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Qualitative and quantitative phytochemicals analysis of selected fabaceae medicinal plants from Allahabad region

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Abstract

Medicinal plants have bioactive compounds which are used for curing of various human diseases and also play an important role in healing. Secondary constituents contain Alkaloids, Flavonoids, Phenol, Saponine, Steroids and Tannins. Medicinal plants have anticancer, antimicrobial, antidiabetic, antidiuretic and anti-inflammation activities. The present study involves ten different medicinal plants *Abrus precatorius* Linn, *Cajanus cajan*, *Cicer arietinum* Linn, *Clitoria ternatea* Linn, *Dalbergia sissoo*, *Delonix regia*, *Lens culinaris* Medic, *Millettia-pinnata*, *Tephrosia purpurea*, *Trigonella foenum-graecum* Linn locally available in Allahabad region of India. The leaves of the selected medicinal plants were washed, air dried and then powdered. The methanolic extract of leaves samples were used for the phytochemical analysis to find out the quantitative and quantitative phytochemical constituents in the plants. The result of the phytochemical analysis of these medicinal plants showed presence or absence as well as quantitative (mg/g) contain of Alkaloids, Flavonoids, Phenol, Saponin, Steroids and Tannins in the selected medicinal plants.

Keywords: phytochemical, secondary constituents, methanolic extract, bioactive compounds and anticancer

1. Introduction

Medicinal plants are rich source of novel drugs that forms the ingredients in traditional system of medicine, modern medicines, pharmaceutical intermediates and lead compounds in synthetic drugs [1]. The reason for using them as medicine lies in the fact that they contain chemical components of therapeutic value [2]. These compounds are naturally occurring in the medicinal plants, leaves, vegetables and roots that have defense mechanism and protect from various diseases. The medicinal value of plants lies in some chemical substances (usually secondary metabolites) that produce a definite physiological action as the human body. In recent times focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems [3] including treatment against hepatocellular carcinoma [4]. Herbal medicines are being used by nearly about 80% of the world population, primarily in developing countries for primary health care [5]. Assessing the current status of health care system, inadequacies of synthetic drugs are likely to be more glaring in the coming years. In the present study, we have concentrated on the preliminary screening, quantitative determination, and the qualitative separation of secondary metabolites from leaves of selected ten different medicinal plants.

2. Materials and Methods

2.1 Collection and Extraction of Medicinal plants

The sample of various plants studied was collect from Allahabad, in month of December-2011. The aerial parts of plants were dried under shed at 25 °C and the dried basic were made in to coarse powder. The powder was extracted with 600 ml of methanol using soxhlet apparatus till exhaustion for about 48 h. The methanol extract was concentrated under vacuum at 40 °C to get the residues.

2.2 Qualitative phytochemical analysis

Phytochemical analysis of methanolic extract of selected medicinal plants was carried out by the standard methods [6] provided for the presence and absence of metabolites such as

Alkaloids, Flavonoids, Phenol, Saponine, Steroids and Tannins was carried out.

2.3 Quantitative phytochemical analysis

Chemical test were carried out on the methanolic extract of selected three medicinal plants and on the powdered specimen using standard procedure to identify the constituents as total alkaloids [7], total flavonoids [8], total phenol [9], total saponine [7], total steroids [10] and total tannins [11].

3 Result and Discussion

3.1 Primary screening of selected fabaceae plant inhabited in Allahabad region

Plants are known in traditional medicine and their therapeutical uses are well documented. Ten plants of the family fabaceae namely *Abrus precatorius* Linn, *Cajanus cajan*, *Cicer arietinum* Linn, *Clitoria ternatea* Linn, *Dalbergia sissoo*,

Delonix regia, *Lens culinaris* Medic, *Millettia-pinnata*, *Tephrosia purpurea*, *Trigonella foenum-graecum* Linn were selected in the study for the screening of their primary phytochemicals. The results showed the presence or absence of certain phytochemicals in the studied methanolic plant extracts. The observed values reveal some differences in the presence of Alkaloids, Flavonoids, Phenols, Saponin, Steroids and Tannins as recorded in the table 1. The methanolic extract of *Abrus precatorius* Linn, *Dalbergia sissoo*, *Millettia pinnata* and *Tephrosia purpurea* displayed the presence of all the studied phytochemicals while *Clitoria ternatea* Linn, *Delonix regia*, *Lens culinaris* Medic and *Trigonella foenum-graecum* Linn. showed the presence of almost all phytochemicals except any one either in. tannins, saponins, steroids and tannins. *Cajanus cajan* was observed to be poor in the studied phytochemicals while *Cicera rietinum* Linn displayed the absence of two tested phytochemicals (table 1).

