Isolation of Long Chain Aliphatic Hydrocarbons from *Momordica tuberosa* (Roxb) Cogn. (Cucurbitaceae) Fruits

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ABSTRACT

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Long chain saturated hydrocarbons were isolated from petroleum ether extract of *Momordica tuberosa* (Roxb) Cogn. (Cucurbitaceae) fruits. The petroleum ether extract was subjected to silica gel (mesh size 60-120) column chromatography using petroleum ether (100%) as mobile phase. The isolated hydrocarbons fraction was characterized by gas chromatography mass spectroscopy (GCMS), along with IR and NMR spectroscopic techniques. Major compounds present in hydrocarbon fraction were hexadecane ($C_{16}H_{34}$) at a retention time (RT) of 9.3 m, octadecane ($C_{18}H_{38}$) at RT of 11.5 m, eicosane ($C_{20}H_{42}$) at RT of 14.3 m, docosane ($C_{22}H_{46}$) at RT of 16.7 min and nonacosane ($C_{29}H_{60}$) at RT of 22.7 m. The newly reported saturated aliphatic hydrocarbons from the *Momordica tuberosa* (Cucurbitaceae) fruit, may serve as marker constituent for further characterization and standardization of crude drug and marketed formulations.

Keywords: *Momordica tuberosa*, Cucurbitaceae, Long chain hydrocarbons, GCMS

INTRODUCTION

Momordica tuberosa (Roxb) Cogn. Syn. *Momordica cymbalaria* Fenzl ex Naud. (Cucurbitaceae) is a perennial, monoecious, trailing plant with large turnip-shaped tuberous rootstock found in Deccan and Carnatic region of India. It is not cultivated. Tender fruits are gathered from November to January and used as vegetables[1]. It is used as abortifaciant and anti-ovulatory agent[2]. Fruits also possess hypoglycemic activity[3]. Tubers are reported to possess antioxidant and hepatoprotective activity[4]. Roots are reported to possess anti-implantation activity[5]. Fruits are reported to contain citric acid, maleic acid and vitamin C[6]. The fixed oil present in fruits of *Momordica tuberosa* is reported to contain palmitic acid, oleic acid, stearic acid, α-Eleostearic acid and γ-Linolenic acid[7]. The plant is relatively virgin and phytochemical and pharmacological profiles are inadequate

Hydrocarbons are biologically stable common components of many species of plants, n-alkanes (C_nH_{2n+2}) are thought to be endogenous to a plants, they are formed as a result of decarboxylation of long chain fatty acids[8,9]. Hydrocarbon may function to prevent desiccation, affect the adsorption of agricultural chemicals, provides a barrier to penetration by microorganism, and serve as a chemotaxonomic character[9]. The durability of hydrocarbons makes them a candidate for marking individual plant species. GC is certainly the most efficient method used for analyzing hydrocarbons, enabling separation of the individual members of the homologous series. A very powerful aid in the identification of hydrocarbons is the coupling of GC and MS, since GC can separate all hydrocarbons and their mass spectra can be easily characterized[10].

From the literature it appears that no such remarkable work has been carried out on fruits of *Momordica tuberosa* which is needed in order to explore its pharmacological importance. In the present work we are reporting the isolation and characterization of aliphatic straight chain saturated hydrocarbons by column chromatography followed by GCMS from the fruits of *Momordica tuberosa.*

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MATERIAL AND METHODS

Plant materials:

The fresh fruits of *Momordica tuberosa* were collected from Tirupati district, Andhra Pradesh, India during the month of November 2011. The plant material was taxonomically identified by Dr. K. Madhava Chetty, Assistant Professor, Department of Botany, S.V. University, Tirupati, Andhra Pradesh, India. The voucher specimen [DBSVUH/ 200/2011] was maintained in herbarium of Department of Botany, S.V. University, Tirupati, Andhra Pradesh, India for future reference. Freshly collected fruits were dried in tray dryer at 55^o for 24 h. The dried fruits were cut and powdered by mechanical grinder. The powder was used for further study.

Chemicals and reagents:

All chemicals and solvents used were of analytical and HPLC grade.

Extraction and isolation:

The dried powder of fruits of *Momordica tuberosa* (3 kg) was extracted with petroleum ether in soxhlet extractor for 72 h. The petroleum ether extract was concentrated (120 g) by rotary evaporator. The dried extract was subjected to column chromatography (length 60 cm and internal diameter 7 cm) on silica gel (Mesh size 60-120) as a stationary phase and petroleum ether (100%) as eluent. The fractions were collected in bulk (250 ml each) and monitored by TLC. Combined initial fractions (Fraction 1-7) afforded a crystalline residue, which was further purified by crystallizing from petroleum ether.

