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Research Article

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GC-MS analysis and Antioxidant activity of Sudanese *Ocimum basilicum* (Lamiaceae.) Essential Oil

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Abstract *Ocimum basilicum*, which has been used for centuries in traditional medicine, is a potential medicinal plant. It is a medium size herb in the family Lamiaceae. The plant contains bioactive constituents like tannins, saponins and cardiac glycosides. *Ocimum basilicum* essential oil has been used traditionally against, nervous disorders and digestive troubles. This study was designed to investigate the constituents of *Ocimum basilicum* essential oil and to screen its antimicrobial potential. *Ocimum basilicum* was investigated by GC-MS analysis. The GC-MS analysis revealed the following major constituents: 9,12-octadecadienoic acid methyl ester (40.77%); 9,12,15-octadecatrienoic acid methyl ester (26.56%); hexdecanoic acid methyl ester(14.74%) and methyl stearate (9.83%). *Ocimum basilicum* essential oil was evaluated for its antioxidant potential by the DPPPH assay. The oil showed good antioxidant activity against stable DPPH free radicals.

Keywords *Ocimum basilicum*, Essential oil, GC-MS analysis, Antioxidant Activity

Introduction

Medicinal plants are rich source of phytochemicals that could serve as leads for drug design and drug development. Recently, the screening of medicinal plants for bioactive molecules and pharmacological activity has become a worldwide active field of research.

Ocimum basilicum is a herb of many attributes. It belongs to the family Lamiaceae. *Ocimum basilicum* contains tannins, saponins and cardiac glycosides [1] which are known for their biological activity. *Ocimum basilicum* essential oil has been used traditionally against a wide array of human disorders including: nervous disorders and digestive troubles. The plant is claimed to be cardioprotective, stomachic, antipyretic and anthelmintic [2]. The antifungal, antiviral, antinociceptic and larvicidal properties of *Ocimum basilicum* oil has been documented [3-5]. The oil has also been used in ethnomedicine against fever, achne, snake bite, nausea, migraine, abdominal cramps, gonorrhea, inflammation, dysentery, headache, piles, cough, colic pain, paralysis and nervous temperament [6,7]. The immunomodulatory properties of leave extract has been reported [8]. The ethanol extract and the essential oil of *Ocimum basilicum* exhibited free radical scavenging capacity [9-11]. The *in vivo* antihyperglycemic and hypolipidemic properties of *Ocimum basilicum* extracts has been reported [12-13]. In the paw edema model, *Ocimum basilicum* seeds showed antiinflammatory activity [14-15].

Materials and Methods

Plant material

Ocimum basilicum seeds were collected from Shambat-Khartoum-Sudan.The plant was identified and authenticated by direct comparison with reference herbarium sample.

Instruments

For GC-MS analysis a Shimadzo GC-MS-QP2010 Ultra instrument with a RTX-5MS column (30m, length; 0.25mm diameter; 0.25 µm, thickness) was used.

Methods

Extraction of oil

Powdered shade -dried seeds of *Ocimum basilicum* (350g) were macerated with n-hexane for 72hr. The solvent was removed under reduced pressure giving the oil.

GC-MS analysis

For GC-MS analysis a Shimadzo GC-MS-QP2010 Ultra instrument was used under the following chromatographic conditions:

Table 1: Chromatographic conditions

Column oven temperature	150.0°C
Injection temperature	300.0°C
Injection mode	Split
Flow control mode	Linear velocity
Pressure	39.3KPa
Total flow	50.0ml/ min
Column flow	1.54ml/sec.
Linear velocity	47.2cm/sec.
Purge flow	3.0ml/min.
Spilt ratio	- 1.0

Results and Discussion

The oil extracted from *Ocimum basilicum* was investigated by GC-MS analysis. Identification of oil constituents was based on retention times and the observed fragmentation pattern. Fifty six components were detected in total ion chromatogram. The typical total ion chromatogram (TIC) is presented in Fig. (1). The constituents of the oil are outlined in Table 2.

