

Phytochemical analysis and medicinal value of Kalmegh (*Andrographis paniculata* Nees)

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Abstract

Andrographis paniculata Nees is an herbaceous plant which is commonly known as “King of Bitters” and belongs to the family Acanthaceae. The plant is commonly used by the local people for the treatment of common cold, liver disorders and some skin diseases. The aerial parts of the plant were screened for their phytochemical properties. Result of the phytochemical screening showed that it is a store house of phytochemicals such as Alkaloid, tannins, flavonoids, steroids, terpendoids, protein, Sugar, Gum, quinones which have bioactive properties. Among the compounds present in the plant, the main ingredient is andrographolide which has antioxidant activity and also effective in many human diseases.

Medicinal plants are important sources for the treatment of various diseases in Ayurvedic system of medicine. Ayurvedic medicines are usually adopted to an Individual constitution. Ayurvedic, Indian and traditional Chinese system have great traditions and play important roles in Bioprospecting of new medicines from medicinal plants. Ayurveda is one of the most ancient repository for the alleviation of various ailments and it is widely practised in India.

The application of medicinal plants specially in traditional medicine is currently well acknowledged and established as a viable profession. *Andrographis paniculata* Nees is a traditional medicinal annual herb, widely distributed in Madhya Pradesh, India and is known as *Kalmegh*. This plant is the richest source of Bioactive constituents. Its phyto

extract can protect human against a number of diseases. It is an erect plant which grows mainly as under shrub in tropical moist deciduous forests. It is one of the most widely used plant in Ayurvedic formulations and homoeopathic system of medicine. It is mostly used for the treatment of fever, and has antimalarial activity^{3,7}, breathing problem, skin disorders, ulcers and worms and also in liver disorders and diabetes as it has been reported to have hypoglycaemic effect as it induces the release of insulin from the pancreas¹⁶. The medicinal value of this plant is due to the presence of active ingredients viz Andrographolide and Neo andrographolide which are derivatives of diterpenoids.⁵ They are known to show medicinal activity as well as exhibit physiological properties. Various phytochemical compounds detected are known

to have beneficial effects in the treatment of a number of health disorders.

Phytoconstituents :

Andrographis paniculata contains diterpenes, loctones and flavonoids present mostly in the root but have also been found in the leaves. The aerial parts contain alkenes, ketones and aldehydes.

The bitter principles in the leaves are due to the presence of andrographolide named Kalmegin, dioxyandrographolide, neoandrographolide and dihydroandrographolide isolated from the aerial parts. The leaves and stems are rich in flavonoids, gums, mucilages and tannins¹⁸. The medicinal value depends on the presence of chemical substance and their role in human body. The popular hepatoprotective Indian herbal drug *Kalmegh (Andrographis paniculata)* can be standardized by high pressure chromatographic determination of its major active constituents. The leaves of the herb were found to contain the highest amount (2.39% w/w) of Andrographolide and the seed to contain the lowest.



Fig. 1. *Andrographis paniculata* plant

1. Plant sampling and preparation : Fresh leaves of *Andrographis paniculata* were obtained from different parts of Vindhya region of Madhya Pradesh. They were identified according to the description in literature and were further authenticated using herbarium.

2. Plant material : *Andrographis paniculata* leaves were collected in the month of January, 2017 and washed 3-4 times with distilled water and dried in an oven at 50°C, ground and stored in air tight polythene bag.

3. Extraction procedures : Dried leaves (200 g) powder was subjected to extraction with 200ml methanol for 48 hours. The methanol extract was collected, filtered and concentrated in vacuums under reduced pressure and dried in a desiccator and stored for further analysis. The concentrated methanol extract was further subjected to phytochemical screening.

4. Phytochemical Testing : Phytochemical screening was carried out using standard method to detect the bioactive compounds. (Dhananjay *et. al.*, 2015).

