS, Shaikh MR, Maleka FA, Shaikh D. Studies of antibacterial activity of ethanolic extracts from *Nericumindicum* and *Habiscusrosasinensis*. Journal of Islamic Academy of Sciences. 1994;7(3):167-8.. Journal of Islamic Academy of Sciences. 1994;7(3):167-8.
25. Pavani CH, Shasthree T. Qualitative screening and Quantitative determination of secondary metabolites from different plant extracts of *Solanum khasianum* Clarke. Research Journal of Chemistry and Environment. 2022;26 (12) December:113-123.
26. Senguttuvan J, Paulsamy S, Karthika K. Phytochemical analysis and evaluation of leaf and root parts of the medicinal herb, *Hypochoerisradicata* L. for in vitro antioxidant activities. Asian Pacific journal of tropical biomedicine. 2014 May 1;4:S359-67.
27. El-Zahar KM, Al-Jamaan ME, Al-Mutairi FR, Al-Hudiab AM, Al-Einzi MS, Mohamed AA. Antioxidant, antibacterial, and antifungal activities of the ethanolic extract obtained from *Berberis vulgaris* roots and leaves. Molecules. 2022 Sep 19;27(18):6114

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