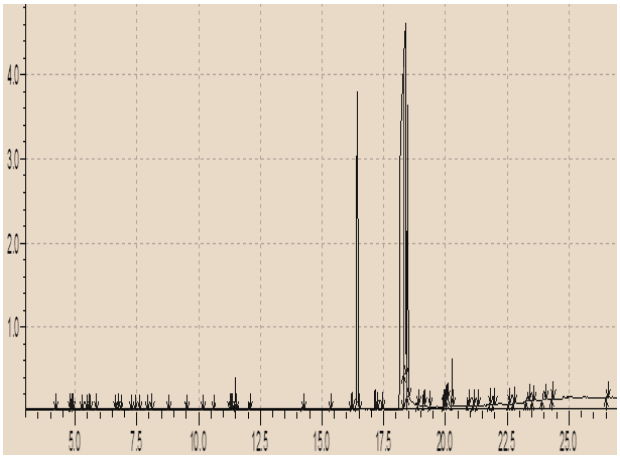

Figure 1: Total ion chromatograms

Table 2: Constituents of the oil

No.	Name	Ret.Time	Area%
1	.beta.-Pinene	4.162	0.01
2	o-Cymene	4.772	0.01
3	D-Limonene	4.829	0.22
4	Eucalyptol	4.885	0.10
5	.gamma.-Terpinene	5.244	0.02
6	.alpha.-Methyl-.alpha.-[4-methyl-3-pentenyl]oxiranemethanol	5.451	0.00
7	3,3,6-Trimethyl-1,4-heptadien-6-ol	5.524	0.00
8	Spiro[4.5]decane	5.583	0.01
9	1,6-Octadien-3-ol, 3,7-dimethyl-	5.817	0.04
10	Bicyclo[2.2.1]heptan-2-one, 1,7,7-trimethyl-, (1S)-	6.593	0.03
11	Benzene, pentyl-	6.696	0.01
12	4-Hexen-1-ol, 5-methyl-2-(1-methylethenyl)-, (R)-	6.823	0.00
13	.alpha.-Terpineol	7.255	0.01
14	4-Isopropyl-5-methylhexa-2,4-dien-1-ol	7.384	0.01
15	Bicyclo[3.1.0]hexan-2-ol, 2-methyl-5-(1-methylethyl)-, (1.alpha.,2.alpha.,5.alpha.)-	7.590	0.01
16	Acetaldehyde, (3,3-dimethylcyclohexylidene)-, (E)-	7.861	0.08
17	1,6-Octadien-3-ol, 3,7-dimethyl-, 2-aminobenzoate	8.058	0.03
18	2-Cyclohexen-1-one, 5,5-dimethyl-3-(1-methylethyl)-	8.746	0.01
19	3-Cyclohexene-1-methanol, .alpha.,.alpha.,4-trimethyl-, acetate	9.486	0.17
20	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta.)]-	10.122	0.03
21	Caryophyllene	10.576	0.01
22	4,5-di-epi-aristolochene	11.242	0.04
23	2-Isopropenyl-4a,8-dimethyl-1,2,3,4,4a,5,6,7-octahydronaphthalene	11.289	0.02
24	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-4a,8-dimethyl-2-(1-methylethenyl)-, [2R-(2.alpha.,4a.alpha.,8a.beta.)]-	11.344	0.07
25	Naphthalene, decahydro-4a-methyl-1-methylene-7-(1-methylethenyl)-, [4aR-(4a.alpha.,7.alpha.,8a.beta.)]-	11.487	0.83
26	Ledol	12.044	0.19
27	Methyl tetradecanoate	14.189	0.09
28	Pentadecanoic acid, methyl ester	15.320	0.04
29	7-Hexadecenoic acid, methyl ester, (Z)-	16.156	0.06
30	9-Hexadecenoic acid, methyl ester, (Z)-	16.201	0.35
31	Hexadecanoic acid, methyl ester	16.435	14.74
32	Hexadecanoic acid, 14-methyl-, methyl ester	17.147	0.54
33	cis-10-Heptadecenoic acid, methyl ester	17.217	0.09
34	Heptadecanoic acid, methyl ester	17.432	0.19
35	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	18.305	40.77
36	9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-	18.387	26.56
37	Methyl stearate	18.473	9.83
38	cis-10-Nonadecenoic acid, methyl ester	18.889	0.11
39	Octadecanoic acid, 17-methyl-, methyl ester	19.112	0.36
40	Nonadecanoic acid, methyl ester	19.362	0.03
41	.gamma.-Linolenic acid, methyl ester	19.933	0.41
42	7-Tetradecenal, (Z)-	19.961	0.31

