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Phytochemical Analysis Of Andrographis Paniculata (Burm. F.) Wall Whole Plant Powder in Western Uttar Pradesh

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Abstract: The phytochemicals present in plants act as potential source of useful drugs and They improve the health status of human beings. Phytochemicals analysis is the first step towards discovery of valuable drugs. Plants are the richest resources of drugs and useful for the various biological activity. In the present investigation the phytochemical screening of *Andrographis paniculata* (Burm.f.) Wall. was one of the highly used medicinal plants. The phytochemical tests were carried out specially for screening secondary metabolites of this plants. In this study we have investigated different phytochemicals from this plant by using different solvents for extraction. The plant shows the phytochemicals like saponins, tannins, terpenoid alkaloids, flavonoids etc. The whole plant of *Andrographis paniculata* were collected and authenticated for its family and species. Its moisture and dry matter content ranged from 56.80 to 58.02 and 39.88 to 41.20 percent, receptively. The *A. paniculata* whole plant powder was prepared from dried *A. paniculata* whole plants. The ethanolic and aqueous extracts were prepared from *A. paniculata* whole plant powder. The yield of ethanolic extract (11.93±0.12 per cent) was significantly ($P \leq 0.01$) higher than the yield of aqueous extract (9.14±0.14 per cent). The ethanolic and aqueous extracts of *A. paniculata* whole plant powder were screened for 12 phytochemicals of which saponins, tannins, phlobatannins, hydrolysable tannins, phenols, alkaloids, terpenoids, flavonoids and glycosides were present in aqueous extract. Ethanolic extract also showed similar results with the exception of cardiac glycosides which were present and phlobatannins which were not detected.

Keywords: Phytochemicals *Andrographis paniculata* (Burm. f.) wall, phytochemicals, saponins, tannins, terpenoid, steroids.

INTRODUCTION

The *Andrographis paniculata* (Burm. f.) Nees, is a small annual herbaceous plant, It is the member of the family acanthaceae, and found in Sri Lanka, Pakistan, Java, Malaysia, Indonesia and throughout India. It is cultivated in Uttar Pradesh, Himachal Pradesh, Assam, Madhya Pradesh, Tamilnadu, Karnataka and Kerala, in India. In Uttar Pradesh, it is cultivated in Meerut, Muzaffar Nagar, Baghpat, Lucknow Kanpur and Bundelkhad region (Tomar A.2022). It is commonly known as, Kalmegh (Hindi) or King of bitters (English).

A. paniculata has been prominently used in at least 26 Ayurvedic formulations as confirmed from Indian Pharmacopoeia; It has been widely used in Chinese medicine as an anti- inflammatory and antipyretic drug for the treatment of cold, fever and laryngitis (Deng 1982).

Numerous secondary metabolites with a variety of medicinal uses have been identified in the plant. The bioactive elements in the ethanolic and aqueous extracts of A. paniculata whole plant powder were examined.

Through the integration of traditional knowledge with contemporary evidence-based medicine, scientific study continues to investigate the potential advantages, safety, and mechanisms of action of numerous medicinal plants. When added to our diets, phytochemicals have numerous potential health benefits. A wide range of phytochemicals that support a balanced diet can be obtained by consuming a variety of plant-based foods, including fruits, vegetables, whole grains, legumes, nuts, and seeds. Numerous secondary metabolites with a variety of medicinal uses have been identified in the plant. The bioactive elements in the ethanolic and aqueous extracts of A. paniculata whole plant powder were sought after.

The plants act as anti-microbial compounds due to the presence of secondary metabolites. To overcome the microbial infection problems agents like anti-microbial and resistance towards the infection were used. T h e 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 and fungal infection.

MATERIALS AND METHODS

Collection of plants material of *Andrographis paniculata*

The whole plants *Andrographis paniculata* of around 120 days old were randomly collected as per the procedure of Jain, (2016) from Herbal

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Garden of Department of Botany Meerut college Meerut and Hastinapur Forest Area. Meerut District lies between 28°57'N to 29°02'N and 77°40'E to 77°45'E in the Indo-Gangetic plains of India. It is bound on the north by Muzaffarnagar District and in the south by Bulandshahar District, while Ghaziabad District and Baghpat District form the southern and western borders.

