

Phytochemical Analysis of Aquous Leaf Extracts of Some Medicinal Herbs, Shrubs and Trees from New Delhi, India

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ABSTRACT: Medicinal plants have bioactive compounds i.e. phytochemicals which are used for curing of various human disease. Phytochemicals have two categories i.e., primary and secondary constituents. Primary constituents have chlorophyll, proteins, sugar and amino acids. Secondary constituents contain terpenoids and alkaloids. Medicinal plants have antifungal, antibacterial and anti-inflammatory activities. The present study involves ten different medicinal plants *Psidium guajava*, *Syzygium cumini*, *Murayya koenigii*, *Saraca asoca*, *Azadirachta indica*, *Withania somnifera*, *Lawsonia inermis*, *Mentha arvensis*, *Trigonella foecum-graecum*, *Ocimum tenuiflorum* locally available in New Delhi, India. The leaves of the selected medicinal plants were washed, air dried and then powdered. The aqueous extract of leaf samples were used for the phytochemical analysis to find out the phytochemical constituents in the plants. The main objective of the research work was to check the presence or absence of the phytochemical constituents in all the selected medicinal plants. The results of the phytochemical analysis of these medicinal plants showed that the terpenoids, phlobatannins, reducing sugar, flavonoids and alkaloids were found to be present in them. The phytochemical analysis of the plants is very important commercially as it is of great interest in pharmaceutical companies for the production of the new drugs for curing of various diseases. It is expected that the important phytochemical properties recognized by our study in the indigenous medicinal plants of New Delhi will be very useful in the curing of various diseases of this region.

KEYWORDS: Medicinal plants; Phytochemicals; Anti-fungal; Antibacterial; Anti-inflammatory activities.

I. INTRODUCTION

Medicinal plants are part and parcel of human society to combat diseases, from the dawn of civilization. [1] There exists a plethora of knowledge, information and benefits of herbal drugs in our ancient literature of Ayurvedic (Traditional Indian Medicine), Siddha, Unani and Chinese medicine. According to the World Health Organization, 2003 about 80% of the population of developing countries being unable to afford pharmaceutical drugs rely on traditional medicines, mainly plant based, to sustain their primary health care needs. [2] Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs. [3-5]. Since the time immemorial our traditional system of medicine and folklore claiming that medicinal plants as a whole or their parts are being used in all types of diseases successfully [6]. About 65% of world populations have access to local medicinal plant knowledge system [7]. Traditional systems of medicine are popular in developing countries and upto 80% of population relies on traditional medicines or folk remedies for their primary health care needs [8]. India has about 45000 plant species and among them, several thousands have been claimed to possess medicinal properties [9,10].

Phytochemicals (from the Greek word phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans [11]. In general, the plant chemicals that protect plant cells from environmental hazards such as pollution, stress, drought, UV exposure and pathogenic attack are called

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as phytochemicals [12,13]. They protect plants from disease and damage and contribute to the plant's color, aroma and flavor. Phytochemicals accumulate in different parts of the plants, such as in the roots, stems and leaves. These compounds are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism and anti cancer property[14].

Phytochemicals, as plant components with discrete bio-activities towards animal biochemistry and metabolism are being widely examined for their ability to provide health benefits. It is important to establish the scientific rationale to defend their use in foods, as potential nutritionally active ingredients. Phytochemicals could provide health benefits as: (1) substrates for biochemical reactions; (2) cofactors of enzymatic reactions; (3) inhibitors of enzymatic reactions; (4) absorbents/ sequestrants that bind to and eliminate undesirable constituents in the intestine; (5) ligands that agonize or antagonize cell surface or intracellular receptors; (6) scavengers of reactive or toxic chemicals; (7) compounds that enhance the absorption and or stability of essential nutrients; (8) selective growth factors for beneficial gastrointestinal bacteria; (9) fermentation substrates for beneficial oral, gastric or intestinal bacteria; and (10) selective inhibitors of deleterious intestinal bacteria. Such phytochemicals include terpenoids, phenolics, alkaloids and fiber. Research supporting beneficial roles for phytochemicals against cancers, coronary heart disease, diabetes, high blood pressure, inflammation, microbial, viral and parasitic infections, psychotic diseases, spasmodic conditions, ulcers, etc is based on chemical mechanisms using in vitro and cell culture systems, various disease states in animals and epidemiology of humans[15].

