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Chemical composition of essential oils of three *Pistacia* cultivars in Khorasan Razavi, Iran

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Abstract

The essential oil from leaves of Pistacia lentiscus L., an aromatic member of three Pistacia (*Pistacia Vera* L.) cultivars, including Kalle Ghoochi, Akbari, and Sefid that were analyzed by GC-MS. These Pistacia species have been collected from Khorasan Razavi, Iran. Constituents were identified by their mass spectra and Kovats' indices. 1,8-cineole, α-pinene, β-pinene, β-thujene, and limonene were found to be the major constituents.

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Introduction

Among the variety of nut trees, the Pistachio (*Pistachia Vera* L.) is the most important. The potential benefits of it include; cultivate in saline, dry and hot areas (Metheney *et al.*, 1998). Every year, the universal production of pistachio nut going up gradually and the foremost producers are Iran, USA, Turkey, Syria, Italy and Greece (FAOSTAT, 2008).Iran is a significance resource of pistachio since to an enormous number of cultivars and genotypes (Ismail Poor, 2005), (Panahi *et al.*, 2001). Analysis and determination of pistachio nutrition components can increase the tendency of nut consumption. Pistachio chemical nutrition includes sterols, fatty acid, phenolic, minerals and vitamins (Brufau and Boatella, 2006), (Ryan *et al.*, 2006), (Venkatachalam & Sathe, 2006), (Miraliakbari& Shahidi, 2008) as well as antioxidant and anti-proliferative properties (Yang *et al.*, 2009).

Recently, fundamental oil composition of genus pistacia has been recognized successfully (Lamiri et al, 2001), (Duru *et al.*, 2003), (Chryssavgi *et al.*, 2008), (Ben Douissa *et al.*, 2005). whereas studies on the essential oils obtained from leaves of Pistacia vera L. cultivars including Kalle Ghoochi, Akbari and Sefid have not been reported.

In this paper, the chemical compositions of the essential oils from leaves of Pistacia vera L. cultivars including Kalle Ghoochi, Akbari, and Sefid was studied.

Material and methods

Plant material

Sample of Pistacia species were obtained from the Khorasan Razavi Agricultural Research Center of Iran. The test was repeated three times in the form of randomized complete blocks. In this study, at the harvest time (4 September 2011), were collected from four sides of the tree, and after mixing them, the intended traits were assessed. The oil was obtained by hydrodistillation on a Clevenger type apparatus for 3 h of the leaves of the plant. The oil yield was calculated relative to the dry matter. The essential oil was collected, dried over anhydrous sodium sulphate and stored at 4°C until used.

Mass Spectrometry Analysis

Agilent 7890 gas chromatograph with mass spectrometry detector 5975C inert MSD (Agilent Corporation, USA) was applied for sample analysis.

Chromatography conditions were set according to AOAC method No. 963/22 (27), and Capillary column of DB-35 MS, length of 30 meters, diameter 0.25 mm and thickness Polar Silica, 0.25 micrometers, at chromatography temperature parameters as follows: injector at 250°C, ion source 200°C. Oven program: initial temperature: 80°C for 20s, 80°C to 240°C at 4°C min^{-1}, 240°C for 10 min. Carrier gas was helium; column flow 1.4 $ml.min^{-1}$, split rate 1:30. 1.0 mm^3 sample was injected. The energy of the EI source of the Agilent mass spectrometer was 70 eV. Mass unit were monitored from 30 to 450 m/z. Identification of components in the oil was based on retention indices relatives to n-alkanes and computer matching with the WILLEY 275.L library, as well as by making a comparison between the fragmentation patterns of mass spectra and those reported in the literature (Congiu *et al.*, 2002), (Pooter *et al.*, 1991), (Adams, 1995), (Kivçak *et al.*, 2004).

Results

Under the optimum condition, the amount of oil was obtained in the range between 0.12% and 0.18% for three cultivars. The achieved results not show the significance difference between the cultivars. The obtained experimental results from a current study totally compatible with results have been reported by Castola's groups (Castola *et al.*, 2000). Nevertheless, it is less than those reported by Zrira et al (Zrira *et al.*, 2003). for the plants collected from Oulmes, Chaouuen and Mehdia in Morocco and Congiu et al (Congiu *et al.*, 2002) for the plant collected from Sardinia in Italy.

