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Pharmacological and Anti-bacterial Activities of the leaves of *Andrographis paniculata* Nees.

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Abstract

Andrographis paniculata Nees is well known as king of bitters and has wide range of medicinal pharmacological application. It contains several secondary metabolites products such as flavonoids, tannins, phenolic compounds, saponins, terpenoids with wide range of therapeutic applications. The plant has been reported to have hepatoprotective, anti-inflammatory, antibacterial, antimicrobial, antifungal, anti-HIV, anti-parasitic, antioxidant, anti-tuberculosis and anti-cancer properties. An attempt was made to analyze the antimicrobial activity of *Andrographis paniculata* Nees leaf extracts against bacterial strain viz., *Escherichia coli*, *Staphylococcus aureus* & *Salmonella typhimurium*. Antimicrobial study was carried out by Agar well diffusion method against the bacteria by using methanolic extracts of *Andrographis paniculata* Nees.

Keywords: Pharmacological activity, Flavonoids, antibacterial, Agar well diffusion method.

1. Introduction

Andrographis paniculata Nees play an significant role in the field of ethnomedicine. It has been extensively used as medicinal herb for many years in several traditional systems of medicine to cure the wide spectrum of health ailments all over the world [1]. It is widely used in Ayurveda, Unani and Siddha medicines as home remedy for various diseases in Indian traditional system. *Andrographis paniculata* Nees having great therapeutic value due to its mechanism of action by enzyme induction [2]. It is an important herb which is generally used in fevers and to remove toxins from the body. They are having “blood purifying” property which is used in diseases where blood “abnormalities” are deliberate cause of disease [3]. The various part of plant like leaf, root, stem & flower is widely used ethno medicinally which contains a large number of phytoconstituents like flavonoids, terpenoids, tannins, saponins, alkaloids and phenolic compounds. The secondary metabolites of this plants are much of interest because of their antimicrobial, antibiotic, insecticidal and hormonal properties. *Andrographis paniculata* Nees has been reported as antibacterial, antifungal, antiviral, choleric, hypoglycemic, hypocholesterolemic, and adaptogenic agents. In the Unani system of medicine, it is considered anti-inflammatory, astringent, diuretic, gastric and liver tonic, carminative, antihelminthic, and antipyretic [4]. Due to its “blood purifying” activity it is recommended for use in cases of leprosy, gonorrhea, scabies, boils, skin eruptions, and chronic and seasonal fevers. Currently, modern research has investigated it for activity against various bacteria, viruses, and parasites. The pharmacological and therapeutic efficacy of *Andrographis paniculata* Nees is well considered in the field of ethno medicine to treat various diseases to all over the world. It is used for the prevention and treatment of the common cold. It appears to have antithrombotic actions, suggesting a possible benefit in cardiovascular disease. Pharmacological and clinical studies suggest the potential for beneficial effects in diseases like cancer and HIV infections. Therefore; the present study was carried out to investigate the pharmacological, phytoconstituents and antibacterial activity of *Andrographis paniculata* Nees against *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhimurium*.

2. Materials and Methods

Collection of Plant Material

The fresh leaves of *Andrographis paniculata* Nees plants were collected from Department of Dravyaguna, Faculty of Ayurveda, I.M.S. Banaras Hindu University, Varanasi, India. The leaves were washed thoroughly 2-3 times with running tap water, then air dried and preserved in air tight containers.

Soxhlet Extraction

The leaves of *Andrographis paniculata* Nees plants were shade dried and pulverized. 250 g of powdered material was packed in Soxhlet apparatus and subjected to continuous percolation for 8 h using 450 ml, methanol as solvent. The methanol extract was concentrated under vacuum and dried in desiccators and then submitted to lyophilization in order to remove the solvent completely to produce powdered form of extracts. Lyophilization removes the water and stabilizes the extract so that it can retain satisfactory pharmacological activity during long term storage. The weight of the dried mass is recorded and used for experimental studies. The yield was 5.9% with respect to dry starting material with characteristic odour and greasy consistency.

Phytochemical Analysis

The phytochemical screening of the leaf extract of *Andrographis paniculata* Nees was done quantitatively and qualitatively to reveal the presence of phytoconstituents like secondary metabolites such as flavonoids, terpenoids, alkaloid, tannins, saponins and phenolic compound according to phytochemical methods accounted by Harborne (1973), Evans (2002), and Sofowora (1993).

