

GC-MS Analysis of *Momordica charantia* and *Momordica dioica* Fruit and Root Methanolic Extracts

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ABSTRACT

The present paper reports the GC-MS analysis studies of *Momordica charantia* and *Momordica dioica* Fruit and Root methanolic extracts. An attempt is made to analyze comparatively for the presence of similar compounds with biological activity in both the plants, to assess the chemotaxonomic relationship between these two plants. These two plants are perennial, rhizomatous, climbers belonging to cucurbitaceae family. These are seasonal vegetables of high demand and medicinal plants in Asian countries. *Momordica charantia* is indigenous and because of its higher medicinal importance it is also cultivated throughout the world. There is a growing demand for fruit and roots of *Momordica charantia* and *Momordica dioica* in the pharmaceutical trade due to their usage as medicinal agents for anti-inflammation, degenerative diseases including atherosclerosis, ischemic heart disease, ageing, diabetes mellitus, cancer, neurodegenerative diseases and others. In the present study fruit and roots of *Momordica charantia* and *Momordica dioica* were sequentially extracted by methanol and GC-MS analysis is carried for the extracts separately. The extracts showed the presence of many phytoconstituents reported in these plants. The GC-MS analysis of the methanolic extract revealed the presence of many similar major compound like palmitic acid with antidiabetic property is identified in both fruit and root methanolic extracts of *Momordica charantia* and *Momordica dioica*. This study forms a basis for the biological characterization and importance of the compounds identified.

Keywords: GC-MS analysis, Fruit and Root extract, *Momordica charantia* and *Momordica dioica*, Palmitic acid, Karela, Boda Kakara, Vegetables.

INTRODUCTION

Indian traditional system of medicine is based on various systems of medicine such as Ayurveda, Siddha, Unani and Homoeopathy. During the last few years the graph of standardization of medicinal plants of potential therapeutic significance has been increased. The evaluation of all medicinal plants is based on phytochemical and pharmacological approaches which lead to drug discovery and it is referred to as “natural product screening”¹. Secondary products from the plants are responsible for its action or pharmacological activity^{2,3}. The World Health Organization (WHO) has listed 21 000 plants, which are used for medicinal purposes around the world. Among them, 150 species are used commercially on a fairly large scale⁴.

Momordica dioica Roxb. is a perennial, rhizomatous, dioecious climber belonging to cucurbitaceae family. This is a seasonal vegetable of high demand and medicinal plant in Asian countries. This species is indigenous and because of its higher medicinal importance it is also cultivated throughout the world⁵. Spine gourd has various vernacular names in different regional languages of India viz: Akakara, Bodakakara, Kakor, Dharkarela, Batkarila, Kartoli, Aegaravalli and Vahisi⁶. Fruits of spine gourd are free from cholesterol and are highly energetic with

adequate amount of water, protein and important minerals and vitamins^{7,8}. The medicinal importance of spine gourd are sex-specific and only female plants have medicinal values. The leaves of female spine gourd are used as an aphrodisiac, to eliminate the parasites present in the human intestine, cure fever and respiratory disorders. Literature review⁹, stated that root tubers are used for the treatment of headaches, kidney stones and jaundice. Medicinal value of this plant was also reported by many researchers that fruits are useful in the treatment of asthma, leprosy, fever, tumors, urinary discharges, excessive salivation, and heart disease. Furthermore¹⁰, it is also noticed that fruit powder is used to induce sneezing, leading to nasal clearing.

Momordica Charantia commonly called bitter melon belongs to the family cucurbitaceae and grows in tropical areas, including parts of the Amazon, East Africa, Asia, and the Caribbean, and is cultivated throughout South America as a food and medicine. It's a slender, climbing annual vine with long-stalked leaves and yellow, solitary male and female flowers borne in the leaf axils. The fruit looks like a warty gourd, usually oblong and resembling a small cucumber. All parts of the plant, including the fruit, taste very bitter. In Guyana the leaf tea is used as traditional medicine for diabetes, to expel intestinal gas, to promote menstruation, as an antiviral for treating measles,