Figure 1 A. paniculata

Dry Matter Content of *A. Paniculata* Whole Plant

Random samples from the collected whole plants were cut and kept in hot air oven for drying at 50 ^{o}C for 24 hours for the estimation of dry matter (Rajat Chakraborty and Tilottama Dey, 2016)

Preparation of *A. paniculata* whole plant powder (APWP) The collected whole plants and roots were washed under running tap water, spread on wetting papers and dried under shade for four weeks with frequent tilting. The whole plants were chaffed and further shade dried for another one week followed by mechanical grinding. Then the whole plants were pulverised and sieved to get a fine powder (Rajat Chakraborty and Tilottama Dey, 2016). The whole plant power was stored in air tight containers for extract preparations of alcohol and water.

Preparation of Extracts of *A. Paniculata* Whole Plant Powder

The aqueous and alcoholic extracts of six samples of *A. paniculata* whole plant powder (APWP) were prepared by adding 20 gram of dry powder to 200 ml of distilled water and 70 percent ethanol, respectively, that were and kept in a rotary shaker for 48hrs, filtered through Whatman No.1 filter paper and then incubated at 50˚C for 48hrs to evaporate the solvents. The dried extract was collected and the percentage yield was calculated (Malahubban *et al*., 2013 and Amin Mir *et al*., 2016) . The collected material was stored in airtight container for phytochemical analysis of the plant.

PHYTO-CHEMICAL ANALYSIS OF WHOLE PLANT POWDER

The qualitative phyto-chemical analysis of aqueous and alcoholic extracts of APWP powder were carried out by using commonly employed precipitation and coloration reaction as per the methodology of Harborne, (1998) , Priyanka Das and Alok Kumar Srivastav, (2014) and Lalitha *et al*., (2015) at department of Boatny Meerut college Meerut India which revealed the presence or absence of Twelve phytochemical compounds *viz*. saponins, tannins, phlobatannins, hydrolysable tannins, phenols, alkaloids, terpenoids, flavonoids,

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glycosides, cardiac glycosides, carbohydrates, and volatile oils .

Detection of Phlobatannins
In to 2.0 ml of each extract, 1.0 ml of dilute HCl solution was added. The appearance of red precipitate is indication presense of phlobatannins.

Detection of Hydrolysable Tannins
In to 2.0 ml of each extract, 2.0 ml of ammonia solution was added. The appearance of emulsion indicates the presence of hydrolysable tannins.

Detection of Flavonoids
In to 2.0 ml of each extract, few drops of sodium hydroxide solution were added. The appearance of intense yellow colour, which became colourless on addition of dilute HCl is confermation of flavonoids.

Detection of Terpenoids
In to 2.0 ml of each extract, an equal amount of chloroform was added followed by addition of 2.0 ml of concentrated H_2SO_4 along the sides of the test tube. The appearance of a brown color ring at the junction of two liquids is indication of terpenoids.

Detection Of Saponins
Two ml of each extract were diluted with 10.0 ml of distilled water and mixed for 15 minutes. The appearance of layers of foam which remains for 10 minutes is suggestive of saponins.

Detection of Carbohydrates
In to 2.0 ml of each extract, 2.0 ml each of Fehling's A and B solution were added and heated at 50˚C for 1 minute. The appearance of red precipitate is confermation of carbohydrates.

Detection of Volatile Oil
In to 2.0 ml of each extract, 0.1 ml of NaOH and a small amount of dilute HCl were added. The appearance of white precipitate is indication of volatile oils.

Detection of Alkaloids
In to 2.0 ml of each extract, 2.0 ml of picric acid (Hager's reagent) was added. The appearance of orange or yellow color precipitate is confermation of alkaloids.

Detection of Cardiac Glycosides
In to 2.0 ml of each extract, 2.0 ml of dilute H_2SO_4 was added and heated at 50˚C for 2 min. Then 1.0 ml of 10 per cent NaOH was added and 5.0 ml each of Fehling's solution A and B were added. The appearance of brick red precipitate is indication of glycosides.

