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RESEARCH ARTICLE

QUALITATIVE PHYTOCHEMICAL ANALYSIS OF NONPOLAR TO POLAR SOLVENT EXTRACTS OF SELECTED MEDICINAL PLANTS

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ABSTRACT

The present study analyses the qualitative phytochemical constituents of different solvent extracts of selected medicinal plants *Boerhaavia diffusa* Linn (root), *Terminalia bellerica* Linn (fruit) and *Tribulus terrestris* Linn (fruit). The extracts of the selected medicinal plants were prepared by using five different types of solvents using Soxhlet apparatus. The qualitative analysis of phytochemicals comprises carbohydrates, proteins, aminoacids, tannins, glycosides, alkaloids, triterpenes and flavonoids. Among the phytochemical constituents, flavonoids and triterpenes were present in all the plant extracts compared to others phytoconstituents. The study revealed that the selected medicinal plants contained various bioactive compounds and thus suggests their use in the treatment of various ailments.

INTRODUCTION

Medicinal plants are in use as a therapeutic agent to cure various kinds of diseases since from thousands of years in all the parts of our country. Some of the plants were also used by tribes with the knowledge of their medicinal value in the treatment of various kinds of infections in all the age groups of both males and females. Medicinal plants are widely used in the human therapy, veterinary, agriculture, scientific research and countless other areas (Vasu *et al*., 2009). From many years plants have been selected for medicinal purpose which makes a way to the development of new therapeutically effective drugs such as anticancer drugs (Dewick, 1996) and antimicrobial drugs (Phillipson and Wright, 1996). Phytochemicals are used as templates for lead optimization programs, which are intended to make safe and effective drugs. The bioactive molecules isolated from the medicinal plants are reported to be free from adverse drug reactions. Medicinal plants rich in chemical diversity is a source of antibiotic resistance modulating compounds (Sibanda *et al*., 2007; Saad *et al*., 2012). Medicinal plants contain some bioactive substances such as tannins, alkaloids, carbohydrates, terpenoids and flavonoids which makes a clear physiological action on the human body (Mann, 1978; Edoga *et al*., 2005). In this present study, the qualitative phytochemical analysis was carried out in three different medicinal plants from non-polar to polar solvent extracts of *Boerhaavia diffusa* (root), *Terminalia bellerica* (fruit) and *Tribulus terrestris* (fruit).

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Boerhaavia diffusa Linn. is popularly known as 'punarnava' belongs to Nyctaginaceae family and is widely used in the treatment of many disorders like Diabetes and Urinary tract infection in ayurveda. It is also used to treat gonorrhea, internal inflammation of all kinds, dyspepsia, oedema, jaundice, menstrual disorders, anaemia, liver, gall bladder and kidney disorders, enlargement of spleen, abdominal pain, abdominal tumours and cancers (Kritikar and Basu, 1956). *Terminalia bellerica* Linn. belongs to the family Combretaceae. The fruit of this medicinal plant is oval in shape. It has been reported that the fruits of *T.bellerica* are used to alleviate asthma, piles and cough (Chatterjee and Pakrasi, 2000). *Tribulus terrestris* Linn. belongs to Zygophyllaceae family and an annual herb found in many tropical areas of the world. It is used as a folk medicine as tonic, aprosidiac, analgesic, astringent, stomachic, anti-hypertensive, diuretic, lithon-triptic and urinary anti infectives (Majeed and Mahmood, 1988). It is also used to treat high blood pressure and rib pain (Topia *et al*., 1994).

MATERIALS AND METHODS

Collection of plant material

Fresh and healthy samples of *Boerhaaviadiffusa* Linn. (root), *Terminaliabellerica* Linn.(fruit) and *Tribulus terrestri* Linn. (fruit) were collected from Biligirirangana hills commonly called as BR hills of Chamarajanagar district, located in the southern tip of Karnataka state which lies between the North latitude 11°40'58'' and 12°6'32'' and East longitude 76°24'14'' and 77°46'55''. It falls in the southern dry zone of this district.

Extraction of plant material

The plant material was shade dried for about 15 days. The dried sample was then coarse powdered and stored in a sterile container. The successive extraction of the samples from nonpolar to polar solvents was done by using five different types of solvents such as petroleum ether, chloroform, ethylacetate, ethanol and water using Soxhlet apparatus. The extracts thus obtained were evaporated to dryness at room temperature and stored in a sterile air tight container (Pan *et al*., 2010).

Qualitative phytochemical analysis

The phytochemical analysis of the plant extracts were carried out for nine phytochemical constituents *viz*., carbohydrates, proteins, aminoacids, tannins, glycosides, alkaloids, triterpenes and flavonoids by using standard methods of Harborne (1973), Trease and Evans (1989) and Sofowara (1993).

RESULTS AND DISCUSSION

In the present study, the phytochemical analysis has been done in different types of extracts of *Boerhaavia diffusa* (root), *Termilalia bellerica* (fruit) and *Tribulus terrestris* (fruit) plant parts and compared between them. The selected medicinal plants showed the presence and absence of various kinds of phytoconstituents. Among all the phytoconstituents present in the plant extracts, flavonoids was found to be the most commonest one. Proteins were absent in all the plant extracts except the ethanolic extract of *Boerhaavia diffusa* (Table 1). Alkaloids was absent only in the extracts of *Terminalia bellerica* (Table 2). Carbohydrates were present in all the types of extracts of *Tribulus terrestris* (Table 3).