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Sample Information

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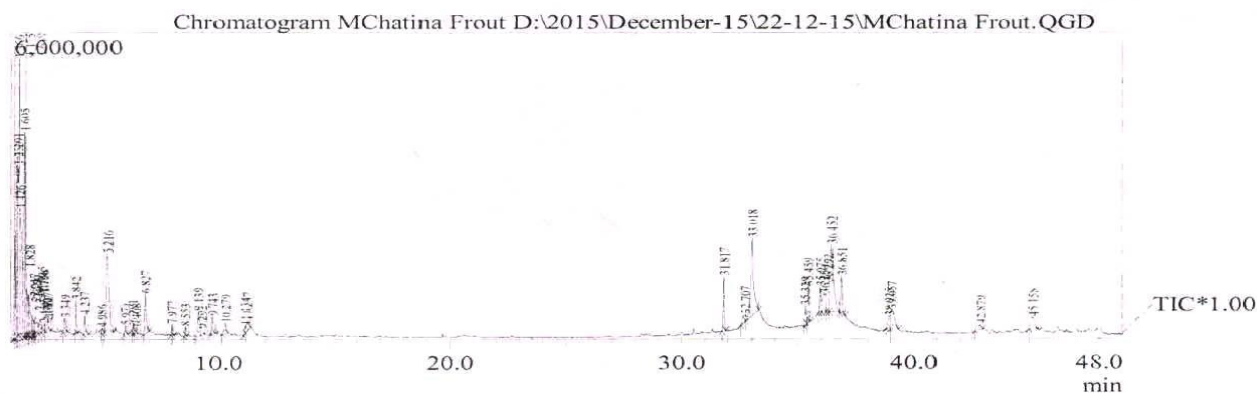


Figure 1: GC-MS Chromatogram of *M. charantia* fruit extract.

Table 1: Major compounds of GC-MS Chromatogram of *M. charantia* fruit extract.

S. no	R. Time	Name of the compound	Molecular formula	Mol Weight	Peak Area %
1	1.250	Ethanedioic acid (CAS) Oxalic acid	C ₂ H ₂ O ₄	90	5.96
2	1.275	2-Propanol (CAS) Isopropyl alcohol	C ₃ H ₈ O	60	4.28
3	1.317	Acetic acid, methyl ester, Devoton	C ₃ H ₆ O ₂	74	9.14
4	1.400	Propanol	C ₄ H ₈ O	72	7.83
5	1.533	Acetic acid (CAS) Ethylic acid	C ₂ H ₄ O ₂	60	7.43
6	1.625	Silane, dimethoxydimethyl, Acetol	C ₄ H ₁₂ O ₂ Si	120	7.11
7	4.237	4-cyclopentene-1,3-dione	C ₅ H ₄ O ₂	96	0.86
8	5.216	2-Cyclopenten-1-one, furfural	C ₅ H ₆ O ₂	98	7.01
9	31.817	Hexadecanoic acid, methyl ester	C ₁₇ H ₃₄ O ₂	270	1.68
10	33.018	n-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	7.23
11	36.452	8,11,14-Eicosatrienoic acid, (Z,Z)	C ₂₀ H ₃₄ O ₂	306	6.23

hepatitis and feverish conditions. It is used as external application for sores, wounds, and infections and internally for worms and parasites^{11,12}. The fruits and leaves contain alkaloids, glycosides, saponin like substances, resin, an aromatic volatile oil and mucilage. These include alkaloids, insulin like peptides, and a mixture of steroidal saponin known as charantin.

Our traditional system of medicine and folklore are using the whole medicinal plant or a part for the treatment of all types of diseases successfully since the time immemorial. It includes antibacterial, anthelmintic, anti-inflammatory, antioxidant, antitumor and cytotoxic agents¹³. This is because the traditional medicines act as an easily available and effective source of medicine to people with broad

spectrum of actions like high percentage of cure with single therapeutic dose, cost effective and free from toxicity^{14,15}. The present study comprising GS-MS analysis studies in *M. charantia* and *M. dioica* fruit and roots methanolic extracts aims to identify chemotaxonomic similarities via the compounds revealed from this study.

MATERIALS AND METHODS

Plants of *M. charantia* and *M. dioica* are collected from Adilabad district of Telangana State. The root and fruit methanolic extracts were obtained from the dried material of both the plants. GS-MS analysis is carried for root and fruit methenolic extracts of *M. charantia* and *M. dioica* at CFRD, Osmania University and the result is analyzed.

Table 2 : Major compounds of GC-MS Chromatogram of *M. charantia* Root extract.