Antimicrobial Activity

The methanolic leaf extracts of *Andrographis paniculata* Nees were tested by Agar well diffusion method. Different concentration of the *Andrographis paniculata* Nees crude extracts AP30 (0.03gm/ml), AP60 (0.06gm/ml), AP120 (0.12gm/ml) was prepared in Double distilled water. Petri plates were prepared by pouring 50 ml of nutrient medium for bacteria. The surfaces of media were inoculated with bacteria from a broth culture. A sterile cotton swab is dipped into a standardized bacterial test suspension and used to evenly inoculate the entire surface of the Nutrient Agar plate. After solidification well (5 mm in diameter) created on petriplate and the crude extracts AP30 (0.03gm/ml of DDW), AP60 (0.06gm/ml of DDW), AP120 (0.12gm/ml of DDW) were placed on test organism-seeded plates. Streptomycin and tetracycline were used as positive control. The antibacterial assay plates were incubated at 37 °C for 24h. The diameter of the inhibition zones were measured in millimeters (mm).

3. Results

Pharmacological activity of the leaves of *Andrographis paniculata* Nees.

Qualitative and Quantitative analysis of the phytochemicals in the leaves of *Andrographis paniculata* Nees

Qualitative and Quantitative analysis of the leaves of *Andrographis paniculata* Nees revealed the presence of

Steroids, Phenols, Saponins, Tannins, Flavonoids, Terpenes and Diterpene lactones. Quantitative estimation of bioactive constituents are summarized in (Table.1). The presence of these phytochemicals in the leaves of *Andrographis paniculata* Nees makes it medically and therapeutically important.

Table 1: Qualitative and Quantitative analysis of the phytochemicals from the leaves of *Andrographis paniculata* Nees.

Bioactive constituents	Presence/Absence	Quantity in gram%(w/w)
Carbohydrate	++	0.26±0.12
Alkaloids	++	1.14±0.17
Saponins	++	2.23±0.89
Tannins	++	1.07±0.11
Flavonoids	+++	1.19±0.18
Phenols	++	1.27±0.20
Terpenoids	++	1.31±0.14

Antimicrobial Activity of the leaves of *Andrographis paniculata*

In our results the antimicrobial activity of the methanolic plant extract of *Andrographis paniculata* Nees (leaf extract). At the dose of AP30 is creating maximum zone of inhibition against the gram negative bacteria (*Escherichia coli* & *Salmonella typhimurium*) and create minimum zone of inhibition against gram positive bacteria (*Staphylococcus aureus*). Then we see that the AP30 is most affected on the *E.coli* and *S. typhi* and less affected on the *staphylococcus aureus*. At the dose of AP60 is creating maximum zone of inhibition against the gram negative bacteria (*S. typhi* & *E.coli*) and create minimum zone of inhibition against the gram positive bacteria (*S. aureus*) [Figure 1 & 2]. Then we see that at the dose of AP60 is most affected on *E.coli* and *S. typhi* and less affected on *S. aureus*. At the dose of AP120 is creating maximum zone of inhibition against the gram negative bacteria (*Salmonella typhimurium*) and create

Table 2: Antimicrobial activity of leaves of *Andrographis paniculata* Nees against *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhimurium* using streptomycin as a positive control

Group	Zone of inhibition* (in mm)		
	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>	<i>Salmonella typhimurium</i>
Control	00±00	00±00	00±00
Streptomycin	19.1±0.82	20.3±0.81	22.1±0.76
AP30	11.7±0.76	11.9±0.79	13.2±0.72
AP60	15.6±0.71	14.3±0.73	17.1±0.77
AP120	16.9±0.69	17.5±0.83	18.5±0.86

minimum and less zone of inhibition against the gram positive bacteria (*Staphylococcus aureus*) [Table 2 & 3].

