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Phytochemical Analysis of Some Medicinal Plants from Western Region of India

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ABSTRACT

The aim of the present study was to investigate total phenols and flavonoids content of 53 traditionally used medicinal plants of western region of India. The plants/plant parts were extracted by cold percolation method in acetone and methanol. Qualitative phytochemical analysis was done for various phytoconstituents like alkaloids, tannins, cardiac glycosides, steroids and saponins. Total phenol and flavonoid conent was quantitatively estimated. Total phenolic contents were determined by the Folin-Ciocalteus reagent method. Total phenolic content was expressed as GAE (Gallic Acid Equivalents). Total flavonoid content was determined by the aluminium chloride colorimetric method. Total flavonoid content was expressed as quercetin equivalents. Tannins were present in more number of plants followed by cardiac glycosides and steroids. The *Mangifera indica* showed highest phenolic content, maximum content being in the methanol extract followed by *Strychnos nux-vomica*, *Origanum marjoram*, The *Aristolochia bracteolate* showed highest flavonoid content, maximum content being in the acetone extract followed by *Phyllanthus reticulates*, *Argemone mexicana*. Many reports suggest a positive correlation between total phenolic content and antioxidant activity so it can be stated that the *Mangifera indica* may possess good antioxidant property because of its high phenolic content.

Key words: Phenols, flavonoids, secondary metabolites, *Mangifera indica*, *Aristolochia bracteolate*

INTRODUCTION

Various medicinal properties have been attributed to natural herbs. Medicinal plants constitute the main source of new pharmaceuticals and healthcare products (Ivanova *et al*., 2005). The history of plants being used for medicinal purpose is probably as old as the history of mankind. The use of medicinal plants in the industrialised societies has been traced to the extraction and development of several drugs from these plants as well as from traditionally used folk medicine (Shrikumar and Ravi, 2007). Extraction and characterization of several active phytocompounds from these green factories have given birth to some high activity profile drugs (Mandal *et al*., 2007). The use of traditional medicine is widespread in India (Jeyachandran and Mahesh, 2007). A growing body of evidence indicates that secondary plant metabolites play critical roles in human health and may be nutritionally important (Hertog *et al*., 1993). It is belived that crude extract from medicinal plants are more biologically active than isolated compounds due to their synergistic effects (Jana and Shekhawat, 2010). Phytochemical screening of plants has revealed the presence

of numerous chemicals including alkaloids, tannins, flavonoids, steroids, glycosides and saponins etc. Secondary metabolites of plants serve as defense mechanisms against predation by many microorganisms, insects and herbivores (Cowan, 1999). Herbal medicines have become more popular in the treatment of many diseases due to popular belief that green medicine is safe, easily available and with less side effects. Indeed, the market and public demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic diversity (Misra, 2009).

Normally free radicals of different forms are generated at a low level in cells to help in the modulation of several physiological functions and are quenched by an integrated antioxidant system in the body. However, if free radicals are produced in excess amount they can be destructive leading to inflammation, ischemia, lung damage and other degenerative diseases (Halliwell *et al*., 1992; Cavalcanti *et al*., 2006). Free radical reactions, especially with participation of oxidative radicals, have been shown to be involved in many biological processes that cause damage to lipids, proteins, membranes and nucleic acids, thus giving rise to a variety of diseases (Lee *et al*., 2005; Campos *et al*., 2006).