S. no	R. Time	Name of the compound	Molecular formula	Mol Weight	Peak Area %
1		Ethanedioic acid (CAS) Oxalic acid.	C ₂ H ₂ O ₄	90	4.00
2		Acetic acid, methyl ester	C ₃ H ₆ O ₂	74	2.24
3		Propanal, 2-methyl- (CAS).	C ₄ H ₈ O	72	4.86
4		Silane, dimethoxydimethyl	C ₄ H ₁₂ O ₂ Si	120	8.54
5		Furfural \$ 2-Furancarboxaldehyde.	C ₅ H ₄ O ₂	96	3.27
6		Hexadecanoic acid, methyl ester.	C ₁₇ H ₃₄ O ₂	270	2.00
7		n-Hexadecanoic acid.	C ₁₆ H ₃₂ O ₂	256	5.72
8		n-Hexadecanoic acid.	C ₁₆ H ₃₂ O ₂	256	8.44
9		Octadec-9Z-enol	C ₁₈ H ₃₆ O	268	7.28
10		2H-Pyran, 2-(2-heptadecynyloxy	C ₂₂ H ₄₀ O ₂	336	6.56

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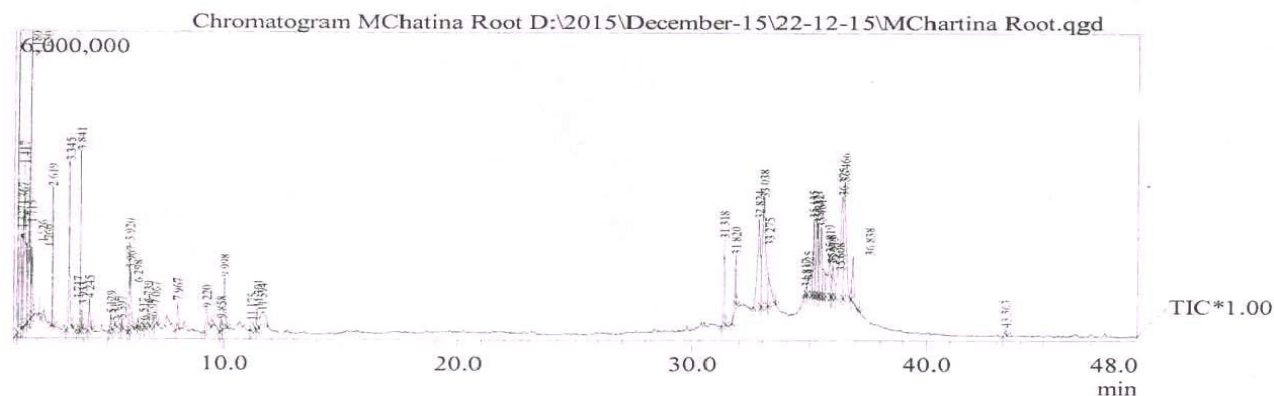


Figure 2: GC-MS Chromatogram of *M. charntia* Root extract.

Preparation of extracts

Plant samples, fruit and root were washed with distilled water and air-dried at room temperature for 7-10 days, then oven-dried at 40 °C to remove the residual moisture. The dried plant parts were pulverized and stored in air-tight containers at 4 °C for future use. 50 g of powdered samples of fruit and root were extracted with methanol by soxhlation method at 60 to 80 °C. The filtrates were separately concentrated in water bath at 40 °C and evaporated under reduced pressure Fig:-1 &2.

Phytochemical analysis

The extracts obtained from the powdered fruit and root extract of *M. charantia* and *M. dioica* were subjected to phytochemical tests to determine the presence of active secondary metabolites using standard procedures. This extract was filtered through a fine mesh into a test tube. This crude extract was used for the phytochemical investigation of secondary metabolites, and GS-MS tests given below and the tests were carried out in triplicate.