43	cis-11-Eicosenoic acid, methyl ester	20.062	0.43
44	Eicosanoic acid, methyl ester	20.265	1.18
45	Methyl 18-methylicosanoate	20.903	0.17
46	Heneicosanoic acid, methyl ester	21.132	0.04
47	Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl-	21.291	0.05
48	13-Docosenoic acid, methyl ester, (Z)-	21.790	0.03
49	Docosanoic acid, methyl ester	21.966	0.25
50	Methyl 20-methyl-docosanoate	22.563	0.08
51	Tricosanoic acid, methyl ester	22.771	0.12
52	1,6,10,14,18,22-Tetracosahexaen-3-ol, 2,6,10,15,19,23-hexamethyl-, (all-E)-	23.322	0.29
53	Tetracosanoic acid, methyl ester	23.543	0.16
54	.gamma.-Sitosterol	23.985	0.55
55	Squalene	24.336	0.14
56	.gamma.-Tocopherol	26.545	0.07

Figures 2- 5 illustrates respectively the mass spectra of the major components of the oil: 9,12-octadecadienoic acid methyl ester (40.77%); 9,12,15-octadecatrienoic acid methyl ester (26.56%); hexdecanoic acid methyl ester (14.74%) and methyl stearate (9.83%). The mass spectrum of 9,12-octadecadienoic acid methyl ester (Fig. 2) showed a signal at m/z 294 (R.T. 18.305) due to M+[$C_{19}H_{34}O_2$]+. The signal at m/z 263 corresponds to loss of a methoxyl. The mass spectrum of 9,12,15-octadecatrienoic acid methyl ester is displayed in Figure 3. The peak at m/z 292 (RT.18.387) corresponds $M^+[C_{19}H_{44}O_2]^+$. Fig. 4 illustrates the mass spectrum of hexadecanoic acid methyl ester. The signal at m/z 270 (RT.16.435) accounts for the molecular ion [$C_{17}H_{34}O_2$] while the peak at m/z 239 is due to loss of a methoxyl. The mass spectrum of methyl stearate is shown in Fig. 5. The signal at 298 (RT.18.473) is due to $M^+[C_{19}H_{38}O_2]$. The signal at m/z 267 corresponds to loss of a methoxyl.