Terpenoids exhibit various important pharmacological activities i.e., anti-inflammatory, anticancer, anti-malarial, inhibition of cholesterol synthesis, anti-viral and anti-bacterial activities [16]. Terpenoids are very important in attracting useful mites and consume the herbivorous insects [17]. Alkaloids are used as anaesthetic agents and are found in medicinal plants [18].

Guava is the common name of the *Psidium guajava* and it belongs to the family Myrtaceae. More recent ethnopharmacological studies show that *Psidium guajava* is used in many parts of the world for the treatment of a number of diseases, e.g. as an anti-inflammatory, for diabetes, hypertension, caries, wounds, pain relief and reducing fever[19]. Jambolan (*Syzygium Cumini* L) Belongs to the family Myrtaceae is one of the widely used medicinal plants in the treatment of various diseases in particular diabetes[20]. *Murraya koenigii* is an aromatic shrub or small tree found throughout India and mainly cultivated for its aromatic leaves. It belongs to family Rutaceae. *Murraya koenigii* is a highly valued plant for its characteristic aroma and medicinal value. It is an important export commodity from India as it fetches good foreign revenue. The plant has been reported to have anti-oxidative, cytotoxic, antimicrobial, antibacterial, anti-ulcer, positive inotropic and cholesterol reducing activities [21,22]. *Saraca asoca* which is also called *Saraca indica* is the ancient tree of the family Caesalpinaceae. Ashoka is traditionally used in the treatment of excessive uterine bleeding, dysmenorrhoea and depression in women. It is also used to treat inflammation, indigestion and also abnormal vaginal discharge. It is found to have antimicrobial, anticancer, antimenorrhagic, anti oxytocic activities.

Azadirachta indica Linn is a tropical evergreen tree native to India and is also found in other southeast countries. It is a tree in the mahogany family Meliaceae. Fruit, seeds, oil, leaves, roots, bark and almost every part of the tree is bitter and contain compounds with proven antiviral, antiretroviral, antiinflammatory, anti-ulcer and antifungal, antibacterial, anti plasmodial, antiseptic, antipyretic and anti diabetic properties [23-25]. The various parts of this tree have many uses that aptly give Neem its name in Sanskrit—"sarva roga nivarini", meaning "the curer of all ailments". *Lawsonia inermis* L. is a much branched glabrous shrub or small tree, cultivated for its leaves although stem bark, roots, flowers and seeds have also been used in traditional medicine. The plant is reported to contain carbohydrates, proteins, flavonoids, tannins and phenolic compounds, alkaloids, terpenoids, quinones, coumarins, xanthenes and fatty acids. The plant has been reported to have analgesic, hypoglycemic, hepatoprotective, immunostimulant, anti-inflammatory, antibacterial, antimicrobial, antifungal, antiviral, antiparasitic, antitrypanosomal, antidermatophytic, antioxidant, antifertility, tuberculostatic and anticancer properties.[26]. *Mentha piperita* L. (Peppermint) is a perennial glabrous and strongly scented herb belonging to family Lamiaceae. The plant is aromatic, stimulant and used for allaying nausea, headache and vomiting. Its oil is one of the most popular widely used essential oils in food products, cosmetics, pharmaceuticals, dental preparations, mouthwashes, soaps and alcoholic liquors[27].