- **Test for flavonoids-** To the test substance in alcohol, a small amount of Magnesium and a few drops of conc. HCl were added and boiled for 5-8 minutes, a red colour shows the presence of flavonoids.
- **Test for tannins -** Test substance mixed with boric lead acetate solution a white colorization shows the presence of tannin.
- **Test for Triterpenoids-** Test substance with tin and Thionyl chloride were added and boiled red colorization indicates the presence of triterpenoids.
- **Test for Steroids -** One gram substance was dissolved in a few drops of acetic acid and acetic aldehyde, warmed and cooled under the tap water and a drop of sulfuric acid was added along the sides

of the test tube, presence of green colour shows the positive test for steroids.

- **Test for Alkaloids** -Substance was added with few drops of 2NHCl and two drops of Mayer's Regent, formation of white colour indicates the presence of alkaloids.
- **Test for quinones** -To the substance Sodium hydroxide was added, a blue green or red colour indicates the presence of quinone.
- **Test for gum (determination of gum)**- To the substance a few water drops were added, the substance swells with formation of adhesive indicates the presence of gum.
- **Determination of proteins** - To the test solution Biuret reagent is added. The blue reagent turns violet indicating the presence of proteins.

- **Determination of Sugar** - The substance was mixed with equal volume of Fehlings A and B solutions, heated on water bath, formation of red colour is the indication of the presence of sugar.

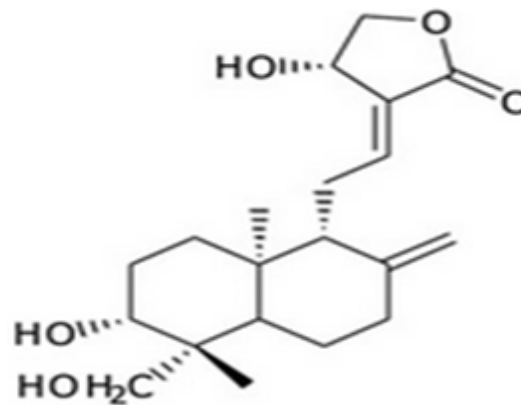


Fig. 2. Molecular Structure of Andrographolide

Table 1. Observation Table of Phytochemical Analysis

S.No.	Phytochemicals	Petroleum ether	Methanol	Water
1.	Alkaloids	-	-	+
2.	Triterpenoids	+	-	-
3.	Steroids	+	+	-
4.	Flavonoids	-	+	-
5.	Tannins	+	-	-
6.	Quinones	-	+	-
7.	Protein	+	+	-
8.	Sugar	+	-	-
9.	Gum	-	-	-

+ = Presence

- = Absence

Analysis of phytochemicals components:
The leaf extract of *A. paniculata* was analysed for the presence of alkaloid, terpenoids, steroids, flavonoids, tannins, quinones, protein, sugar and gum. The phytochemicals in the leaves are reported to have antimicrobial activity through the plant

extract and antibacterial also¹⁵. Thus the phytochemicals are medicinally important for use to treat infections and some other diseases.

The phytochemical screening and quantitative analysis of leaves and stem of

A. paniculata shows that they are rich in flavonoids, Alkaloids, steroids, phenols and tannin. These phytochemicals confer antimicrobial activity of the plant extract.

Significance of phytochemicals:

The various Phytochemical compounds detected are known to have beneficial importance in medicinal science as shown in table 2. Flavonoids have been referred to as Nature's biological response modifiers because of their inherent ability to modify the body's reaction to allergic disorders. They show anti-allergic, anti-inflammatory, antimicrobial and anticancer activities. Alkaloids have been used

to treat diseases like malaria, pain and managing heart diseases/disorders. Steroids are known to be important against microbial activity. They are also used in herbal medicine and cosmetics. Phenolic compounds are the largest group of phytochemicals and account for most of the antioxidant activity in plants or plant products. Tannins can inhibit the growth of microorganisms and act as an antifungal agent at higher concentrations by coagulating the protoplasm of the microorganism. Saponin is used as mild detergent and in intracellular histochemical staining. It is also used to allow antibody access in intercellular protein.