GC-MS Analysis Method

GC-MS analyses of methanol extract were performed using a SHIMADZU QP-2010 Gas- Chromatography-Mass spectroscopy. It employed a fused silica column packed with Elite -5 ms (5% Diphenyl 95% Dimethyl poly siloxane, 30 mm × 0.25 mm × 0.25 µm df) and the components were separated using helium as carrier gas at a constant flow of 1ml / min. The 2 µl sample extract is injected into the instrument. It was detected by the turbo gold mass detector with aid of Turbo mass 5.2 software. During the GC Process the oven was maintained at temperature of 110°C with 2 min holding. The injector temperature was set at 250° C. The inlet line temperature was 200°C and source temperature was 200°C. Mass spectra were taken at 70 eV, a scan period of 0.5 S and fragment from 45 - 450 Da. The MS detection was completed in 36 min. Interpretation on mass spectrum GC-MS was conducted using the database of National Institute standard and technology (NIST) having more than 62,000 patterns. The spectrum of unknown components stored in the NIST library. The Name, molecular weight and

Table 3: Major compounds of GC-MS Chromatogram of *M. dioica* Fruit extract.

S. no	R. Time	Name of the compound	Molecular formula	Mol Weight	Peak Area %
1	1.405	Propanal, 2-methyl(CAS) Isobutanal	C ₄ H ₈ O	72	2.11
2	1.635	Silane, dimethoxydimethyl	C ₄ H ₁₂ O ₂ Si	120	2.46
3	3.350	2-Furancarboxaldehyde (CAS)	C ₅ H ₄ O ₂	96	4.14
4	5.929	2-furancarboxaldehyde	C ₆ H ₆ O ₂	110	5.09
5	31.808	Hexadecanoic acid, methyl ester	C ₁₇ H ₃₄ O ₂	270	5.16
6	33.209	Hexadecanoic acid (CAS) Palmitic acid	C ₁₆ H ₃₂ O ₂	256	18.64
7	33.334	9,12-Octadecadienoic acid (Z,Z)	C ₁₉ H ₃₄ O ₂	294	4.66
8	36.660	9,12-octadecadienic acid	C ₁₈ H ₃₂ O ₂	280	25.21
9	37.030	Octadecanoic acid	H ₃₆ O ₂	284	5.19

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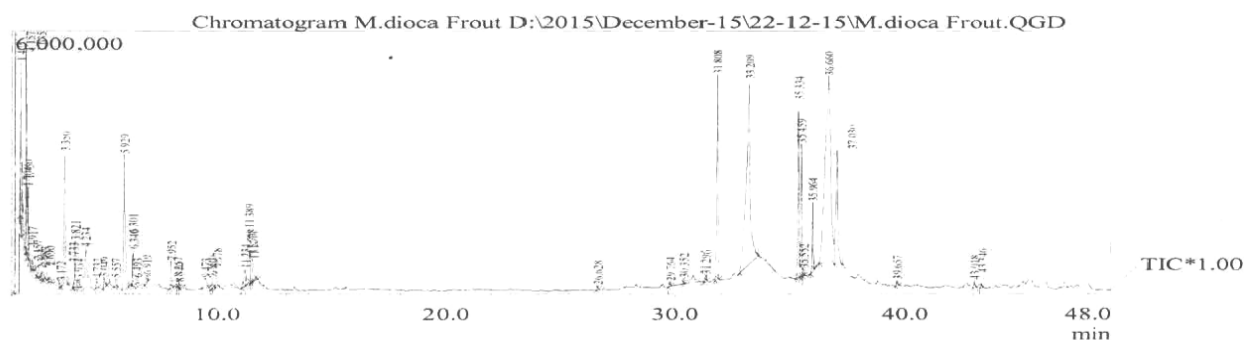


Figure 3: GC-MS Chromatogram of *M. dioica* Fruit extract.

structure of the components of the test materials were ascertained.

RESULTS AND DISCUSSION

Gas chromatography coupled mass-spectroscopic studies (GC-MS) are carried to detect the nature of products formed from the *M. charantia* Root, *M. charantia* Fruit, *M. dioica* Fruit and *M. dioica* Root extracts. The spectra of unknown compounds were compared with spectra of known compounds stored. The identification of compounds was confirmed based on the active principle, Molecular Weight (MW), Concentration (%), Retention Time (RT), Molecular Formula (MF) and Peak Area (PA) and presented for *M. charantia* Root, *M. charantia* Fruit, *M. dioica* Fruit and *M. dioica* Root extracts analysis (Figs 1-4). More than 20 major compounds were identified the

GC-MS analysis. Comparative compounds are studied in *M. charantia* and *M. dioica* fruit and root extracts, presented in (Tables 1-4). The following observations are made. 1. Furfural, silane, propanal, hexadecanoic acid (palmitic acid) present in fruit and root methanolic extracts of *Momordica dioica* and *Momordica charantia*. 2. Oxalic acid, n-hexadecanoic acid present in *M. charantia* fruit and root and *M. dioica* root. 3. Acetic acid present in root and fruit of *Momordica charantia*. 4. Octadecanoic acid present in fruit and root of *Momordica dioica* and also present in *Momordica charantia* root. 5. Ergosterol and sitosterol present in *M. dioica* root only.