The phenolic compounds are one of the largest and most ubiquitous groups of plant metabolites that possess an aromatic ring bearing one or more hydroxyl constituents (Singh *et al*., 2007). Phenolic compounds are widely found in the secondary products of medicinal plants, as well as in many edible plants (Hagerman *et al*., 1998). A number of studies have focused on the biological activities of phenolic compounds, which are potential antioxidants and free radical-scavengers (Rice-Evans *et al*., 1995; Cespedes *et al*., 2008; Reddy *et al*., 2008; Chanda and Dave, 2009). They posses biological properties such as: Antiapoptosis, anti-aging, anticarcinogen, anti-inflammation, anti-artherosclerosis, cardiovascular protection and improvement of the endothelial function, as well as inhibition of angiogenesis and cell proliferation activity (Han *et al*., 2007). Several studies have described the antioxidant properties of medicinal plants, foodsand beverages which are rich in phenolic compounds (Brown and Rice-Evans, 1998; Krings and Berger, 2001). Natural antioxidant mainly come from plants in the form of phenolic compounds such as flavonoids, phenolic acids, tocopherols, etc. (Ali *et al*., 2008). Many reports suggest that plants which are having more phenolic content show good antioxidant activity that is there is a direct correlation between total phenol content and antioxidant activity (Brighente *et al*., 2007; Salazar *et al*., 2008).

Plant products have been part of phytomedicines since time immemorial. These can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds, etc (Cragg and David, 2001) i.e., any part of the plant may contain active components. Knowledge of the chemical constituents of plants is desirable because such information will be of value for the synthesis of complex chemical substances. Such phytochemical screening of various plants is reported by many workers (Mojab *et al*., 2003; Parekh and Chanda, 2007; Parekh and Chanda, 2008).

In the present work, qualitative and quantitative phytochemical analysis was carried out in 53 plants of Western region of India.

MATERIALS AND METHODS

Plant collection: Fresh plant parts were collected randomly from Gujarat region, India (Anand Agricultural University, Anand; Junagadh Agricultural University, Junagadh and Saurashtra University campus, Rajkot) in the year 2007. The details of the plant/plant parts screened their families and vernacular name are presented in Table 1. Plants were compared with

voucher specimens deposited by Dr. P.S. Nagar at Department of Biosciences, Saurashtra University, Rajkot, Gujarat and India. Fresh plant materials were washed in tap water, air dried and then homogenized to fine powder and stored in airtight bottles.

Extraction: Ten gram of air-dried powder was taken in 100 mL of petroleum ether in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 190-220 rpm for 24 h. After 24 h, the supernatant was discarded and petroleum ether was evaporated from the powder. This dry powder was then taken in 100 mL of solvent (methanol or acetone) in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 190-220 rpm for 24 h. After 24 h, the extracts were centrifuged at 5000 g for 10 min, the supernatant was collected, solvents were evaporatedand the dry extract was stored at 4°C in airtight bottles. The extraction was done at least three times for each plant and the mean values of extractive yields are presented (Vaghasiya and Chanda, 2007).

The preliminary qualitative phytochemical analysis was carried out in crude dry powder of 53 plants; while total phenol and flavonoid content was estimated in methanol and acetone extracts of 53 plants.

Preliminary qualitative phytochemical screening: Preliminary qualitative phytochemical screening was done with meathod of Harbone (1998) and Parekh and Chanda (2007).

Alkaloids: The methanolic extract of the crude dry powder of each plant was evaporated to dryness in a boiling water bath. The residue was dissolved in 2 N HCl. The mixture was filtered and the filtrate was divided into 3 equal portions. One portion was treated with a few drops of Mayers reagent; one portion was treated with equal amount of Dragondroffs reagent and the other portion was treated with equal amount of Wagners reagent. The creamish precipitate, orange precipitate and brown precipitate, indicated the presence of respective alkaloids (Salehi-Surmaghi *et al*., 1992).

Tannins: The water extract of the crude dry powder of each plant was treated with alcoholic $FeCl_3$ reagent. Blue color indicated the presence of tannins (Segelman *et al*., 1969).

Cardiac glycosides: Keller-kiliani test was performed to assess the presence of cardiac glycosides. The crude dry powder of each plant was treated with 1 mL of $FeCl_3$ reagent (mixture of 1 volume of 5% $FeCl_3$ solution and 99 volumes of glacial acetic acid). To this solution a few drops of concentrated H_2SO_4 was added. Appearance of greenish blue color within a few minutes indicated the presence of cardiac glycosides (Ajaiyeobu, 2002).