Table 2. showing phytochemicals and their medicinal utility

S.No.	Phytochemical	Medicinal Value
1.	Alkaloids	Used in malaria as pain killer and managing heart disorders.
2.	Tannins	Inhibit the growth of micro-organisms and act as antifungal agent.
3.	Flavonoids	Antiallergic, anti-inflammatory, antimicrobial anticarcinogenic
4.	Steroids	Antimicrobial activity and also used in cosmetics.
5.	Terpenoids	Used in viral, bacterial and fungal infections.
6.	Sugar	Sources of food energy, providing sweetness and also used in dehydration.
7.	Protein	Used in nutrition and important components of every cell in the body and useful for repair of tissues and to make enzyme and hormones.
8.	Qinones	Skin irritation, domestic and allergic reactions if applied to the skin.
9.	Gum	Useful for reducing irritation and inflammation.

Phytochemical analysis shows that the extract contains alkaloid, tannins, flavonoids, steroids terpenoids, sugar, protein and gum. Many phytochemicals are found in plants, either they are the product of plant metabolism or synthesized for different purposes. The phytochemicals are useful for different purposes. The phytochemical are useful for defense of many disease like alkaloids are used

in malaria, pain killers and heart disease/disorder; tannin are used in inhibiting growth of microorganism, flavonoids are used as antiallergic, anti-inflammatory, anticancer activities, steroids show antimicrobial activities. The sugars are sources of food energy, sweetness providing and also used in dehydration and the proteins are useful for nutrition and important components of every

cell in the body and also useful for repair of tissues, making of enzyme and hormones. The gums are useful for reducing irritation and inflammation. The Andrographolide, is the main constituent and it is also active principle of the plant. Neoandrographolide, 14-deoxy-11, 12-Didehydroandrographolide, 14 Deoxyandrographolide and andrographoside are also found. The andrographolide is anti-Inflammatory¹⁴, hepatoprotective, antioxidant¹⁰, antipyretic¹³, anticancer⁶, anthelmintic¹¹ antiviral (against Chikungunya)³⁶ and antihyperglycaemic¹³.

The Neoandrographolide has antipyretic² antiinflammatory and antioxidant activities¹ and hepatoprotective¹¹.

14-Deoxy-11,12-didehydroandrographolide is antipyretic² Anti-Inflammatory and exhibits antioxidant activities¹², anticancer activity and cardiovascular activity¹⁰.

14 Deoxyandrographolide has antipyretic, and anti-Inflammatory activity² Anticancer activity also⁶. Andrographoside has hepatoprotective activity⁴.

Medicinal Value of Andrographis paniculata

- *Andrographis paniculata* (*Kalmegh*) is an antioxidant and anti-inflammatory in nature.
- It is used for the treatment of cancer and HIV.
- The regular use of *Andrographis paniculata* is helpful to cure cough, cold, sinusitis and body pain.
- *Kalmegh* is used as antibacterial, anti-

parasitic and antifungal.

- It is used as a blood purifier and enhances immunity.
- It protects the liver and used as a liver tonic.
- Traditionally, *Andrographis paniculata* is used in the treatment of leprosy and cholera.
- The tonic is used against weakness to provide strength and vigour to the body.
- The extract of *Kalmegh* is used in the treatment of slow digestion, bowel irritation and irregular menstrual syndrome.
- It is used against various skin infections, scabies, boil and patches.
- The *Kalmegh* syrup is also used against fever and malaria.
- *Andrographis paniculata* is used against the respiratory infections.
- *Kalmegh* juice is traditionally used to cure ulcers.
- It has also been proved as anti-hepatotoxic and has anti-typhoid activity.
- Because of its bitterness, *Andrographis paniculata* is also used as an anti-diabetic herb.
- The bitter extract of the leaves is useful in killing worms in the stomach.
- The entire plant is very useful in the treatment of snake bite and scorpion sting.
- It is used against heart diseases and reduces high blood sugar.
- The juice is antipyretic and also used to treat diarrhoea.
- The entire plant is helpful for the treatment of filaria, influenza and bronchitis.
- The plant is strongly avoided during pregnancy because of its anti-fertility

property.

- The Chinese use this herb for the treatment of throat disorders.
- Charaka Samhita quotes the plant in the treatment of jaundice.

Very important Phytochemicals were obtained from *Andrographis paniculata*. *A. paniculata* can be used as a potent drug as anticancer, antiinfection, antidiabetes, anti cardiac diseases, and antiallergic.

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