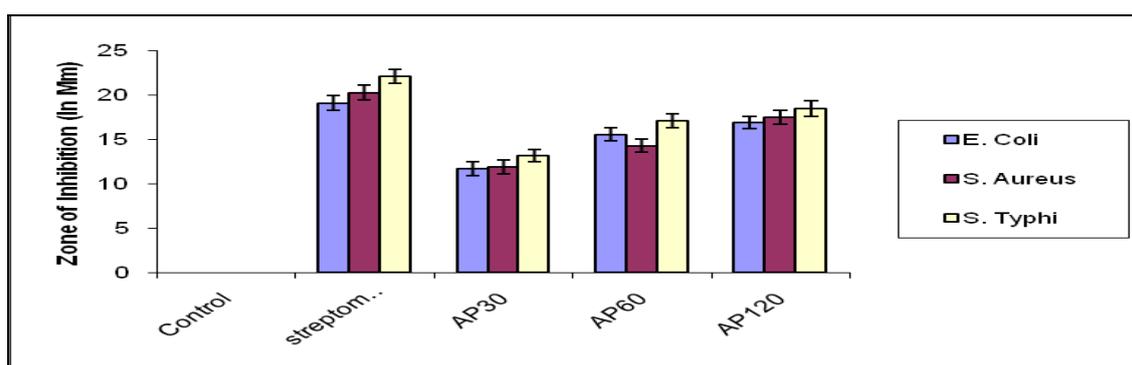
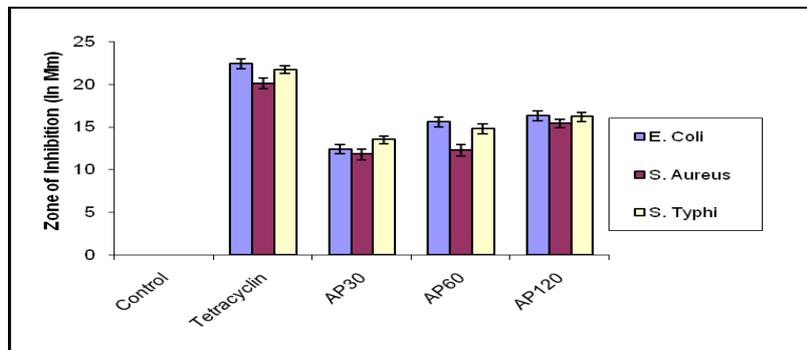


Fig 1: Antimicrobial activity of methanolic extract of leaves of *Andrographis paniculata* Nees with antibiotic streptomycin as positive control.

Table 3: Antimicrobial activity of leaves of *Andrographis paniculata* Nees against *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhimurium*, using Tetracycline as a positive control.

Group	Zone of inhibition* (in mm)		
	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>	<i>Salmonella typhimurium</i>
Control	00±00	00±00	00±00
Tetracycline	22.4±0.56	20.1±0.64	21.7±0.44
AP30	12.4±0.52	11.8±0.63	13.5±0.45
AP60	15.6±0.57	12.3±0.66	14.8±0.56
AP120	16.3±0.59	15.4±0.53	16.2±0.54

**Fig 2:** Antimicrobial activity of methanolic extract of leaves of *Andrographis paniculata* Nees with antibiotic tetracycline as positive control.

4. Discussion

Currently, there has been considerable interest in the use of plant material as an alternative method to control pathogenic microorganism [5] and many components of plants products have been shown to be specially targeted against resistant pathogenic bacteria [6]. Therefore attempts must be directed towards the development of effective natural, non-toxic drug for treatment. Many reports are available on the antiviral, antibacterial antifungal, anthelmintic, antimolluscal and antiinflammatory properties of plants [7]. The methanolic leaf extract of *Andrographis paniculata* Nees showed the activity against all the tested bacteria. The plant based products have been effectively proven for their utilization as source for antimicrobial compounds. The methanolic extracts of medicinal plants were significantly active against *Staphylococcus species* [8]. Thus, the significant activity against *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhimurium* may be due to their phytoconstituents or secondary metabolites like alkaloids, carbohydrates, saponins, phenolic compounds, flavonoids). They have been found to possess a wide range of activities, which may help in protection against chronic diseases. The present study was carried out to investigate the pharmacological phytoconstituents and the antibacterial activity of *Andrographis paniculata* Nees against *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhimurium*.

5. Conclusion

The leaf extract of *Andrographis paniculata* Nees have great potential as antimicrobial compounds against bacteria. *Andrographis paniculata* Nees contains large number of secondary metabolites like flavonoids, terpenoids, alkaloids, tannins and phenolic compound with antibacterial activities and thus are sources of natural bioactive molecules to control pathogens that cause disease in humans. Based on the results we concluded that methanolic extract of the leaves of *Andrographis paniculata* Nees were exhibited pharmacological phytoconstituents and antimicrobial property. Thus, they can be used in the treatment of infectious

diseases caused by the different microbes.

6. Acknowledgement

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