Steroids: Liebermann-Burchard reaction was performed to assess the presence of steroids. A chloroform solution of the crude dry powder of each plant was treated with acetic anhydride and a few drops of concentrated H_2SO_4 were added down the sides of the test tube. A blue green ring indicated the presence of terpenoids.

Saponins: The presence of saponins was determined by Frothing test. The crude dry powder of each plant was vigorously shaken with distilled water and was allowed to stand for 10 min and classified for saponin content as follows: No froth indicate absence of saponins and stable froth more than 1.5 cm indicated the presence of saponins (Kapoor *et al*., 1969).

Quantitative phytochemical screening

Total phenol determination: Total phenolic content of the extracts was determined by Folin Ciocalteu reagent method (Mc Donald *et al*., 2001) with some modifications. Plant extract (1 mL) was mixed with Ciocalteu reagent (0.1 mL, 1 N) and allowed to stand for 15 min. Then 5 mL of saturated Na_2CO_3 was added. The mixtures were allowed to stand for 30 min at room temperature and the total phenols were determined spectrophotometrically at 760 nm. Gallic acid was used as a standard. Total phenol values are expressed in terms of gallic acid equivalent (mg g^{-1} of extracted compound).

Total flavonoid determination: Aluminium chloride colorimetric method (Chang *et al*., 2002) with some modifications was used to determine flavonoid content. Plant extract (1mL) in methanol was mixed with 1ml of methanol, 0.5 mL aluminium chloride (1.2%) and 0.5 mL potassium acetate (120 mM). The mixture was allowed to stand for 30 min at room temperature; then the absorbance was measured at 415 nm. Quercetin was used as standard. Flavonoid content is expressed in terms of quercetin equivalent (mg g^{-1} of extracted compound).

Statistical analysis: Each of the measurements was carried out in triplicateand the results are expressed as Mean±SEM.

RESULTS AND DISCUSSION

Preliminary qualitative phytochemical screening: Out of 53 plants, 14 plants showed good antimicrobial activity, as reported by Vaghasiya and Chanda (2007).

The secondary plant metabolites (phytochemicals) with antibacterial potency have been actively investigated as alternatives to and/or in combination with antibiotics in the therapy of bacterial infections (Sato *et al*., 1995; Liu *et al*., 2001).

The preliminary qualitative phytochemical screening of the crude powder of 53 plants was done to assess the presence of bioactive components. The presence of alkaloids (Dragendroff, Mayer, Wagner), flavonoids, tannins, steroids, saponins and cardiac glycosides was determined (Table 1).

Alkaloids were present in lower amount (+) in 32.08% of plants with Dragondroff test, in 13.21% with Mayer test and in 33.96% with Wagner test. Moderate amount (++) of alkaloids were present in 3.77% of the plants with Dragondroff test and Wagner test, 1.89% with Mayer test. Only 3.77% of plants contained higher amount (+++) of alkaloids with Dragondroff test.

Tannins were present in 20.75% of plants in lower amount, 13.21% in moderate amount and 33.96% in higher amount. Cardiac glycosides were present in 22.64% of plants in lower amount, in 20.75% in moderate amount and in18.87% in higher amount. Steroids were present in 13.21% of plants in lower amount, 32.08% in moderate amount and 15.09% in higher amount. Saponins were present in 33.96% of plants in lower amount, 1.89% in moderate amount and 3.77% in higher amount.

Quantitative phytochemical screening: Antioxidants and antimicrobial properties of various extracts from many plants have recently been of great interest in both research and the food industry, because their possible use as natural additives emerged from a growing tendency to replace synthetic antioxidants and antimicrobials with natural ones (Deba *et al*., 2008).

The results of total phenolic content and flavonoid content of methanol and acetone extracts of 53 plants are presented in Table 2.

