American Journal of Advanced Drug Delivery

www.ajadd.co.uk

Original Article

Phytochemical Screening and GC-MS Analysis of *Drynaria quercifolia* Rhizome

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Date of Receipt- 23/10/2014
Date of Revision- 28/11/2014
Date of Acceptance- 28/11/2014

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ABSTRACT

The investigation was carried out to determine qualitatively the phytoconstituents from the methanol and petroleum ether extracts of *Drynaria quercifolia* Linn. rhizome. Among the phytochemical screening of these extract, methanolic extract showed high number of constituents like alcohol, carbohydrates, phytosterols, phenols, tannins, flavonoids, proteins and aminoacids, steroids, saponins, cholinergic acids, glycosides, and resins than petroleum ether extract. In this study, we also analyzing the potent bioactive compounds in the methanol extract using Gas Chromatography-Mass Spectroscopy. Thirty compounds have been identified from GC-MS analysis. Some of them found in high concentration which were identified by high peak values. Medicinal potential of these components needs further research on toxicological aspects to develop safe drug.

Keywords: Phytochemical, *Drynaria quercifolia*, GC- MS analysis.

INTRODUCTION

Drynaria quercifolia (Asvakatri) belongs to Family of Polypodiaceae is an epiphytic medicinal pteridophyte, distributed widely in the evergreen forests of the western Ghats of Kerala, and locally called Marappan kilangu or Attukal kilangu. The rhizome is reported to be used by tribal communities of Tamil Nadu and Kerala to cure various diseases like dyspepsia and cough[1]. The leaves are used for poulticing swelling. The plant is used to treat body ache, head ache and with other drugs in rhematic pain[2]. The whole plant of *Drynaria quercifolia* is anthelmintic, pectoral, expectorant and tonic, and is used to treat skin diseases and loss of appetide[3]. The plant is known to have therapeutic uses in tuberculosis and fever. The fronds are pounded and used as a poultice for swelling because of its antibacterial and astringent properties[4]. Rhizome and roots are used as tonic in typhoid fever[5]. It is very specifically used in the treatment of migraine. Traditional use of this drug is in diarrhea,

typhoid, cholera, jaundice, and syphilis[6]. *Drynaria* rhizome is used topically in traditional Chinese medicine to stimulate hair growth and to treat baldness. In the treatment of hyperthyroidism, *Drynaria* along with other drugs are used. In these conditions *Drynaria* is used externally as well as internally. *D. quercifolia* along with other combination of herbs is used to treat pain from traumatic injury, such as sprains and contusions with bruising and swelling[4]. The rhizome is also reported to have antifertility[7], anti inflammatory[8], analgesic[9], antipyretic[10,11], antibacterial[12] and anti-ulcer[13] properties. In the present study, phytochemical components were analyzed qualitatively and GC-MS analysis was also performed.

MATERIALS AND METHODS

Collection and processing of plant material

The rhizome of *Drynaria quercifolia* linn. (Fam: Polypodiaceae) was collected from Kollimalai, Namakkal district, Tamil Nadu, India. The collected samples were carefully kept in polythene bags. These plant samples were authenticated by Dr. S. Johnbritto, The Director, the Rabinet Herbarium Centre for Molecular Systematic, St. Joseph's College, Tiruchirappalli and a voucher specimen was deposited in the Department of Biochemistry, S.T.E.T. Women's College, Mannargudi, Thiruvarur District, Tamil Nadu (Voucher NO 001). The rhizome is covered with small brown coloured hair like structures. They were removed using sterile scalpel and washed with sterile distilled water. They were cut into small pieces and dried in shade and made into fine powder, using blender, and stored in air tight containers until further studies.

Extraction of plant material

20g of rhizome powder of *Drynaria quercifolia* was weighed and macerated in methanol and petroleum ether extract separately in the ratio of 1:6. They were kept at room temperature for 72 h. The mixture was stirred every 24 h using a sterile glass rod. Then it was filtered through the Whatman No: 1 filter paper. Extraction procedure was done further twice for complete extraction of bioactive compounds. The obtained filtrates were combined together and concentrated in vacuum using rotary evaporated. The dried residues of each extract was used for qualitative analysis. 2µl of methanolic extract of *Drynaria quercifolia* rhizome was employed for GC-MS analysis.

Phytochemical studies

The freshly prepared methanol and petroleum ether extract were subjected to preliminary phytochemical screening for the presence of bioactive constituents[14,15].

GC-MS analysis

GC-MS was performed with GC Clarus 500 Perkin Elmer equipment. Compounds were separated on Elite-1 capillary column (100% Demethly polysiloxane). Samples were injected with a split ratio of 10:1 with a flow rate of helium (carrier gas) 1ml/min. Mass detector-Tyrbo Mass gold–Perkin elmer Software–Turbomass 5.1 was used as a detector. Other conditions are oven temperature upto 110^0 - 2min. Hold; upto 280^0 at the rate of 5 deg/min^{-9} minutes hold. Injector temperature was maintained at 250^0 C[16]. The constituents were identified after comparison with those available in the Computer Library (NIST ver. 2.1) attached to the GC-MS instrument and reported.

