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Evaluation of Essential oil, Seed Extracts, of Carum Carvi L.

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ABSTRACT

Carawey is biennial plant. It is a widely used and incredibly useful plant. The seeds are used for culinary purposes and medicinal treatment. It's seeds oil was extracted by cold extraction method used two solvents, n-hexane and petroleum ether. Extracts has been investigated by Gas Chromatography Mass Spectrometry (GC/MS) technique. Total of 45 compounds were detected for n-hexane extract and 62 compounds likewise for petroleum ether. The two solvent extracts showed a chemical composition correlation. The most abundant compounds detected are hexadecanoic acid; Estragole; 9,12-octadecandienoic acid ; 9-octadecanoic acid; Stearatric acid, D-Limonene, octadecanal, Eicosanoic acid, 11-Eicosanoic acid, dodec-9-ynyl Cyclohexanecarboxylicacid, 7-hexadecanoic acid, 9- octandecanone, 10- nonadecanone and anethole . Besides there are some new compounds that have not been previously reported.

1. Introduction

The value of natural products in the treatment of ailments is well-known. Amongst the various natural sources, plants are an important source of bioactive constituents. More than 1000 plant species are known for their anticancer potential. The use of plant compounds as prototypes of new drugs has a historical and economic importance.

Some plants extracts were defined as effective in treating cancer, there action was attributed to additional or synergistic effect of compounds present in the extract [1]. In consequence, the cytostatic effect of the extract observed in tumor cells seems to be more effective than the effect of isolated and biologically active compounds [2].

Caraway seeds are used in rye bread, cookies and cheese as seasoning [3], the essential oil from *Carum carvi* fruits (Family: Apiaceae) was found to possess insecticidal activity towards the maize weevil, *Sitophilus zeamais* (Motsch) and red flour beetle, *Tribolium castaneum* Herbst. Common caraway (*C. carvi*), one of the oldest herbs known and with a pleasant aroma, is native to North Africa, Asia and Europe. Its fruits are used in pharmacy, perfumery and food. The dried ripe fruits of *C. carvi* are used in traditional Sudanese medicine and other folk medicines as a carminative, since it is effective against spasmodic gastrointestinal complaints, flatulence, irritable stomach, indigestion, lack of appetite, and dyspepsia in adults [4].

2. Materials and Methods

Sample Collection

The *Carum carvi* seeds were purchased from the local market in Omdurman area, taxonomic authentication of the plant has been carried out in the National Center for Research (NCR) – Medicinal and Aromatic Plants Research Institute in Sudan.

Extraction of Plant Materials

Carum carvi seeds (100g) were washed with distilled water to remove dust particles. The seeds were shaded, dried and powdered. The final ground powder was soaked in n-hexane (1L) for 3 days at room temperature. Then filtration and concentrated using rotary evaporator at 45 ^{o}C [6] [7].

Gas Chromatography Mass Spectrometry (GC/MS) Analysis

The GC/MS analysis of n-hexane fraction extract was performed on a GC-MS equipment (Thermo Scientific Co. Thermo GC-TRACE ultra ver.: 5.0, Thermo MS DSQ II. Experimental conditions of GC-MS system were as follows: TR 5-MS capillary standard non-polar column, dimension: 30Mts, ID: 0.25 mm, Film thickness: 0.25µm. Flow rate of mobile phase (carrier gas: He) was set at 1.0 ml/min. In the gas chromatography part, temperature program (oven temperature) was 75°C raised to 250°C at a rise of 5°C/min, and held for 30min. The injection volume was 1 µl and sample was injected in split less mode. Finally the sample was run fully at a range of 50–650 m/z and the results were compared by using Wiley Spectral library search program. The petroleum ether extract was analyzed at the same measurement conditions [8].

3. Results and Discussion

The percentage yields of n- hexane and petroleum ether extracts for *Carum carvi* seeds are shown in Table 1. The GC/MS results of n – hexane and petroleum ether extracts, revealed the presence of 45 and 62 compounds. GC chromatograms for n-hexane and petroleum ether extracts are shown in Fig 1 and Fig 2 respectively. The organic compounds for n-hexane and petroleum ether are shown in Table 2 and Table 3 respectively.