Table 1: Preliminary qualitative phytochemical analysis of crude powder of 53 plants

	Alkaloids						
Name of the plant (Family, Vernacular name, part used)	DR	MR	WR	TN	CG	ST	SP
Abutilon glaucum (Cav.) (Malvaceae, balbij, leaf+stem)	+	-	+	-	+++	+	-
Adenanthera pavonina (L.) (Mimosaceae, raktchandan, leaf)	+	-	-	+	+++	+++	-
Agave vera cruz, Mill (Agavaceae, agave, leaf).	+	-	+	++	-	-	+++
Alangium salvifolium (Linn. F.) wang.(Alangiaceae, ankola, leaf)	-	-	+	+	++	++	+
Alpinia speciosa (Wendl.) k.schum. (Zingiberaceae, sthulgranthi, leaf+stem)	-	-	+	+++	-	-	-
Argemone mexicana (L.) (Papaveraceae, darudi, leaf+stem)	-	-	++	+++	+++	++	+
Argyreia speciosa Sweet (Convolvulaceae, samudrashokha, leaf+stem)	-	-	-	-	-	-	+
Aristolochia bracteolata Lam.(Aristolochiaceae, kidamari, whole plant)	-	-	-	+++	++	++	+
Aristolochia indica (L.) (Aristolochiaceae, nodvel/isarmuula, leaf)	-	+	+	+	+	++	+
Asphodelus tenuifolius Cav. (Liliaceae, dungro, leaf+stem)	-	-	+	-	-	-	-
Baliospermum montanum (Euphorbiaceae, danti, leaf+stem)	+	+	-	+++	-	-	++
Boerhavia diffusa (L.) (Nyctaginaceae, satodi, leaf+stem)	-	-	-	+	++	+++	-
Bombax ceiba (L.) (Bombacaceae, simlo, leaf)	+	-	-	+++	+	++	-
Carissa carandas (L.) Var. (Apocynaceae, karamda, leaf+stem)	+	-	-	+++	-	+	+
Cassia occidentalis (L.) (Caesalpiniaceae, kasundro, leaf+stem)	+	-	-	++	+	+	-
Casuarina equisetifolia (L.) (Casuarinaceae, sharu, leaf+stem+fruit)	+	-	-	+++	+	+	-
Celastrus paniculatus Willd. (Celastraceae, malkangni, leaf)	-	-	-	-	-	++	-
Citrus medica (L.) (Rutaceae, bijoru, leaf)	+	-	-	-	+	++	-
Clerodendrum phlomidis (Verbenaceae,arani, leaf+stem)	-	-	-	-	-	-	-
Datura innoxia Mill. (Solanaceae, daturo, leaf)	-	-	+	-	+++	+++	-
Desmodium gangeticum (L.) Dc (Fabaceae, saliparni, leaf)	-	-	-	-	+++	+++	-
Drypetes roxburghii (Wall.) hurasawa (euphorbiaceae, putranjiva, leaf)	+	-	-	+++	+++	++	+
Ficus carica (L.) (Moraceae, anjir, leaf)	-	-	-	++	++	+	-
Gymnema sylvestre (Retz.) R. Br. (Asclepiadaceae, madhunasini, leaf+stem)	+	-	-	+	+++	+	+++
Hemidesmus indicus (L.) R.Br. (Asclepiadaceae, anantmul+ leaf)	-	-	+	+++	+	-	+
Holoptelea integrifolia (Roxb.) planch. (Urticaceae, chibil, leaf)	+	-	-	+	++	+++	+
Jasminum auriculatum Vahl. (Oleaceae, juuhi, leaf)	-	-	+	++	++	++	+
Leptadenia reticulata (Retz.) wight and arn. (asclepidaceae, dodishaak, leaf+stem)	-	-	-	+	+++	++	-
Leucas aspera (Willd.) link. (Labiatae, kubo, leaf)	-	-	-	+	++	+++	-
Madhuca indica gmelin. (Sapotaceae, mahudo, leaf)	+++	+	-	++	-	++	-
Mangifera indica (L.) (Anacardiaceae, keri, seed)	-	-	-	+++	-	+	-
Maranta arundinacea L. (Marantaceae, kookaineer, leaf)	-	-	-	-	-	-	-
Merremia turpethum (L.) shah and bhatt (Convolvulaceae, nashottar, leaf)	+		+	+	++	++	-
Murraya paniculata (L.) jack (Rutaceae, kamini, leaf+stem)	-	-	+	++	++	-	+
Origanum marjoram (L.) (Lamiaceae, dawanam, leaf+stem)	-	-	-	++	-	-	-
Phyla nodiflora (L.) greene (Verbenaceae, ratvelio, leaf+stem)	-	-	+	+++	-	-	-
Phyllanthus reticulatus Poir (Euphorbiaceae, kamboi, leaf+stem)	+	-	-	+++	+	++	+
Pluchea arguta boiss (Asteraceae, rashna, leaf+stem)	+	++	++	+++	+++	-	+
Randia dumetorum Lam. (Rubiaceae, gangeda, leaf+stem)	++	+		++		+	+
Rauvolfia tetraphylla (L.) (Apocynaceae, bada chand, leaf+stem)	-	-	+	+++	++	++	+
Scaevola koenigii Vahl. (Goodeniaceae, bhadraaksha, leaf)	-	-	+	-	-	-	-
Scindapsus officinalis (Roxb.) schott (Araceae, gajapipal, leaf)	-	-	+	+	++	++	-
Strychnos nux-vomica (L.) (Loganiaceae, zerchochlu, leaf+stem)	-	-	-	+++	+	+++	-
Tamarindus indica (L.) (Caesalpiniaceae, amli, leaf+stem)	+	+	-	-	+	-	-
Tecomella undulata (Sm.) seem. (Bignoniaceae, ragatrohido, leaf+stem)	+	+	+	+	+	-	-
Tephrosia purpurea (L.) pers. (Fabaceae, sarpankho, leaf)	-	-		+++	++		-