RESULTS AND DISCUSSION

The phytochemical compounds of *Drynaria quercifolia* were investigated and their results were given in the table -1. The phytochemical compound such as tannins,

saponins, flavonoids, steroids, coumarins, alcohol, glycosides, carbohydrate, phytosterol, fixed oils, phenol, protein and amino acids and cholinergic acids were found in methanolic extract. Tannins, saponins, coumarins, glycosides, carbohydrate, fixed oils and phenols were present in petroleum ether extract. These compounds may be responsible for several medicinal activities.

The results pertaining to the GC-MS analysis were given in table 2. Thirty compounds were identified in methanolic extract of *Drynaria quercifolia* rhizome. The GC-MS analysis was done using the instrument GC Clarus 500 Perkin Elmer. The sample was run for 35 mins. The active principles with their retention time (RT), molecular formula, molecular weight (MW) and concentration (peak area %) were presented. The chromatogram shows the four prominent peaks in the retention time range from 21.731 to 25.700. The peak at 21.731 retention time is having the peak area 36.05%. The largest peak is due to the presence of 1, 2-Benzenedicarboxylic acid diethyl ester. The second less prominent peak at 21.633 retention time has the peak area of 13.95% is due to the presence of 1,2- Benzenedicarboxylic acid, methyl ester followed by the third less prominent peak of 4,P-chlorophenyl-2-dimethyl amino-5-nitro-sothiozole (6.57%) has the retention time 32.608, and fourth less prominent peak was indicated the compound 1,3-diphenyl-1, 3, 5, 5-tetra methylcyclotrisiloxane (6.08%) and their retention time is 25.700. The other less prominent peak at other retention time of various compounds were also given in table 2 and fig 1. Among the phytochemical, n-Hexadecanoic acid has the antimicrobial, antioxidant[17], and larvicidal activity[18]. The another phytochemical 9, 12, Octa decadienoic acid (Z, Z) has anti-inflammatory and anti arthritic activity[19].

CONCLUSION

In the present study, thirty chemical constituents have been identified from methanolic extract of *Drynaria quercifolia* rhizome by Gas Chromatogram Mass Spectrometry (GC-MS) analysis. These results revealed that the presence of various bioactive compounds which may have high medicinal value to cure various diseases. However, further studies are needed on these extract in order to isolate, identify, characterize and elucidate the structure of these compounds.

ACKNOWLEDGEMENT

Authors are thankful to our Managing Trustee, Correspondent, and Principal of S.T.E.T. Women's College, Mannargudi, Thiruvarur, Tamil Nadu for their moral support, encouragement and guidance during research work.

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Table 1. Phytochemical screening of *Drynaria quercifolia* rhizome

S. No.	Phytochemicals	Results	
		Methanol extract	Petroleum ether extract
1	Tannins	+	+
2	Phlobatannins	-	-
3	Saponins	+	+
4	Flavonoids	+	-
5	Steroids	+	-
6	Terpenoids	-	-
7	Coumarins	+	+
8	Alkaloids	+	-
9	Glycosides	+	+
10	Carbohydrate	+	+
11	Phytosterols	+	-
12	Fixed oil and fats	+	+
13	Phenol	+	+
14	Protein and aminoacids	+	-
15	Cholinergic acid	+	-

(+)-positive
(-)-negative

Table 2. Phyto components identified in the methanolic extracts of *Drynaria quercifolia* rhizome by GC-MS