The residue gave an appearance of single charred band on TLC with petroleum ether (100%) as a mobile phase and 5% sulphuric acid as a detecting reagent. The residue was subjected to IR (KBr), ^{1}H NMR ($CDCl_3$), and gas chromatography mass spectroscopy (GCMS) onto a HP5 gas chromatograph capillary column coupled with quadruple mass selective detector. Helium was used as carrier gas. Other GCMS conditions are Column: Capillary column HP-5(Length 30 m, id 0.25 mm), carrier gas: Helium, Flow Rate: 1ml/min, Inlet Temp: 100°, Detector temp: 280°. Injector was operated in a split mode with a split ratio 1:50. The column temperature program started at 100° and changed to 200° at the rate of 10°/m and hold for 2 m. The temperature was raised to 240° at the rate of 10°/m and hold for 5 m. Then the temperature was increased to 280° at the rate of 30°/m and kept constant for 3m. Total elution time was 25m. Identification of individual compounds was carried out with library search by HPCHEM Software from Indian Institute of Technology (IIT), Bombay and published mass spectra.

RESULTS AND DISCUSSION

The Long chain aliphatic hydrocarbons from *Momordica tuberosa* (Cucurbitaceae) fruits were isolated by silica gel (Mesh size 60-120) column chromatography using petroleum ether as mobile phase. The structures of the individual components were determined by spectroscopic methods. Identification was based on melting point, IR, NMR spectroscopy and GCMS (gas chromatography equipped with mass spectrophotometer). The hydrocarbon fraction has melting point ranging from 64-74°, showed IR absorption bands at 2920, 2860, 1460, 730 cm^{-1} indicating it's saturated and aliphatic nature. ^{1}H NMR showed a triplet at δ value 0.88 for terminal methyl group and a multiple peaks at δ value 1.26 for $(CH_2)_n$, indicating the absence of branching in either of the hydrocarbon components (Fig. 1). GC analysis indicated a mixture of mainly five components (Fig.2). GC-MS spectrum defined each member more specifically with their fragmentation pattern (Fig.3). The members of the homologous series of n-alkanes elutes in the increasing order of the carbon chain length. Based on the retention time (RT) and fragmentation pattern, the GCMS analysis indicates the presence of hexadecane ($C_{16}H_{34}$) at a retention time (RT) of 9.3 m, octadecane ($C_{18}H_{38}$) at RT of 11.5 m, eicosane ($C_{20}H_{42}$) at RT of 14.3 m, docosane ($C_{22}H_{46}$) at RT of 16.7 m and nonacosane ($C_{29}H_{60}$) at RT of 22.7 m as major components of hydrocarbon fraction, while some of the minor peaks could not be identified.

CONCLUSION

This study provides a simple method for isolation of hydrocarbons and in large quantity unlike conventional preparative TLC. The newly reported saturated aliphatic hydrocarbons from the *Momordica tuberosa* (Cucurbitaceae) fruit, may serve as marker constituent for further characterization and standardization of crude drug and marketed formulations.

Fig. 1: ^{1}HNMR spectra of hydrocarbon fraction from *Momordica tuberosa* fruits in $CDCl_3$

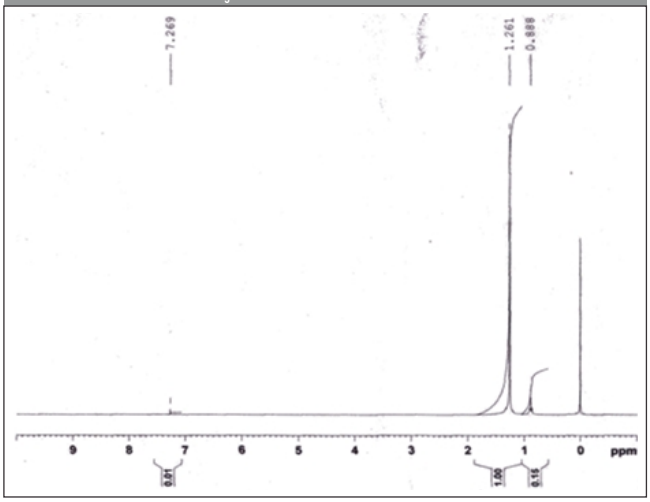


Fig. 2: Gas chromatograph of hydrocarbon fraction from *Momordica tuberosa* fruits