Detection of Glycosides
In to 2.0 ml of each extract, an equal amount of glacial acetic acid was added. Then, one drop of 10 percent ferric chloride and 2.0 ml of concentrated H_2SO_4 were added. The appearance of three layers of colours like upper green, middle brown and lower violet is confermation of cardiac glycosides.

Detection of Phenols
Two ml of each extract were diluted with 2.0 ml of 10 per cent ferric chloride. The appearance of bluish color indicates the presence of phenols.

Detection of Tannins
In to 2.0 ml of each extract, 3 drops of 1 per cent ferric chloride was added. The appearance of blue green color is presence of tannins.

RESULTS AND DISCUSSION

The present study was carried out to investigate the photochemical profile of whole plant of *Andrographis paniculata* (Burm.f.) Wall. The Phytochemicals like saponins, tannins, terpenoid and steroids are present in all the extracts and shown potent biological activity and medicinal property.

The aqueous extract revealed the presence of maximum phytochemicals such as alkaloids, carbohydrates, phytosterol, saponins, phenolic compounds, tannins, flavonoids, proteins, cardiac glycosides and steroids.

The methanol extract revealed the presence of photochemical such as reducing sugar, phytosterol, saponins, phenolic compounds, tannins, terpenoid, cardic glycosides and steroids.

Bhatnagar (2023) . reported the presence of several active phytochemicals in methanol extract like phenols, flavonoids, alkaloids, phytosterols, tannins, saponins, glycosides, amino acids and terpenoids. In chloroform extract phenols, flavonoids, alkaloids, saponins, glycosides, amino acids, terpenoids are present. Aqueous extract consist of alkaloids and amino acids only.

The presence of secondary metabolites in plants is influenced by several environmental factors. The presence of saponins are responsible for the bitter taste and a well known for their hemolytic effect on red blood cells. (Prohp *et.al.*, 2012) The saponins content of plants also helps in fighting pathogens and boosting the immune system. Additionally cytotoxic qualities, anti-bacterial, anti-viral properties are posses due to the presence of saponin. (Bailly and Vergoten 2020).

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Tannin possesses an anticancer property. (Mazni *et.al.,* 2016) . The presence of terpenoids and steroid have a great importance in synthesizing sex hormones synthetic compounds. (Okwu *et.al.,*2001) . Cardiac glycosides posses an effective and direct action on the cardiac system, supporting the strength of the heart and the rate of contraction when failing. (Iwu 1983)

Dry Matter Content of *A. Paniculata* Whole Plant

The percent dry mater and moisture contents of *A. paniculata* whole plant collected from Botany department meerut college Meerut, and Hastinapur Area Meerut is presented in the Table 1

Table 1: Moisture and dry matter content of fresh *A. paniculata* whole plant

Sl. No	Plant Collected	Moisture (%)	Dry Matter (%)
1	BDMC Meerut	58.02	39.88
2	H AREA Meerut	56.80	41.20

Six observations taken for each value

The moisture and dry mater content of collected samples of *A. paniculata* ranged from 57.90 to 59.02 and 40.98 to 42.10 per cent, respectively. Whereas, the range of moisture content were 72.01-70.60, 67.00 and 30.30 per cent and dry matter content were 26.98- 28.35, 32.00 and 68.60 per cent respectively, in leaves, stems and seeds, as reported by Moyo *et al*. (2011) , Abasiekong and Osabor (2017) and Geetha and Rajeswari (2019) The lower moisture and higher dry matter content of APWP when compared to the reported values might be due to the mixture of leaves, stems and roots. Here whole plant is analysed.

Yield of Aqueous and Alcoholic Extracts

The percent yield of aqueous and alcoholic extracts of APWP is presented in Table 2 and Figure 1. The mean percent yield of aqueous and alcoholic extracts of APWP samples were 9.14 ±0.14 and 11.93±0.12 per cent, respectively. The mean per cent yield of alcoholic extract was significantly ($P<$ 0.01) higher than aqueous extract which indicated that APWP consisted of contains higher amount of alcohol soluble bioactive compounds than that of water soluble compounds in whole plant extract.