Ocimum tenuiflorum, also known as *Ocimum sanctum* is an aromatic plant in the family Lamiaceae. *Ocimum Sanctum* L is a plant which is used in several traditional medicine systems to cure diseases. The plant has been known to possess antibacterial activity, antianaphylactic effect, antidiabetic effect, anti oxidant activity, anti-carcinogenic properties,

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immunologic effects, contraceptive effects, larvicidal property, anti genotoxic effect, neuro-protective effect, cardio-protective effect and other miscellaneous activities[28]

Trigonella foenum -graecum (Linn.) belonging to the family Papilionaceae commonly known as Fenugreek is a aromatic, 30-60 cm tall, annual herb. It has antidiabetic activity, antiplasmodic activity, hypolipidemic activity, immunological activity, antibacterial activity, anthelmintic activity, anti-inflammatory, analgesic activity and antioxidant activity[29]. Withania somnifera Linn is the most important plant commonly known as Ashwagandha belongs to the family solanaceae. It is an important medicinal plant that has been used in Ayurvedic and indigenous medicine for over 3,000 years. Ashwagandha is used in asthma, bronchitis, rheumatoid arthritis.

II. MATERIALS AND METHODS

1.Plant materials:

The present study included plant species which were Psidium guajava, Syzygium cumini, Murayya koenigii, Saraca asoca, Azadirachta indica, Withania somnifera, Lawsonia inermis, Mentha arvensis, Trigonella foecum-graecum and Ocimum tenuiflorum.

2.Chemicals:

Fehling solution A and Fehling solution B, ethanol, distill water, aqueous HCl, methanol, chloroform, concentrated sulphuric acid, Ammonia solution, picric acid, Hexane.

3.Sample collection:

Ten medicinal plants were collected from the herbal garden of Jamia Millia Islamia University, New Delhi, India. The plants were used for the purpose of their phytochemical analysis. Plant species selected during present investigation are given in Table 1.

S.No.	Plant species	Local name	Part used
1.	<i>Psidium guajava</i>	Amrood	Leaves
2.	<i>Syzygium cumini</i>	Jamun	Leaves
3.	<i>Murayya koenigii</i>	Kari patta	Leaves
4.	<i>Saraca asoca</i>	Ashoka	Leaves
5.	<i>Azadirachta indica</i>	Neem	Leaves
6.	<i>Withania somnifera</i>	Ahwagandha	Leaves
7.	<i>Lawsonia inermis</i>	Mehendi	Leaves
8.	<i>Mentha arvensis</i>	Pudina	Leaves
9.	<i>Trigonella foecum-graecum</i>	Methi	Leaves
10.	<i>Ocimum tenuiflorum</i>	Tulsi	Leaves

Table 1: Ethnobotanical information of selected medicinal plant species for phytochemical analysis in New Delhi, India.

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4. Preparation of plant extract:

The leaves of the selected plants were removed from the plants and then washed under running tap water to remove dust. The plant samples were then air dried for few days and the leaves were crushed into powder and stored in polythene bags for use.

The plant powder was taken in a test tube and distilled water was added to it such that plant powder soaked in it and shaken well. The solution then filtered with the help of filter paper and filtered extract of the selected plant samples were taken and used for further phytochemical analysis.

5. Test for phlobatannins:

Plant powder sample was mixed with distilled water in a test tube and shaken well, after that it was filtered to take plant extract. Then to each plant extract, 1% aqueous hydrochloric acid was added and each plant sample was then boiled with the help of Hot plate stirrer. Formation of red colored precipitate confirmed a positive result.

6. Test for reducing Sugar:

0.50 g of selected plant sample was added in 5 ml of distilled water. Then 1 ml of ethanol mixed in plant extract. After that we took 1 ml of Fehling solution A and 1 ml of Fehling solution B in a test tube, heated it to boiling and then poured it in the aqueous ethanol extract. When color reaction was observed, it showed positive result.