Table 1: Primary screening and qualitative phytochemicals of fabaceae plant in Allahabad region

Local Fabaceae plant	Alkaloids	Flavonoids	Phenols	Saponin	Steroids	Tannins
<i>Abrus precatorius</i> Linn	+	+	+	+	+	+
<i>Cajanus cajan</i>	-	+	-	+	-	+
<i>Cicera rietinum</i> Linn	+	+	+	-	-	+
<i>Clitoria ternatea</i> Linn	+	+	+	+	+	-
<i>Dalbergia sissoo</i>	+	+	+	+	+	+
<i>Delonix regia</i>	+	+	+	-	+	+
<i>Lens culinaris</i> Medic	+	+	+	+	-	+
<i>Millettia pinnata</i>	+	+	+	+	+	+
<i>Tephrosia purpurea</i>	+	+	+	+	+	+
<i>Trigonella foenum-graecum</i> Linn.	+	+	+	+	+	-

(+) indicates present; (-) indicates absence

3.2 Quantitative phytochemicals in selected medicinal plants

Quantification of phytochemical constituents of the selected plants (*Dalbergia sissoo*, *Delonix regia* and *Tephrosia purpurea*) revealed the variations in concentrations of Alkaloids, Flavonoids, Phenol, Saponin, Steroids and Tannins.

3.2.1 Alkaloids

The alkaloids are believed to function as defensive elements against predators, especially mammals because of their general toxicity and deterrence capability [12]. The alkaloids isolated from natural herbs seem to have many targets to realize their multiple pharmacological effects, especially for the treatment of complex diseases such as cancer [12]. The variable concentrations of alkaloids were recorded in the leaves of studied plants (Table 2). The *Delonix regia* showed highest alkaloids (0.79±0.04 mg/g DW) which was found almost two fold higher than *Dalbergia sissoo* (0.32±0.05 mg/g DW). *Tephrosia purpurea* had better contents of alkaloids and was almost nearer (0.65±0.04) to *Delonix regia*. The alkaloids are believed to function as defensive elements against predators, especially mammals because of their general toxicity and deterrence capability as well as analgesic, anti-inflammatory and adaptogenic activities which help to alleviate pains, developed resistance against diseases and endurance against stress [27, 28]. The high degree precipitation of alkaloids found in the methanol and chloroform extracts. The presence of alkaloids in the plants cure asthma, snake bite and skin diseases [29]. The alkaloids and their amazing effect on humans have led to the development of powerful pain killer medicine and anesthetics agents [30, 31].

3.2.2 Flavonoids

Flavonoids have been referred to as nature's biological response modifiers because of strong experimental evidence of their inherent ability to modify the body's reaction to allergies, virus and carcinogens [16]. The analysis of leaves shows that *Tephrosia purpurea* was the richest source of flavonoids (32.59±0.42) retained almost two fold higher flavonoids than *Dalbergia sissoo* (16.02±0.29 mg/g DW). *Delonix regia* had better content of flavonoids (28.29±0.65) that was almost near to *Tephrosia purpurea* (Table 1). Flavonoids are generally nontoxic and manifest a diverse range of beneficial biological activities. Epidemiological studies have provided data that high dietary intake of flavonoids with fruits and vegetables could be associated with low cancer prevalence in humans, these include carcinogen inactivation, anti-proliferation, cell cycle arrest, induction of apoptosis and differentiation, inhibition of angiogenesis, antioxidation and reversal of multidrug resistance mechanisms [20]. The flavonoids are polyphenolic compounds found as integral components of the human diet. They are universally present as constituents of flowering plants, particularly of food plants [29]. Several plants and spices containing flavonoid derivatives have found application as disease preventive and therapeutic agents in traditional medicine in Asia for thousands of years [30].

3.2.3 Phenols

The plant derived polyphenolic compounds are promising nutraceuticals for control of various disorders such as cardiovascular, neurological and neoplastic disease [21]. The analysis of leaves shows that *Tephrosia purpurea* was the richest source of phenol (56.79±0.49 mg/g DW) as compared

to other two medicinal plants. The lowest source was examined to be *Delonix regia* (32.80±0.52 mg/g DW) while *Dalbergia sissoo* contained bit higher (35.75±0.71 mg/g DW) than *Delonix regia* (Table 1). Phenolic compounds have the ability to reduce risk for development or treatment of cancers, cardiovascular disorders, obesity, diabetes, aging-diseases, urinary tract infections, and periodontal disease [22]. The plant-derived polyphenolic compounds are promising nutraceuticals for control of various disorders such as cardiovascular, neurological and neoplastic disease. The richness of the polyphenolic contents of green tea and red wine has made them popular choices for associated anticancer and cardiovascular health benefits [31].