Table 2: Per cent yield of extracts of *A. paniculata* whole plant powder

Sl. No	lic extract yield (%)	us extract yield (%)
1	12.20	8.75
2	12.01	9.68
3	11.80	9.41
4	11.70	8.60
5	11.50	8.98
6	12.35	9.20
Mean±SE	11.93±0.12	9.14 ±0.14

The result of aqueous and alcoholic extracts in the of present study were was lower than the reported values (Mohan *et al.*, 2013; Banji *et al.*, 2018 and Nagajothi *et al.*, 2018). Which were attributed to the fact that as the extracts of the present study were prepared from the dried whole plant powder where as in reported studies, the extracts were prepared only from dried leaves. But the yield of alcoholic extracts was comparable with the values from the aerial parts as reported by Mishra *et al.* (2009).

Qualitative Phytochemical analysis

The results of qualitative phytochemical constituents of aqueous and alcoholic extracts of *A.paniculata* whole plant powder (APWP) are presented in the Table 3.

The qualitative analysis showed that saponins, tannins, phenols, alkaloids, terpenoids, flavonoids, hydrolysable tannins and glycosides were present both in aqueous and alcoholic extracts of APWP. Whereas, amino acids, carbohydrates, volatile oils and vitamin C were absent both in aqueous and alcoholic extracts of APWP.

Phytochemical screening of aqueous and ethanolic extracts of APWP showed positive for eight bioactive compounds of which phlobatannins and cardiac glycosides were detected only in aqueous and ethanolic extract, respectively. The probable reason might be due to the difference in extraction potential of the solvents (Polash *et al.*, 2017) [18]

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The presence of alkaloids, phenols, tannins, hydrolysable tannins, flavonoids, terpenoids and saponins in both the extracts were earlier reported to be important for antiviral activity (Arbab *et al.*, 2017) [19].

Table 3: Qualitative phytochemical constituents of aqueous and alcoholic extracts of ***A. paniculata*** **whole plant powder**

Sl. No	Phytochemicals	Alcoholic extract	Aqueous extract
1	Alkaloids	Present	Present
2	Carbohydrates	Absent	Absent
3	Cardiac glycosides	Present	Absent
4	Flavonoids	Present	Present
5	Glycosides	Present	Present
6	Hydrolysable tannins	Present	Present
7	Phenols	Present	Present
8	Phlobatannins	Absent	Present
9	Saponins	Present	Present
10	Tannins	Present	Present
11	Terpenoids	Present	Present
12	Volatile Oils	Absent	Absent

Similar observations were reported by Malahubban *et al.*,(2013), Adedapo *et al.*,(2014), Umadevi and Kamalam,(2014) , Adegboyeg and Oyewole (2015) , Neha Sinha (2016) , Nagajothi *et al.* (2018) and Bhargavi and Kalpana Kaloori (2018) except for the absence of alkaloids as reported by Adedapo *et al.* (2014) and absence of terpenoids as reported by Neha Sinha (2016) and Bhargavi and Kalpana Kaloori (2018) in aqueous extracts. Similarly, presence of phylobatannins in aqueous and presence of cardiac glycosides in alcoholic extracts of APWP were also earlier reported by Nagajothi *et al.* (2018). Tomar A. (2022).

CONCLUSION

The phytochemicals observed in this study shows these plants have a potency for use in producing pharmaceutical bioactive compounds for therapeutic drugs. Further studies should be carried out on these in order to isolate, identify the bioactive compounds and determine their mechanism in action. The presence of phytochemicals make the plant useful for treating different disease and have a potential for providing a drug for human use.

The phytochemicals analysis showed rich contain of bioactive molecules in *Andrographis paniculata* (Burm.f.) Wall. due to the presence of saponin, tannin, terpenoid and steroid. The aqueous extract showed more bioactive constituents followed by methanol . Thus this plant may be used for the production of herbal drugs for human welfare..

All these phytochemicals present in *A. paniculata* act synergistically and exhibit beneficial effects in treatment of wide variety of disease conditions ranging from pyrexia to cancer. So, *A. paniculata* is included as an ingredient in several polyherbal preparations for its heaptoprotective (Ram, 2001) , antiviral (Calabrese *et al.*, 2000) and immune stimulant activity (Kavinilavan *et al.*, 2017) for treatment of wide variety of disease conditions ranging from pyrexia to COVID-19 (Lim *et al.*, 2021) and fever not only in human and but also in animals.

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