Table1. PercentagesYields for n-Hexane and Petroleum ether Extracts.

Extract	PercentageYield (%w/w)
n-Hexane	3.5%
Petroleum ether	4.5%

The results in above table revealed that the percentage yield for petroleum ether extract is higher than that of n-hexane extract.

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This is attributed to the petroleum ether being a mixture of hydrocarbons but both solvents are equivalent in their polarity index (0.1).

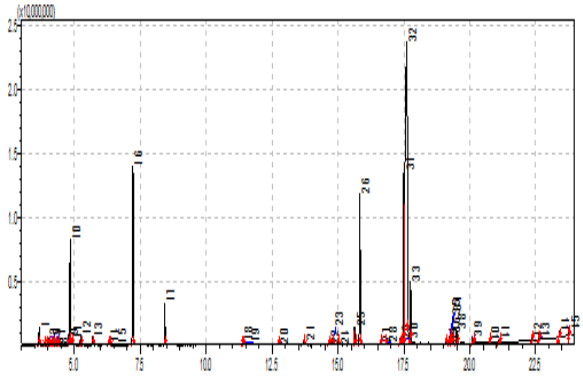

Fig 1. GC chromatogram of Carum carvi seeds n-hexane extract.

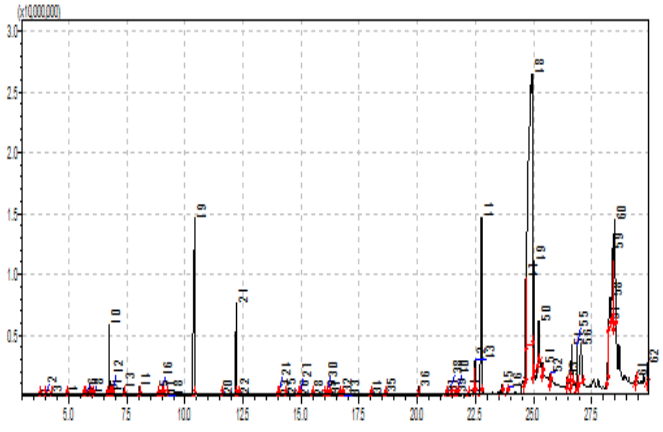

Fig 2. GC chromatogram of *Carum carvi* seeds Petroleum ether extract.