Table 1: Countinued

Name of the plant (Family, Vernacular name, part used)	Alkaloids						
	DR	MR	WR	TN	CG	ST	SP
Thespesia populnea (L.) Solex correa (malvaceae, paraspipal. Leaf)	+	-	-	-	-	-	-
Tinospora cordifolia (Willd.) miers hook. F and Th (menispermaceae,galo, leaf+stem)	-	-	-	-	+	++	-
Trienthema monogyna (L.) (Aizoaceae, satodo, leaf+stem)	-	-	-	-	-	+	-
Trigonella foenum-graecum (L.) (Fabaceae, methi, leaf+stem)	-	-	-	-	+	+++	-
Vitex negundo (L.) (Verbenaceae, nagod, leaf+stem)	-	-	+	+++	+++	-	+
Woodfordia fruticosa Kurz. (Lythraceae, dhavdi, leaf)	+++	+	+	+++	-	-	+
Woodfordia fruticosa Kurz. (Lythraceae, dhavdi, stem)	++	-	-	+++	+	++	+

DR: Dragondroff's reagent; MR: Mayers reagent; WR: Wagners reagent; TN: Tannins; CG: Cardiac glycosides; ST: Steroids; SP: Saponins; (-): Absence; (+): Less presence; (++): Moderate presence; (+++): High presence

Table 2: Total phenolic and flavonoids content of acetone and methanol extracts of 53 plants