Tannins were absent in the extracts of *B. diffusa*. Many studies have proven that medicinal plants used as folk medicine in our country that plays an important role in the scientific field which enables in the development of new herbal drugs. As there is an increase in resistance by microorganisms to the present antibiotics and the high cost of production of synthetic compounds, there is a need to develop the antimicrobials from other sources effective against pathogens resistant to current antibiotics (Cowan, 1999). The phenolic compounds are one of the largest and most ubiquitous groups of plant metabolites (Singh *et al*., 2007). In a study, the selected medicinal plant containing phenolics, terpenoids and flavonoids proved to have a good antimicrobial activity against the multi drug resistant uropathogens showing maximum inhibition zone. Different kinds of phytoconstituents in aqueous, methanol and ether extracts of the medicinal plant proved to be anti-diabetic by decreasing the blood sugar level in diabetic rats (Kujur *et al*., 2010).

The effect of extract of bitter leaf showed a remarkable decrease in blood glucose level of the rats and has been reported that the presence of phytoconstituents and other components in the extract must have acted synergistically to potentiate the anti-diabetic role of the plant extract (Nwaoquikpe, 2010). Several studies have described the antiapoptosis, antiaging, anticarcinogen, antiinflammation, antiatherosclerosis, cardiovascular protection and improvement of endothelial function, as well as inhibition of angiogenesis and cell proliferation activities (Han *et al*., 2007). Natural antioxidant mainly comes from plants in the form of phenolic compounds such as phenolic acids, flavonoid, etc. (Ali *et al*., 2008). The plant extracts also revealed to contain

Table 1. Phytochemical analysis of different solvent extracts of *Boerhaavia diffusa*

Tests / Extracts	Carbohydrates	Proteins	Amino Acids	Tannin/ Phenolic Compounds	Glycosides as		Alkaloids	Triterpenes	Flavonoids
					Cardiac	Saponins			
Petroleum ether	-	-	-	-	-	-	-	+	+
Chloroform	-	-	-	-	+	-	-	+	+
Ethyl acetate	-	-	-	-	+	+	+	+	+
Ethanol	+	+	+	-	+	+	+	+	+
Water	+	-	-	-	-	+	+	-	-

+, present; –, absent

Table 2. Phytochemical analysis of different solvent extracts of *Terminalia bellerica*

Tests / Extracts	Carbohydrates	Proteins	Amino Acids	Tannin/ Phenolic Compounds	Glycosides as		Alkaloids	Triterpenes	Flavonoids
					Cardiac	Saponins			
Petroleum ether	+	-	-	-	-	-	-	+	+
Chloroform	+	-	-	-	-	-	-	-	+
Ethyl acetate	+	-	-	-	+	-	-	-	+
Ethanol	+	-	-	+	+	+	-	+	+
Water	-	-	-	+	-	+	-	-	-

+, present; –, absent

Table 3. Phytochemical analysis of different solvent extracts of *Tribulus terrestris*

Tests / Extracts	Carbohydrates	Proteins	Amino Acids	Tannin/ Phenolic Compounds	Glycosides as		Alkaloids	Triterpenes	Flavonoids
					Cardiac	Saponins			
Petroleum ether	+	-	-	-	-	-	-	+	+
Chloroform	+	-	-	-	+	-	-	+	+
Ethyl acetate	+	-	-	-	-	-	-	-	+
Ethanol	+	-	-	+	+	+	+	+	+
Water	+	-	-	+	+	+	+	-	+

+, present; –, absent

saponins which are known to produce inhibitory effect on inflammation (Just *et al*., 1998). Some of the characteristics of saponins include formation of foams in aqueous solutions, haemolytic activity, cholesterol binding properties and bitterness (Sodipo *et al*., 2000; Okwu, 2004). Alkaloids have been associated with medicinal uses of centuries and one of their common biological properties is their cytotoxicity (Nobori, 1994). The phytochemical analysis of the selected medicinal plants revealed the presence of alkaloids, tannins triterpenes and flavonoids, which has various medicinal properties. Plants containing tannins are known to posses antihelmintic activity (Makkar *et al*., 2009). The tannic acid is believed to be a potential therapeutic agent, which can be used in neurological diseases (Fu *et al*., 2008). Plants containing glycosides are naturally occurring compounds possessing pharmacological activities such as antibacterial, antitumour, antiviral, anti-inflammatory, neuroprotective, antioxidant, hepatoprotective, immunomodulatory and tyrosinase inhibitory activity (Nobre and Helio, 2007). Flavonoids are known to remove LDL-c from blood by increasing the LDL receptor densities in liver and binding to apolipoprotein B (Baum *et al*., 1998). Flavonoids also play a significant role in human health and fitness.

Conclusion

The present study revealed that the extracts of the selected medicinal plants containing many important phytochemical constituents such as carbohydrates, glycosides, flavonoids, tannins, phenols, saponins, carbohydrates, triterpines and alkaloids can be taken for the further study investigating pharmacological activities such as antibacterial, antitumour, antiviral, anti-inflammatory, neuroprotective, antioxidant, hepatoprotective, immunomodulatory and antidiabetic, urinary anti-infectives and to isolate the active compounds and develop effective drugs. Despite the widespread use of these medicinal plants in India, the literature contains a few reports on its phytochemical studies. The study may be a support for the preparations of food products or neutraceuticals. Similar studies are needed on medicinal plants in the view of new drug discovery.

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