7. Test for terpenoids:

0.8 g of selected plant sample was taken in a test tube, then 10 ml of methanol was poured in it, it was shaken well and filtered to take 5 ml extract of plant sample. Then 2 ml of chloroform were mixed in extract of selected plant sample and 3 ml of sulphuric acid were added in selected sample extract. Formation of reddish brown color indicates the presence of terpenoids in the selected plants.

8. Test for flavonoids:

For the confirmation of flavonoid in the selected plants, 0.5 g of each selected plant powder were added in a test tube and 10 ml of distilled water, 5 ml of dilute ammonia solution were added to a portion of the aqueous filtrate of each plant extract followed by addition of 1 ml concentrated H₂SO₄. Indication of yellow color shows the presence of flavonoid in each extract.

9. Test for alkaloids:

For the purpose of phytochemical analysis of the selected plants, 0.2 g of the selected plant samples were added in each test tube and 3 ml of hexane were mixed in it, shaken well and filtered. Then took 5 ml of 2% HCl and poured in a test tube having the mixture of plant extract and hexane. Heated the test tube having the mixture, filtered it and poured few drops of picric acid in a mixture. Formation of yellow color precipitate indicates the presence of alkaloids.

III. RESULTS

This study has revealed the presence of phytochemicals considered as active medicinal chemical constituents. Important medicinal phytochemicals such as terpenoids, reducing sugar, flavonoids, alkaloids and phlobatannins were present in the samples. The result of the phytochemical analysis shows that the ten plants are rich in at least one of alkaloids, flavonoids, terpenoids, reducing sugars and phlobatannins. Plants *Psidium guajava*, *Syzygium cumini* and *Mentha arvensis* have all these phytochemicals. The phytochemical screening and qualitative estimation of 10 medicinal plants studied showed that the leaves were rich in phlobatannins, terpenoid, flavonoids, alkaloids and reducing sugar (Table 2). Phlobatannins are present in *Psidium guajava*, *Syzygium cumini*, *Murayya koenigii*, *Saraca asoca*, *Azadirachta indica*, *Withania somnifera*, *Mentha arvensis* and *Ocimum tenuiflorum*. Phlobatannins have been reported for its wound healing

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properties, these are anti-inflammatory and analgesic [30] and antioxidant [31]. Reducing sugars are present in seven plants out of 10 i.e., *Psidium guajava*, *Syzygium cumini*, *Saraca asoca*, *Lawsonia inermis*, *Mentha arvensis*, *Trigonella foecum-graecum* and *Ocimum tenuiflorum*. Terpenoids are present in *Psidium guajava*, *Syzygium cumini*, *Saraca asoca*, *Azadirachta indica*, *Lawsonia inermis*, *Mentha arvensis* and *Ocimum tenuiflorum*. Terpenoids are reported to have anti-inflammatory, anti-viral, anti-malarial, inhibition of cholesterol synthesis and anti-bacterial [32]. Flavonoids are found in *Psidium guajava*, *Syzygium cumini*, *Saraca asoca*, *Azadirachta indica*, *Withania somnifera*, *Lawsonia inermis*, *Mentha arvensis* and *Trigonella foecum-graecum*. Epidemiologic studies recommend that coronary heart disease is opposed by dietary flavonoids. Alkaloids are present in *Psidium guajava*, *Syzygium cumini*, *Murayya koenigii*, *Azadirachta indica*, *Withania somnifera*, *Lawsonia inermis*, *Mentha arvensis*, *Trigonella foecum-graecum* and *Ocimum tenuiflorum* as shown in Table 2. Plants having alkaloids are used in medicines for reducing headache and fever. These are attributed for antibacterial and analgesic properties [33].