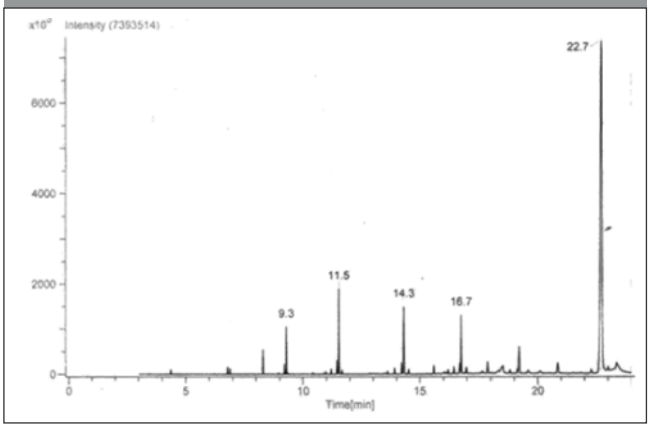
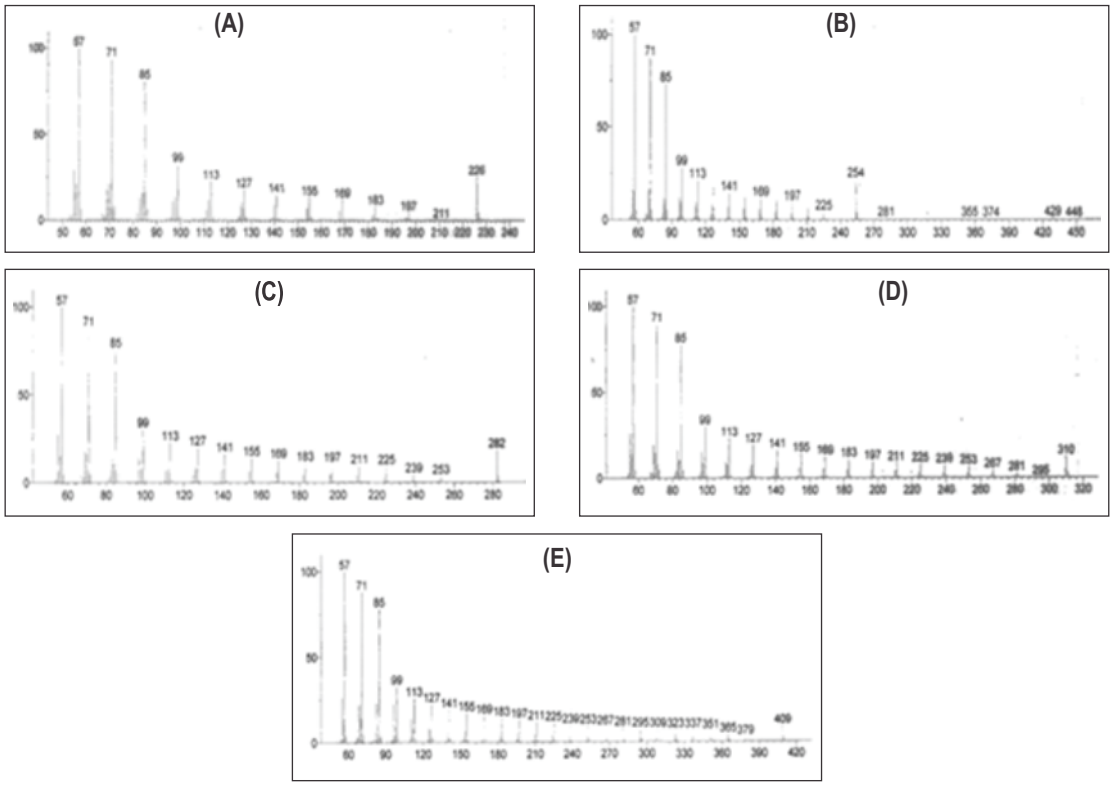


Figure 3: GC-MS spectra of hydrocarbon fraction from *Momordica tuberosa* fruits.



A- Fragmentation of hexadecane, B- Fragmentation of octadecane, C- Fragmentation of eicosane, D- Fragmentation of docosane, E- Fragmentation of nonacosane

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REFERANCES

1. CSIR (India). The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Product. New Delhi: CSIR; 1962.
2. Koneri R, Balaraman R, Sarswati CD. Antiovulatory and abortifacient potential of the ethanolic extract of roots of *Momordica cymbalaria* Fenzl. in rats. Indian J. of Pharmacol. 2006; 38(2): 111-4.
3. Nilugal K , Sunilson JAJ, Das A, Radhamani S, Gopinath R. Free radical scavenging activity of *Momordica tuberosa* (Roxb) Cogn. fruits in alloxan-induced diabetic rats. Journal of Pharmacy Research 2009; 2(5): 839-40.
4. Kumar P, Rao DG, Setty RS. Antioxidant and hepatoprotective activity of tubers of *Momordica tuberosa* cogn against CCL_4 induced liver injury in rats. Indian Journal of Experimental Biology 2008; 46: 510-13.
5. Koneri R, Balaraman R, Sarswati CD, Ajeesha EA. Antiimplantation activity of ethanolic root extract of *Momordica cymbalaria* Fenzl. in rats. Indian J. of Pharmacol. 2007; 3(2): 90-6.
6. Parvati S, Kumar VJ. Studies on chemical composition and utilization of wild edible vegetables Athalakkai (*Momordica tuberosa*). Plant foods Hum Nutr. 2002; 57(3-4): 215.
7. Kale MS, Laddha KS. Characterization of fixed oil from seeds of *Momordica tuberosa* (Roxb) cogn. (Cucurbitaceae) fruits by GC-MS. Indian drugs 2012; 49(4): 39-42.
8. Iyer S, Millar T, Clemens S, Zachgo S, Giblin M, Tayor D, Kunst L, In : Sanchez J, Cerda-Olmedo E, Martinez-Force E (Eds). Advances in plant lipid research, Seville: Universidad de Sevilla; 1998; 87.
9. Kolattukudy PE. Chemistry and biochemistry of natural waxes. 4th ed. Amsterdam: Elsevier; 1976.
10. Lanzon A, Albi T, Cert A, Gracian. J The hydrocarbon fraction of virgin olive oil and changes resulting from refining. J. Am Oil Chem Soc. 1994; 71: 285-91.