Plants	Total phenol (mg g^{-1})		Flavonoids (mg g^{-1})	
	AE	ME	AE	ME
Abutilon glaucum	12.85±0.11	17.89±0.52	14.68±0.38	18.25±0.07
Adenanthera pavonina	22.48±0.35	57.43±1.41	19.86±0.46	32.50±0.17
Agave vera	27.51±0.13	25.54±0.46	4.16±0.14	15.85±7.89
Alangium salviifolicum	15.48±0.14	65.71±1.93	0.83±0.05	44.74±0.11
Alpinia speciosa	27.41±0.19	120.54±3.47	35.21±0.73	64.65±2.23
Argemone mexicana	17.49±0.26	29.75±0.31	28.32±0.30	79.54±0.62
Argyreia speciosa	58.43±0.58	81.78±0.19	33.87±0.15	27.08±3.97
Aristolochia bracteolate	39.67±0.92	59.22±0.65	130.93±2.58	36.06±0.17
Aristolochia indica	25.11±0.18	56.66±1.68	30.41±0.19	27.22±0.10
Asphodelus tenuifolius	17.23±0.53	23.88±0.86	34.02±1.20	8.79±0.31
Baliospermum montanum	16.87±0.41	71.48±1.98	52.55±0.32	42.67±8.17
Boerhavia diffusa	28.07±0.21	84.05±0.11	1.23±0.01	29.77±0.20
Bombax ceiba	31.11±0.77	45.64±0.24	25.74±0.14	76.94±0.60
Calastrus paniculatus	7.68±0.04	14.81±0.11	29.62±0.65	31.49±0.19
Carissa carandas	77.98±0.60	84.70±0.20	27.42±5.20	28.65±0.52
Cassia occidentalis	65.82±0.90	71.28±0,84	21.90±0.48	45.76±0.51
Casuarina equissetifolia	146.33±0.73	248.15±3.55	42.28±0.74	33.38±0.39
Citrus medica	20.05±0.41	40.77±0.29	30.67±0.53	22.62±0.18
Clerodendron phlomidis	9.05±0.10	29.78±0.32	35.88±0.30	17.98±0.55
Datura innoxia	3.65±0.05	29.53±0.38	19.35±0.20	33.00±0.20
Desmodium gangeticum	6.66±0.16	49.19±0.96	10.61±0.47	37.02±0.15
Drypetes roxburghii	136.15±2.18	83.04±1.25	26.83±0.31	42.32±0.07
Ficus carica	4.02 ±0.08	46.45±0.68	24.26±0.24	65.44±0.60
Gymnema sylvestre	26.41±0.32	40.22±0.74	70.99±0.89	17.98±0.55
Hemidesmus indicus	11.97±0.14	85.45±0.82	31.03±0.42	26.29±0.29
Holoptelea integrifolia	10.65±0.17	29.62±0.30	43.59±0.94	51.37±0.37
Jasminum auriculatum	68.74±1.05	41.97±0.68	26.14±0.28	22.79±0.12
Leptadenia reticulate	24.45±0.03	47.15±0.21	24.90±0.92	54.88±9.42
Leucas aspera	23.58±0.46	50.90±0.35	1.56±0.02	48.19±0.32
Madhuca indica	83.02±1.98	59.44±0.26	15.15±0.10	26.99±0.15

Table 2: Continued

Plants	Total phenol (mg g^{-1})		Flavonoids (mg g^{-1})	
	AE	ME	AE	ME
Mangifera indica	219.31±3.69	427.28±10.5	9.86±0.70	6.36±0.30
Maranta arundinacea	5.96±0.13	25.92±0.86	13.69±0.19	17.63±0.38
Merremia turpethum	12.34±0.03	45.75±0.14	15.81±0.69	30.16±0.09
Murraya paniculata	14.83±0.12	53.00±0.90	25.30±0.08	41.92±13.92
Origanum marjoram	33.75±1.02	274.95±2.63	27.65±0.08	45.01±0.92
Phyla nodiflora	10.79±0.26	64.84±1.04	39.79±0.26	31.64±0.18
Phyllanthus reticulatus	191.73±6.62	172.27±2.90	20.31±0.30	49.84±0.13
Pluchea arguta	59.50±0.79	78.82±1.28	88.47±0.91	53.67±0.44
Randia dumetorum	23.65±0.08	66.72±0.13	49.16±0.86	22.98±0.08
Rauvolifera tetraphylla	25.54±0.59	59.30±0.80	20.21±0.61	65.50±0.60
Scaevola koenigii	18.69±0.14	36.31±0.30	16.03±0.15	14.36±0.18
Scindapsus officinalis	7.81±0.13	54.35±0.52	63.12±0.19	33.11±0.18
Strychnos nux-vomica	208.18±2.73	337.82±2.80	19.15±0.10	56.76±0.29
Tamarindus indica	17.84±0.28	29.26±0.17	3.84±0.05	18.77±0.02
Tecomella undulate	31.46±0.07	65.01±1.24	14.77±0.08	34.14±0.16
Tephrosia purpurea	16.52±0.46	58.74±0.06	15.89±0.11	31.84±0.03
Thespesia populnea	6.78±0.32	37.77±0.45	28.64±0.13	27.41±0.07
Tinospora cordifolia	15.90±0.32	38.86±0.32	17.76±0.10	28.09±0.08
Trienthema monogyna	11.69±0.01	26.85±0.46	11.83±0.09	14.82±0.43
Trigonella foenumgraecum	15.79±0.11	46.03±0.51	14.49±0.11	30.97±0.24
Vitex negundo	23.81±0.47	62.38±0.55	16.37±0.51	21.80±0.69
Woodfordia fruticosa (Stem)	140.28±5.73	130.43±2.13	14.87±0.85	9.10±0.14
Woodfordia fruticosa (Leaf)	118.31±6.19	387.84±7.73	63.74±0.71	38.42±0.71