Table 2. Organic compounds of *Carum carvi* seeds n-hexane Extract

Peak No	Name	M.wt	RT	Area %	Medicinal activities NMA (no medicinal activity)
1	AlphaPinene	136	3.666	0.65	Anti bacterial and anti fungal
2	Camphor	136	3.860	0.01	Anti oxidant
3	1-ethyl-3-methyl benzene	120	3.980	0.01	NMA
4	1,2,3-trimethyl Benzene	120	4.061	0.00	NMA
5	Bicyclo[3.1.0],4-methylene-1-(1-methylethyl) hexane	136	4.131	0.18	Anti-onchocerca
6	Bicyclo[3.1.1],6,6-dimethylene heptane	136	4.202	0.07	Anti microbial
7	Beta.-Myrcene	136	4.286	0.07	Anti genotic
8	Mesitylene	120	4.390	0.02	Anti oxidant
9	O-Cymene	134	4.780	0.40	Anti oxidant
10	D-Limonene	136	4.841	4.54	Anti oxidant
11	Eucalyptol	152	4.896	0.25	Anti microbial and anti bacterial
12	Gamma.-Terpinene	136	5.699	0.38	Anti oxidant
13	L-Fenchone	152	6.305	0.37	Anti oxidant, anti microbial and antibacterial
14	3,Oxatricyclo[4.1.1.0(2,4)],2,7,7-tri methyl octane	152	7.223	0.10	Anti botulinum and anti oxidant
15	4,Cyclohexylidenebutyraldehyde	152	8.430	0.06	Anti inflammatory and anti anthelmintic
16	Estragole	148	11.369	11.48	Anti genotoxic
17	Anethole	148	11.403	1.94	Anti helminthic
18	ButylatedHydroxytoluene	220	12.742	0.18	Anti oxidant
19	Dodecanoic acid.	214	13.721	0.08	Anti microbial
20	Apiol	222	14.637	0.05	Anti microbial
21	Tetradecanoic acid	242	14.797	0.23	NMA
22	Cis-5-Dodecenoic acid	212	15.017	0.05	Anti oxidant
23	Pentadecanoic acid	256	15.629	0.17	Anti oxidant
24	6,10,14-trimethyl-2-Pentadecanone	268	15.829	0.03	Anti allelopathic
25	5-eicosenoic acid	268	16.592	0.83	NMA
26	Hexadecanoic acid	270	16.802	8.91	Anti oxidant
27	(Z) 6-Octadecanoic acid	296	17.35	0.13	NMA
28	Heptadecanoic acid	284	17.404	0.12	Anti fungal and anti oxidant
29	5,11,14-eicosatrienoic acid	320	17.499	0.45	Anti inflammatory
30	(Z) 6,9-Octadecanoic acid	294	17.613	0.29	Anti oxidant
31	(Z,Z) 9,12-Octadecadienoic acid	294	17.748	15.00	Anti flammatory and antinematicide, antiincectifuga
32	9-Octadecanoic acid(Z).	296	19.104	45.82	Anti microbial, and anti oxidant
33	Stearatric acid	298	19.235	2.74	Anti diarrheal cytotoxic and anti proliferative active
34	Methyl 6,11-octadecadienoite	294	19.277	0.11	Anti oxidant
35	2-Hexadecenoic acid	268	19.305	0.40	Anti oxidant and anti androgenic
36	11-Eicosenoicacid	324	19.496	0.32	Anti inflammatory
37	13-Docoenoic acid	352	19.098	0.94	Anti bacterial
38	18- Methylnonadecanoate	326	20.098	0.76	Anti microbial
39	7-Octadecanoic acid	268	20.734	0.55	NMA
40	9-Octadecenoic acid, 1,2,3-propanetriyl ester	884	21.117	0.11	Anti microbial and anti oxidant
41	Methyl 20-methyl-heneicosanoate	354	22.362	0.23	Anti bacterial
42	Dotriacontane	450	22.620	0.17	NMA
43	Tetracosanoicacid	382	23.390	0.16	Anti cancer and anti oxidant
44	Heptadecyl Oxirane	282	23.768	0.35	Adhesive
45	Tetracosane	338	23.68	0.30	NMA