Biological activities of compound derived: 1. Palmitic acid used to control of insulin secretion and hypocholesterolemic

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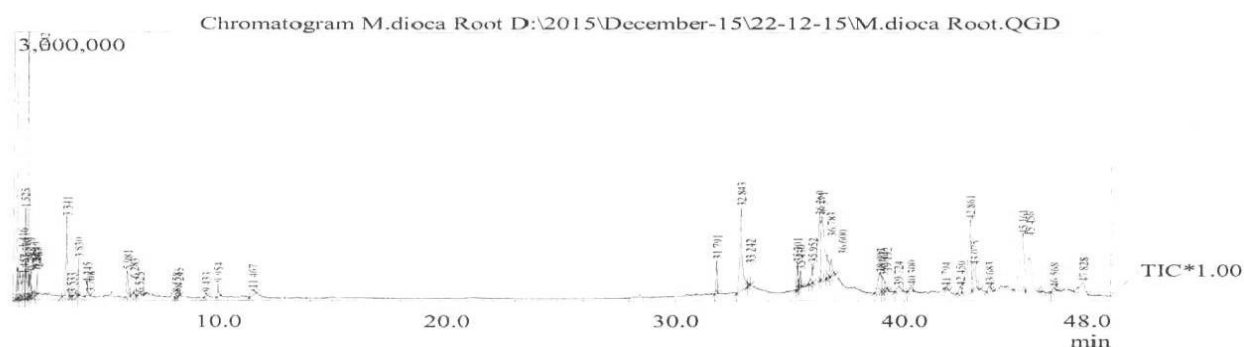


Figure 4: GC-MS Chromatogram of *M. dioica* Root extract.

Table 4: Major compounds of GC-MS Chromatogram of *M. dioica* Root extract.

S. no	R. Time	Name of the compound	Molecular formula	Mol Weight	Peak Area %
1	1.249	Ethanedioic acid (CAS) Oxalic acid	C ₂ H ₂ O ₄	90	1.22
2	1.416	Propanal, 2-methyl- (CAS) Isobutanal	C ₄ H ₈ O	72	0.98
3	1.642	ETHYL ACETATE	C ₄ H ₁₀ O ₂	120	9.45
4	3.341	Silane, dimethoxydimethyl	C ₅ H ₄ O ₂	96	3.27
5	31.791	Furfural 2-Furancarboxaldehyde	C ₇ H ₆ O ₂	270	1.23
6	32.843	Hexadecanoic acid, methyl ester	C ₁₇ H ₃₄ O ₂	256	7.97
7	36.260	n-Hexadecanoic acid	C ₁₉ H ₃₈ O ₂	294	9.04
8	36.371	9,12-Octadecadienoic acid (Z,Z)	C ₁₈ H ₃₄ O ₂	238	7.67
9	42.861	7-Hexadecyn-1-ol	C ₂₈ H ₄₆ O	398	8.80
10	45.161	Ergosta-7,22-dien-3-ol, (3.β.,22E)	C ₃₁ H ₅₂ O ₂	456	8.93
11	45.456	Sitosterol acetate, 9,19-Cyclocholestene-3,7-diol, 4,14-dimethyl-,3-acetate	C ₃₁ H ₅₂ O ₃	472	6.12

Antioxidant, Antiondrogenic. 2. Ergosterol used to irritation to skin, eyes and respiratory tracts. its used for hypercalcemia lead to calcium deposits in the soft tissues and in particular the kidneys. 3. Sitosterol used to reduce benign prostatic hyperplasia and blood cholesterol levels. 4. 9,12,15- octadecatrienoic acid used to hypercholesterolemic, cancer preventive, hepatoprotective. The presence of some similar compounds in both the plants reveals relationship between these two plants. The presence of the plamictic acid in both the plants reveals their antidiabetic property which helps in designing a novel antidibetic drug.

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