n = 3, Data is presented as Mean±SEM; AE: Acetone extract; ME: Methanol extract

Total phenolic content was higher in methanol extracts than acetone extracts. Only 11.32% acetone extracts showed higher total phenolic content than methanol extracts, while 88.68% methanol extracts showed higher total phenolic content than acetone extracts. 35.85% acetone extracts showed higher flavonoid content than methanol extracts, while 64.15% methanol extracts showed higher flavonoid content than acetone extracts. These results are in support with the Pourmorad *et al.* (2006).

Out of 53 acetone extracts of the plants studied, 9 plants contained higher total phenolic content (>70 mg g^{-1}), which were in the following order: *Mangifera indica*>*Strychnos nux-vomica* >*Phyllanthus reticulatus*>*Casuarina equissetifolia*>*Woodfordia fruticosa* (Stem)>*Drypetes roxburghii*>*Woodfordia fruticosa* (Leaf)>*Madhuca indica*>*Carissa carandas* (Table 2).

Of the methanol extracts of the 53 plants studied, 16 plants contained higher total phenolic content (>70 mg g^{-1}), which were in the following order: *Mangifera indica*>*Woodfordia fruticosa* (Leaf)>*Strychnos nux-vomica*>*Origanum marjoram*>*Casuarina equissetifolia*>*Phyllanthus reticulatus*>*Woodfordia fruticosa* (Stem)>*Alpinia speciosa*>*Hemidesmus indicus*>*Carissa carandas* >*Boerhavia diffusa*>*Drypetes roxburghii*>*Argyreia speciosa*>*Pluchea arguta*>*Baliospermum montanum*>*Cassia occidentalis* (Table 2).

Of the acetone extracts of the 53 plants studied, only 3 plants contained higher amount of flavonoids (>70 mg g^{-1}), which were in the following order: *Aristolochia bracteolate*>*Pluchea arguta* >*Gymnema sylvestre*. Out of 53 methanol extracts of the plants studied, only two plants contained higher amount of flavonoids, which were *Argemone mexicana* and *Bombax ceiba*.

The antioxidant properties of plant extracts is attributed to their polyphenolic contents (Lu and Foo, 2001; Murthy *et al*., 2002). As such plants containing a high level of polyphenols have a greater importance as natural antimicrobics (Baravalia *et al*., 2009).

CONCLUSION

The results of preliminary qualitative phytochemical study of the crude powder of 53 plants showed the presence of alkaloids (30.82%), tannins (67.92%), cardiac glycosides (62.26%), steroids (60.38%)and saponins (39.62%). Tannins were present in more number of plants followed by cardiac glycosides and steroids.

The results of total phenolic and flavonoid content showed that the methanol extract of *Mangifera indica* showed highest total phenolic content, while acetone extract of *Aristolochia bracteolate* showed highest flavonoid content than other plant extracts. Thus, the plants studied here can be seen as a potential source of new useful drugs. The phytochemical characterization of the extracts, the identification of responsible bioactive compounds and quality standards are necessary for future study.

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