Table 2. Organic compounds of *Carum carvi* seeds Petroleum Ether Extract

Peak No	Name	M.wt	RT	Area %	Medicinal activities NMA (no medicinal activity)
1	Ethylbenzene	106	3.714	0.05	Anti bacterial
2	n-Butyl ether	130	3.978	0.01	Anti genotoxic
3	O-Xylene	106	4.209	0.05	Anti oxidant
4	Alpha.-Pinene	136	4.902	0.08	Anti bacterial and anti fungal
5	Bicyclo[3.1.0],4-methylene- hexane	136	5.633	0.04	Anti HIV
6	Beta.-Pinene	136	5.718	0.01	Anti bacterial and anti fungal
7	Beta.-Myrcene	136	5.923	0.03	Anti genotoxic
8	Mesitylene	120	6.026	0.01	Anti oxidant
9	O-Cymene	134	6.640	0.13	Anti oxidant
10	D-Limonene	207	6.733	1.95	Anti oxidant
11	Eucalyptol	154	6.803	0.07	Anti microbial and anti bactrial
12	Trans-.beta.-Ocimene	136	6.864	0.08	Anti fungal
13	Gamma.-Terpinene	136	7.347	0.18	Anti oxidant
14	Bicyclo[2.2.1] -2-one,1,3,3-tri methyl heptane	152	8.016	0.21	NMA
15	2,6-di methyl-,(E,Z)- 2,4,6-,Octatriene	136	8.803	0.02	Anti oxidant and anti genotoxic
16	3-Oxatricyclo[4.1.1.0(2,4)],2,7,7-tri methyl octane	152	8.960	0.06	Anti oxidant and anti botulium
17	(+)(E)-Limonene oxide	152	9.053	0.03	Anti oxidant
18	Camphor	152	9.250	0.01	Anti oxidant
19	Estragole	148	10.418	10.49	Anti genotoxic
20	4-methoxi- Benzaldehyde	136	11.565	0.05	COMT inhibitor
21	Anethole	148	12.203	3.51	Anti helminthic
22	2-methyl-5-(1-methylethyl)- Phenol	192	12.269	0.05	Anti microbial
23	4-methoxy- Benzoic acid	166	13.981	0.02	Anti microbial
24	Copaene	204	14.034	0.05	Anti bacterial and anti fungal
25	1-chloro- Octadecane	288	14.306	0.06	NMA
26	3-(1-5-dimethyl-4-hexenyl)-4-methyl Cyclohexene	204	14.848	0.01	Anti oxidant
27	Caryophyllene	204	14.928	0.01	Anti eishmanil
28	(E)-.beta.-Famesene	204	15.454	0.01	NMA
29	1-(1,5-di methyl-4-hexanyl)-4-methyl Benzene	202	16.011	0.00	Anti HIV and anti inflammatory
30	Beta.-copaene	204	16.090	0.06	NMA
31	Tetradecan	198	16.190	0.03	NMA
32	Dodecanoicacid	214	16.666	0.09	Anti microbial
33	4-dimethoxy-6-(2-propenyl) 1,3-Benzodioxole,	222	16.781	0.02	Anti metabolic
34	Hexadecane	226	17.972	0.02	NMA
35	Apiol	222	18.610	0.10	Anti microbial
36	Tetradecanoic Acid	242	20.042	0.23	NMA
37	Bicyclo[4.1.0] -3-01,7,7,7-trimethyl heptane	154	21.243	0.07	NMA
38	Pentadecanoic acid	256	21.452	0.22	Anti oxidant
39	Phytol,acetate	338	21.625	0.06	Anti oxidant and Manufacture of vitamin E and K active thetranscription factors PPAR-alpha and retinoid X receptor.
40	6,10,14-trimethyl-2 pentadecanone	268	21.724	0.05	Anti allelopathic
41	3,7,11,15-Tetramethyl-2-hexadecen	296	22.177	0.05	Anti bactria
42	6-Octadecenoicacid (Z)-	296	22.450	0.84	Cancer preventive and insectifuge
43	Methyl5-eicosenoate	324	22.481	0.75	NMA
44	Hexadecannoicacid	270	22.754	7.03	Anti oxidant, Hypochoesterolemic, Nematiandrogenic, Lubricant, Anti androgenic, Haemolytic, 5-Alpha reductase inhibitor, Expression of cyclooxygenase-2increase cytosolic Ca+
45	6-Octadecenoic acid(Z)	296	23.621	0.28	Cancer preventive and insectifuge
46	Heptadecanoicaacid	284	23.870	0.19	Anti oxidant, anti fungal and antisutactant
47	9,12-Octadecadienoicacid(Z,Z)	294	24.664	4.23	Anti flammatory, anti nematicide and

					anti insectifage
48	9-Ocatdecenoicacid(Z)	310	24.938	43.56	Anti microbial , steroid and primer pheromone
49	Stearatric Acid	298	25.011	2.84	Anti diarrheal cytotoxic and anti proliferative active
50	6-Octadecenoicacid	282	25.221	1.66	Cancer preventive and insectifuge
51	Ethyl Oleate	310	25.388	0.29	Anti gonadotrophic
52	13-Docosenoic acid	352	25.724	0.23	Anti bactrial
53	6 ,11-octadecadienoic acid	294	26.449	0.21	Anti oxidant
54	11-Eicosenoic acid	324	26.933	1.65	Anti oxidant , anti inflammatory, anti arthric and anti-coroney
55	Eicosanoic acid	326	26.865	1.14	Anti oxidant
56	Octadecanal	268	27.047	2.87	Anti bactrial
57	dodec-9-ynyl Cyclohexanecarboxylicacid	292	28.208	1.87	Anti inflammatory
58	7-Hexadecanone	240	28.293	1.48	Anti tumor
59	9-Octadecanone	268	28.397	3.30	Anti inflammatory
60	10- Nonadecanone	282	28.485	6.71	Anti microbial
61	Tri cosanoic acid	368	29.406	0.13	Anti oxidant
62	Dotriacontane	450	29.914	0.46	Anti insecticidal activity