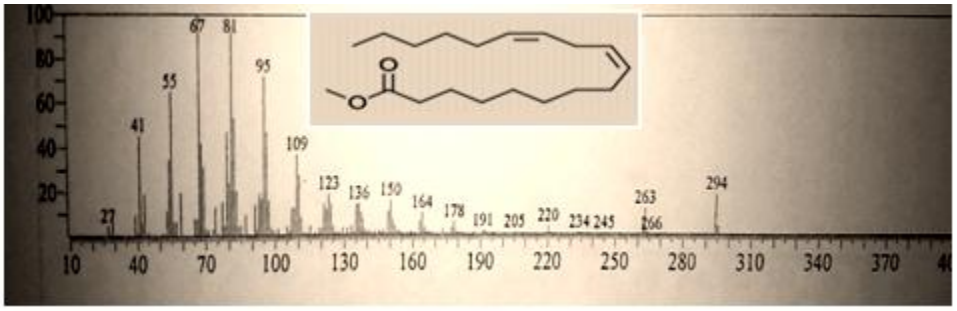

Figure 2: Mass spectrum of 9,12-octadecadienoic acid (Z,Z)-methyl ester

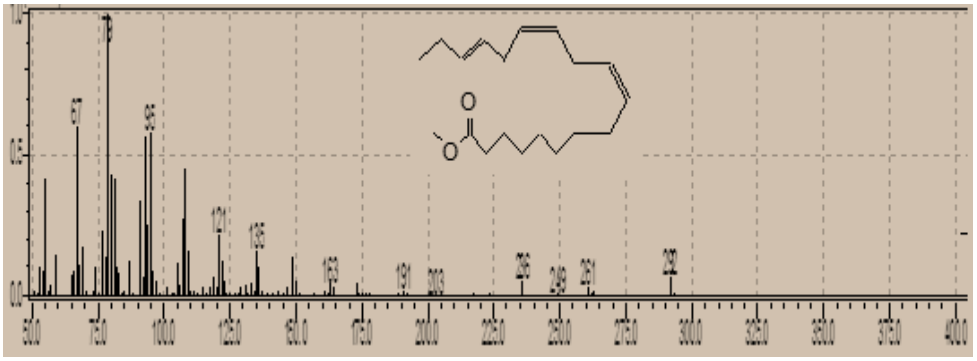

Figure 3: Mass spectrum of 9,12,15-octadecatrienoic acid methyl ester

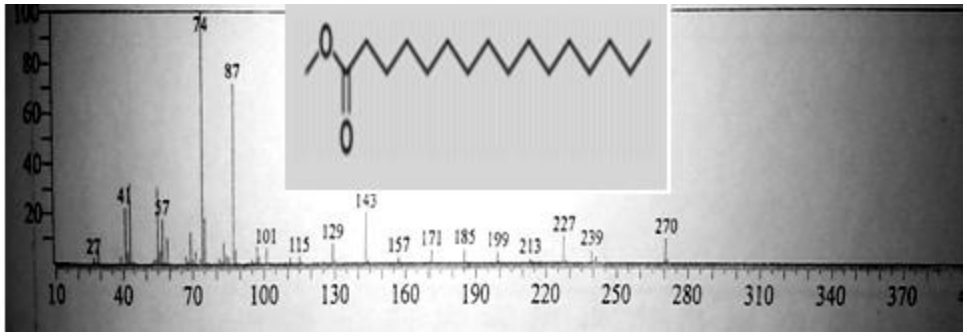

Figure 4: Mass spectrum of hexadecanoic acid, methyl ester

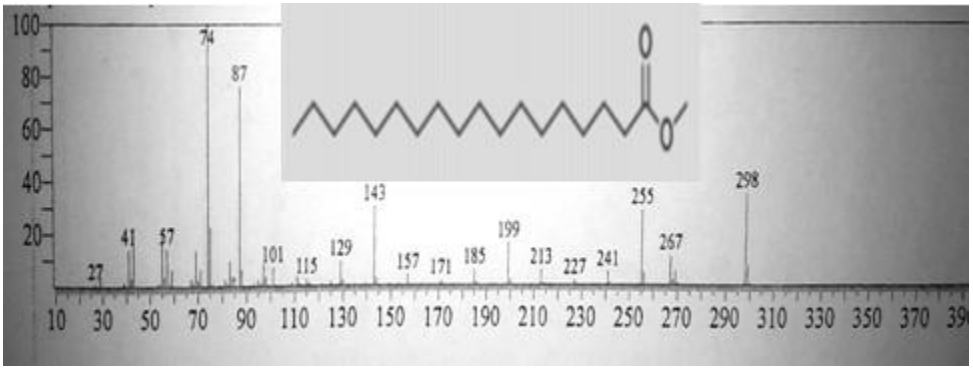

Figure 5: Mass spectrum of methyl stearate

Antioxidant Activity

Ocimum basilicum essential oil was evaluated for its antioxidant potential by the DPPPH assay. The oil showed good antioxidant activity against stable DPPH free radicals (Table 3).

Table 3: Radical scavenging activity of the oil

Sample	Antioxidant activity (%)
Sesamum indicum oil	54.4
Propyl gallate(standard)	90.6

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