3.2.4 Saponins

The saponin is widely distributed in the botanical kingdom and has many pharmacological actions and biological activities [20]. The analyzed leaves samples of the selected plants shows that *Delonix regia* was devoid of Saponins while *Tephrosia purpurea* displayed highest source of Saponins (0.70±0.20 mg/g DW) and contained almost five fold higher than *Dalbergia sissoo* (0.12±0.15 mg/g DW) (Table 2). Saponins from plants sources are also responsible for some pharmacological effects like anti-inflammatory, molluscicidal, antimicrobial, antispasmodic, antidiabetic and anticancer, hypocholesterolemic, antioxidant, anticonvulsant and analgesic, anthelmintic, antitussive and cytotoxic activities [23]. Generally saponins are toxic, but [36] showed that consumption of saponins by human beings may be beneficial in reducing heart disease (by binding of saponins with plasma membrane and cholesterol). The presence of steroidal saponins could develop resistance to viral diseases such as cancer [37]. The saponins had expectorant action which is very useful in the management of upper respiratory tract inflammation and stop bleeding and in treating of wounds.

3.2.5 Steroids

The steroids were present in trace amount with their higher concentration (0.18±0.03 mg/g DW) in *Tephrosia purpurea*

and near about same content were obtained from *Delonix regia* (0.17±0.06 mg/g DW). The least content of steroids was noted in *Dalbergia sissoo* (0.11±0.37 mg/g DW) (Table 2). Phytosterols are currently used for treating symptoms of uterine cramps, abdominal colic and menstrual irregularity while topical progesterone in pharmacological doses is used to treat a variety of conditions including premenstrual syndrome, anovulatory cycles, dysfunctional uterine bleeding, and menopausal symptoms [25]. An inverse association of sterols (Beta sitosterol and stigmasterol) interpreted against stomach cancer. This effect of plants sterol could have a major public health impact in a disease such as gastric cancer. This relationship remains after control for other antioxidant, such as Vitamin C [34]. Cholesterol and bile acid may promote colon cancer. The consumption of plant sterol, indirectly involved in bile secretion mechanisms and its effects lowered bile acid secretion. These effects may lead to a decreased risk for colon cancer development [35].

3.2.6 Tannins

The variable concentrations of tannins were observed in the leaves of studied plants (Table 2). The *Dalbergia sissoo* showed highest value (1.59±0.31 mg/g DW) as compared to other two medicinal plants and the moderate concentration in *Tephrosia purpurea* (0.77±0.05 mg/g DW) whereas lowest source was examined to be *Delonix regia* (0.52±0.15 mg/g DW). The defensive properties of tannins are generally attributed to their ability to bind proteins [12]. Plant tannins extracted from various sources have been also shown to possess antitumor-promoting effects in the skin of hairless mice by inhibiting several biochemical markers of tumor promotion induced by exposure to ultraviolet-B light. The protective effects of tannins against many types of cancers lead us to postulate that these polyphenols are universal antitumor agents. Other effects include their ability to hepatocellular carcinoma, accelerate blood clotting, reduce blood pressure, decrease the serum lipid level and modulate immunologic responses depending on the tannin doses and types used [26]. The research work was carried out on the ten selected medicinal

Table 2: Quantitative phytochemical constituents of selected fabaceae medicinal plants expressed as mg/g dry weight (DW).

Secondary Metabolites	Methanolic Extract of Plants		
	<i>Tephrosia purpurea</i>	<i>Delonix regia</i>	<i>Dalbergia sissoo</i>
Alkaloids	0.65±0.04	0.79±0.04	0.32±0.05
Flavonoids	32.59±0.42	28.29±0.65	16.02±0.29
Phenols	56.79±0.49	32.80±0.52	35.75±0.71
Saponins	0.70±0.20	-	0.12±0.15
Steroids	0.18±0.03	0.17±0.06	0.11±0.37
Tannins	0.77±0.05	1.59±0.31	0.52±0.15

(Data expressed as mean ± SD, n =3)

4. Conclusions

The selected ten medicinal plants are the source of the secondary metabolites i.e. alkaloids, flavonoids and phenol, saponins, steroids and tannins. Medicinal plants play a vital role in preventing various diseases. The antidiuretic, anti-inflammatory, antianalgesic, anti-cancer, 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 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 in the local plant of Allahabad will be helpful in the coping different diseases of this particular region. This study also leads to the further research in the way of isolation & identification of the active compound from these plants.

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