The oil yield obtained by hydrodistillation from a aerial parts of P. lentiscus L. was 0.2 and it was 0.4% from the even parts of plant obtained by but supercritical CO2. The oil yield of P. lentiscus L. seems to depend on the nature of parts of plants used for extraction and also on the mode of extraction.

The extracted oils from pistachio samples (Kalle Ghoochi, Akbari, and Sefid) showed 32, 33, and 33 compounds accounting for 98.24, 95.81 and 97.57%

Table 1. Compounds obtained from GC/GC-MS analysis on pistachio kernel essential oil.

Compound	(P. Sefid) (%)	(P. Kalle Ghoochi) (%)	(P. Akbari) (%)	RI
n-Pentane	0.45	-	1.06	752
2-methyl- Pentane	-	1.25	1.60	756
Iso Amyl Alcohol	1.20	0.24	1.70	761
Methylcyclopentane	-	0.15	1.13	765
n-Heptane	0.35	0.25	1.15	775
3-methyl Hexane	0.75	0.35	0.45	786
Styrene	1.24	1.43	1.2	871
iso penthyl acetate	1.35	0.33	0.18	884
4-Methoxybenzaldoxime	1.25	1.01	1.60	894
α-Pinene	11.83	12.39	13.02	918
α-Thujene	1.14	1.61	1.00	928
Camphene	0.77	1.91	5.20	931
Benzaldehyde	1.25	-	-	955
β-Pinene	6.01	13.62	5.21	968
Sabinene	1.83	-	-	970
Cis-pinene	1.56	1.46	3.49	974
ethyl hexanoate	2.57	2.86	0.77	991
Myrcene	3.60	6.43	1.23	994
n-Heptacosane	-	-	2.11	1013
Phenylmethanol	1.35	-	-	1014
o-Cymene	1.15	1.44	1.01	1017
Heptadecane	-	-	2.64	1018
p-Cymene	3.03	4.12	0.67	1029
Octadecane	0.85	-	0.89	1031
Limonene	1.23	5.86	3.10	1037
n-Pentacosane	1.16	-	0.75	1047
Dihydrotagetone	3.20	2.85	0.68	1049
1,8-Cineole	22.26	20.9	19.9	1051
γ-Terpinene	1.29	0.76	0.69	1060
Cis- Linalol oxide	1.11	1.21	0.99	1069
p-Cymenene	1.82	0.48	4.61	1088
α,p-Dimethylstyrene	2.32	-	-	1092
Linalol	0.88	1.30	0.89	1098
2-nonanol	2.05	1.01	2.8	1099
nUndecane	-	0.41	-	1100
n-Nonanal	-	0.57	-	1103
cis rose oxide	4.50	0.42	2.85	1111
β-Thujene	11.19	6.11	4.93	1114
2-Hydroxymethylbenzoate	-	0.72	-	1116
n-Tridecane	-	0.52	-	1206
Palmitinic acid	1.03	4.27	6.31	1320

of the whole oils, respectively. In order to determine the variations of essential oils of three Pistacia species from Khorasan Razavai in Iran, the collected data of their composition were analyzed using GC/Mass. The oils of Kalle Ghoochi were mainly composed of 1,8-Cineole (20.9%), β-Pinene (13.62%), α-Pinene (12.39%), Myrcene (6.43%), β-Thujene (6.11%), Limonene (5.86%), Palmitinic acid (4.27%), p-Cymene (4.12%), and ethyl hexanoate (2.86%); the oils of Akbari were composed of 1,8-Cineole (19.9%), α-pinene (13.02%), β-Pinene (5.21%), Camphene (5.20%), β-Thujene (4.93%), and p-Cymenene (4.61%); and the oils of Sefid were composed of 1,8-Cineole (22.26%), α-Pinene (11.83%), β-Thujene (11.19%), β-Pinene (6.01%), and cis rose oxide (4.50%).

The obtained results from this study were revealed, there is small variability between the chemical components of oils in three different species of Pistacia in Iran.

Each organic compound from the oil samples was identified based on their retention time indices in the achieved gas chromatograph with a reference to homologues series of n-alkanes. Furthermore, the obtained mass spectrum of each analytes was

compared with a mass fragmentation in a library pattern number (NIST 08. L database / Chem station data system) and also was compared with other results has been reported.

Table 1 presents the results of the analyses carried out in this study.

Conclusion

Significant qualitative differences were found in terms of chemical composition of the oils obtained from the Pistacia species that were investigated in this paper (Table 1).

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