NMA (Now Medicinal Activity in previous literatures).

n-Hexane and petroleum ether extracts of the *courum caravi* seeds revealed that the presence of 45 and 62 compounds were depicted by the GC/MS (see Fig 1 and Fig 2) . The medicinal activities of all reported compounds were recorded from published literatures[9][10]. The medicinal activity of 1-ethyl-3-methyl benzene, 1,2,3-trimethyl Benzene, Tetradecanoic acid, 5-eicosenoic acid, (Z) 6-Octadecanoic acid, 7-Octadecanoic acid, Dotriacontane, Tetracosane in n-hexane extract and Bicyclo[2.2.1] -2-one,1,3,3-tri methyl heptane, 1-chloro- Octadecane, E)-.beta.-Famesene, Tetradecanoic Acid, Bicyclo[4.1.0] -3-01,7,7,7-trimethyl heptane, Methyl5-eicosenoate in petroleum ether extract, are not reported in literates.

The most abundant compounds detected are hexadecanoic acid; Estragole; 9,12- octadecandienoic acid ; 9-octadecanoic acid; Stearatric acid, D-Limonene, octadecanal, Eicosanoic acid, 11-Eicosanoic acid, dodec-9-ynyl Cyclohexanecarboxylicacid, 7-hexadecanoic acid, 9-octandecanone, 10- nonadecanone and anethole. Besides these were some new compounds that have not been previously reported.

A total of 17 compounds were found in petroleum ether extract that were not detected n-hexane extract such as : Ethyl benzene ; n- Butyl ether ; O-Xylene ; Beta Pinene ; Trans-.beta.-Ocimene ; Bycyclo[2.2.1]heptan-2-one,1,3,3-trimethyl ; 2,4,6-Octatriene,2,6-dimethyl-(E,Z) ; (+)-(E)-Limonene ; Benzaldehyde,4-methoxy ; Phenol, 2-methyl-5-(1-methylethyl) ; Benzoic acid,4-methoxy ; Copaene ; Octadecane,1-chloro ; Cyclohexane, 3-(1,5-dimethyl-4-hexenyl) ; Beta.-Copaene ; Tetradecane ; 1,3-Benzodioxole,4-methoxy-6-(2-propenyl) ; Hexadecane ;Bicyclo[4.1.0] heptanes-3-ol,7,7,7-trimethyl ; Phytol ,acetate ; 3,7,11,15-tetramethyl-2-hexadecen-1-ol ; Ethyl Oleate ; Eicosanoic acid ; Octadecanal ; acid,dodec,9,ynyl Cyclohexanecarboxylic ; 7-Hexadecanone ;9- Octadecanone ; 10- Nonadecanone ; Tricosanoic acid.

4. Conclusion

From the data obtained in the gas chromatography mass spectrometry for the cold extraction of the essential oil of *Carum carvi L*. using n- hexane and petroleum ether, it can be concluded that :

1. n-Hexane (C_6H_{14}) is a single non polar hydrocarbon solvent while petroleum ether is a mixture of several volatile hydrocarbons, with a boiling rage 60 – 80 ^oC essentially isomers of pentane, although both solvents are eqvalent in their polarity index (0.1), yet petroleum ether has the capability of high extraction and hence more organic compounds are detected.
2. the wide scope of the organic compounds of the petroleum ether extract with the medicinal activities listed there in table (2), might the more effective in the ailment due to the additional segregation effect of the compounds present in the extract.
3. The data indicated that the essential oil possessed antimicrobial , anti fungal, anti oxidant and anti cancer.
4. The most abundant compounds detected are hexadecanoic acid; Estragole; 9,12- octadecandienoic acid ; 9-octadecanoic acid; Stearatric acid, D-Limonene, octadecanal, Eicosanoic acid, 11-Eicosanoic acid, dodec-9-ynyl Cyclohexanecarboxylicacid, 7-hexadecanoic acid, 9-octandecanone, 10- nonadecanone and anethole.

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