S.No.	Plant Species	Phlobatanins	Reducing Sugar	Terpenoids	Flavanoids	Alkaloids
1.	<i>Psidium guajava</i>	+	+	+	+	+
2.	<i>Syzygium cumini</i>	+	+	+	+	+
3.	<i>Murayya koenigii</i>	+	-	-	-	+
4.	<i>Saraca asoca</i>	+	+	+	+	-
5.	<i>Azadirachta indica</i>	+	-	+	+	+
6.	<i>Withania somnifera</i>	+	-	-	+	+
7.	<i>Lawsonia inermis</i>	-	+	+	+	+
8.	<i>Mentha arvensis</i>	+	+	+	+	+
9.	<i>Trigonella foecum-graecum</i>	-	+	-	+	+
10.	<i>Ocimum tenuiflorum</i>	+	+	+	-	+

Table 2: Preliminary phytochemical analysis of screened medicinal plant species.

IV. DISCUSSION

The research work was carried out on the ten selected medicinal plants which shows that phytochemical constituent's i.e., terpenoids, flavonoids, alkaloids, reducing sugars and phlobatanins are either present or absent in these plants and the results were summarized in Table 2. In the present investigation, reducing sugars, terpenoids, alkaloids, flavonoids and phlobatanins all were present in *Psidium guajava*, *Syzygium cumini* and *Mentha arvensis*. This is in concordance with the previous findings[34-37]. Phlobatanins and alkaloids were present in *Murayya koenigii*, similar results have been reported previously[38]. Reducing sugar, flavanoids and terpenoids were absent in the plant which has also been reported earlier [39]. *Saraca asoca* was found to contain flavanoids, reducing sugar and alkaloids were absent in it, similar results have been reported earlier[40-42]. Present study shows that phlobatanins and terpenoids were also present in *Saraca asoca*.

Azadirachta indica was found to contain terpenoids, flavanoids and alkaloids which is in concordance with the earlier reported results[43-45]. Reducing sugar was absent in *Azadirachta indica*, similar results were reported earlier[46].

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Phlobatanins were absent, although their presence had been reported earlier[47]. The recent research studies and previous research studies results were different which might be due to the change in location and genetic variation due to cross pollination, which would have led to a change in their genetic makeup and they gave different results. *Withania somnifera* was found to contain flavanoids and alkaloids, similar results were reported earlier[48]. Reducing sugar and terpenoids were found to be absent as has been reported earlier[49,50]. Phlobatanins were found to be present in the plant in the present study.

Reducing sugar, terpenoids, flavanoids and alkaloids were found to be present in *Lawsonia inermis*, similar results have been reported earlier[51,52]. In the present study it was found that phlobatanins were absent in *Lawsonia inermis*. Alkaloids and flavanoids were present in *Trigonella foecum-graecum*, similar results were reported earlier[53,54]. In the present analysis reducing sugar was found to be present in *Trigonella foecum-graecum* whereas phlobatanins and terpenoids were absent.

Phlobatanins and terpenoids were found to be present in *Ocimum tenuiflorum*, similar to what has been reported earlier[55]. Alkaloids and reducing sugars were present whereas flavanoids were found to be absent in *Ocimum tenuiflorum*, similar results have been reported earlier[56].

V. CONCLUSION

The selected ten medicinal plants are the source of the secondary metabolites i.e., alkaloids, flavonoids, terpenoids, phlobatanins and reducing sugars. Medicinal plants play a vital role in preventing various diseases. The antidiuretic, anti-inflammatory, antianalgesic, anticancer, anti-viral, anti-malarial, anti-bacterial and anti-fungal activities of the medicinal plants are due to the presence of the above mentioned secondary metabolites. Medicinal plants are used for discovering and screening of the phytochemical constituents which are very helpful for the manufacturing of new drugs. The previous phytochemical analysis and present studied show nearly the similar results due to the presence of the phytochemical constituents. The phytochemical analysis of the medicinal plants are also important and have commercial interest in both research institutes and pharmaceuticals companies for the manufacturing of the new drugs for treatment of various diseases. Thus we hope that the important phytochemical properties identified by our study of common herbs, shrubs and trees from New Delhi, India will be helpful in the development of herbal medicines against different diseases of this particular region.

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