S. No	R. time	Name of the compound	M. formula	MW	Peak area%
1.	4.354	Pentanoic Acid, Methyl Ester	$C_6 H_{12} O_2$	116	0.29
2.	9.780	Undecane (Cas) N-Undecane	$C_{11} H_{24}$	156	0.46
3.	13.255	Cyclohexasiloxane, Dodecamethyl-	$C_{12}H_{36} O_6$	444	0.32
4.	21.633	1, 2-Benzenedicarboxylic Acid, Diethyl Ester	$C_{12} H_{14} O_4$	222	13.94
5.	21.731	1, 2-Benzenedicarboxylic Acid, Diethyl Ester	$C_{12} H_{14} O_4$	222	36.05
6.	23.209	Cyclooctasiloxane, Hexadecamethyl-	$C_{16}H_{48}O_8Si_8$	592	1.87
7.	25.700	1, 3-Diphenyl-1, 3, 5, 5-Tetramethyl-yclotrisiloxane	$C_{16}H_{22}O_3Si_3$	346	6.08
8.	26.163	Benzenesulfonamide, 3-Amino-4-Hydroxy-	$C_6 H_8 N_2 O_3 S$	188	0.82
9.	26.274	Octadecamethylcyclononasiloxane	$C_{18} H_{54} O_9 Si_9$	666	0.78
10.	27.108	Benzenepropanoic Acid,. Alpha., 4-Bis(Acetyloxy)-, Methyl Ester	$C_{14} H_{16} O_6$	280	1.54
11.	27.221	1, 2-Benzenedicarboxylic Acid, Bis (2-Methylpropyl) Ester	$C_{16} H_{22} O_4$	278	3.74
12.	27.285	2-Pyridinepropanamide, N-Phenyl-	$C_{14} H_{14} N_2 O$	226	1.95
13.	27.419	Silane, [1, 3, 5-Benzenetriyltris (Oxy)] Tris [Trimethyl-	$C_{15} H_{30} O_3 Si_3$	342	3.66
14.	27.975	Hexadecanoic Acid, Methyl Ester (Cas) Methyl Palmitate	$C_{17} H_{34}$	270	3.33
15.	28.495	Palmitic Acid	$C_{16} H_{32} O_2$	256	2.18
16.	28.673	1, 2-Benzenedicarboxylic Acid, Dibutyl Ester	$C_{16} H_{22} O_4$	278	3.08
17.	29.396	Nonamethyl, Phenyl-, Cyclopentasiloxane	$C_{15}H_{32}O_5Si_5$	432	0.89
18.	30.283	1-Octadecanol	$C_{18} H_{38} O$	270	0.36
19.	30.386	9, 12-Octadecadienoic Acid (Z, Z)-, Methyl Ester	$C_{19} H_{34} O_2$	294	3.26
20.	30.450	9-Octadecenoic Acid (Z)-, Methyl Ester	$C_{19} H_{36} O_2$	296	0.93
21.	30.653	Tetracosamethylcyclododecasiloxane	$C_{24} H_{72} O_{12} Si_{12}$	888	0.23
22.	30.747	Octadecanoic Acid, Methyl Ester	$C_{19} H_{38} O_2$	298	0.24
23.	30.925	Octadec-9-Enoic Acid $$ 9-Octadecenoic Acid	$C_{18}H_{34}O_2$	282	0.57
24.	31.497	Pentamethyl Phenyl-Disilane	$C_{11}H_{20}Si_2$	208	1.20
25.	32.608	4-P-Chorophenyl-2-Dimethylamino-5-Nitrosothiazole	$C_{12} H_{13} N_3 O S$	247	6.57
26.	33.962	1.26 Pentamethyl Phenyl-Disilane	$C_{11} H_{20} Si_2$	208	1.26
27.	34.593	(4-Chlorophenyl)Methanesulfonamide	$C_7H_8ClNO_2S$	205	1.10
28.	37.299	Cyclooctasiloxane, Hexadecamethyl	$C_{16}H_{48}O_8Si_8$	592	0.48
29.	38.298	1, 2-Benzenedicarboxylic Acid, Diisooctyl Ester	$C_{24} H_{38} O_4$	390	1.70
30.	38.553	Phosphine Oxide, Triphenyl-	$C_{24} H_{38} O4$	390	1.11

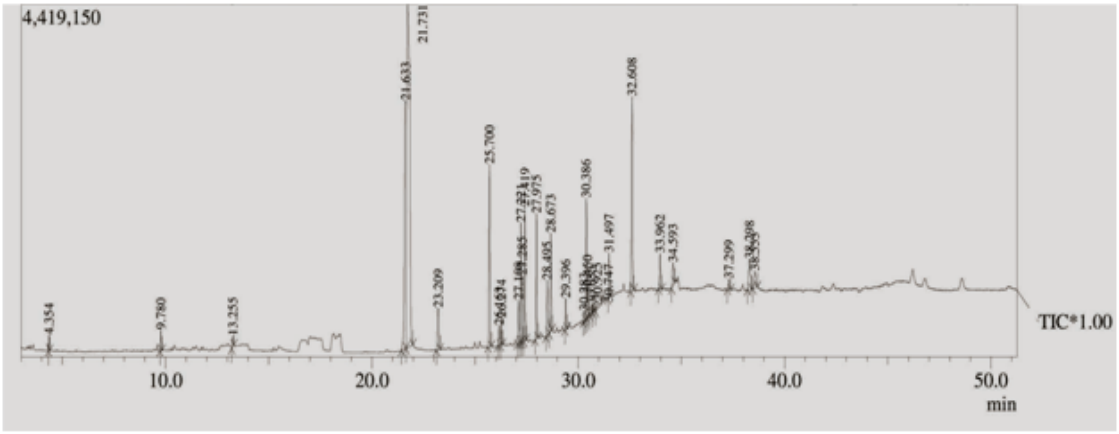

Figure 1. GC-MS Chromatogram of methanolic extract of *Drynaria quercifolia* rhizome