Original Article

The Essential Oil Compositions of *Origanum majorana L.* Cultivated in Konya and Collected from Mersin-Turkey

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ABSTRACT

Purpose: In this study, essential oil (EO) compositions of the dried and fresh aerial parts of *Origanum majorana* cultivated in the research field and collected from f from Mersin was investigated. **Material and Methods:** EO was distilled by using Clevenger type apparatus for 3 h and the chemical compositions were detected in GC-MS. While, the oil yields of the the collected marjoram was determined to be 2,5 ml both in dried and fresh aerial parts, the yields of the cultivated plants for fresh and dried parts were 3.6 ml and 5 ml, respectively. The cultivation of the plant had positive effects on the EO yield. Drying of the material also increased the oil yield in the cultivated marjoram. **Results:** While there were 42 and 35 of EO components were observed in the fresh and dried parts of the collected marjoram, respectively; in the cultivated plants there were 30 and 40 components detected. Besides EO yields, in this research the differences with respect to composition and components were determined between the cultivated and collected plants. On the other hand, in this study, it was determined that the EO compositions varied with respect to be fresh or dry of the plant parts. It was observed that carvacrol and linalool were the major EO contents. **Conclusion:** The aim of the study to compare of differences between the EO compounds and compositions varied according to be the plant fresh or dry and collected or cultivated.

Key words: Oregano, *Origanum majorana*, Essential Oil Composition, Carvacrol, Linalool, Oil Yield.

INTRODUCTION

Lamiaceae/Labiatae comprise of ca. 7200 species and 236 genera. The family is represented by 45 genera, 546 species and 730 taxa in Turkey. The members of the Lamiaceae are common mainly in the mountainous areas of the Mediterranean parts of Turkey. The herbs of Lamiaceae family possess two types of glandular trichomes on the surface of their leaves, termed peltate and capitate glands.[1-10] Recent investigations showed[4] that most (if not all) of the essential oil (EO) was on the surface of leaves in peltate glandular trichomes (peltate glands). Many species of family are aromatic and often used as herb species, folk medicines and fragrences. This property stems from this family's glandular hairs secreting rich oil and ether. More taxa of Lamiaceae generally used as hemostatic plants and for its tonic property.

The genus *Origanum* (Labiatae), known as "oregano" in English, is an annual, perennial and shrubby herb that is native to the Mediterranean, Euro-Siberian and Irano-Siberian regions. A total 38 Origanum species are recognized in the World. Most of the Origanum species, over 75%, are concentrated in the East Mediterranean sub region. Of them, 16 species are considered as endemic for the flora of Turkey.[5] Origanum species grow abundantly on stony slopes

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and in rocky mountain areas at a wide range of altitudes (0–4000 m). Due to the variability in chemical and aroma characteristics, *Origanum* plants belongs to different species and ecotypes (biotypes).[8]

Sweet marjoram (*Origanum majorana* L. Syn. *Majorana hortensis*), a member of the Lamiaceae family, is a herbaceous, perennial plant native to Cyprus and the Eastern Mediterranean. It can be grown in Northern European areas with mulching materials[6] In tropical countries fresh plants can be affected by mould diseases. It is of great economic and industrial importance.[10] Commercial *Origanum majorana* L. oil is used as a spice and condiment. The fresh or dried highly aromatic leaves and flowering tops of marjoram (*Origanum majorana* L.) are widely used to flavor many foods. In Turkish cuisine, oregano is mostly used for flavoring of meat, especially for mutton and lamb. In barbecue and kebab restaurants, it can be usually found on Table, together with paprika, salt and pepper.

The volatile aromatic compounds are employed in the food industry as flavouring in foods and beverages. The oil is used in perfumery for its spicy herbaceous notes[9] and as fungicides or insecticides in pharmaceutical and industrial products.[4]

Marjoram contains 0.5–3.5% of essential oil in dry herb.[11] The composition of the oil and its content in the herb also changes under the influence of fertilizing with different types of nitrogenous fertilizers and liming.[3-6] *Origanum majorana* has strong antioxidant activity, mainly because of its high content of phenolic acids and flavonoids, which is useful in health supplements and food preservation. Traditionally, the plant has been used as a folk remedy against asthma, indigestion, headache and rheumatism. Furthermore, *Origanum majorana* (marjoram) are used as blood anti-coagulator in Iranian folk medicine.

MATERIAL AND METHODS

MATERIALS

Plant materials were collected in 2015 from Mersin and Selcuk University, Field Crops Department, Medical Plant Garden. A voucher specimen has been deposited at the KNYA herbarium.

METHODS

Aerial parts (dried and fresh branch, leaf and herb) of the *Origanum majorana* were subjected to hydrodistillation for 3 h using Clevenger type apparatus to produce EO. The essential oils (EOs) were stored at -20 °C until analysed. The compositions of *Origanum majorana* L. (OME), EOs were identified by The GC-MS analyses.

RESULTS AND DISCUSSION

As a result of the studies done, the volatile oil components of wet and dry specimens of *Origanum majorana* plant cultivated and from nature were compared (Table 1, Figure 1-3). Table 1 revelaed that there were significant ($p<0.01$) differences between the the aerial parts of

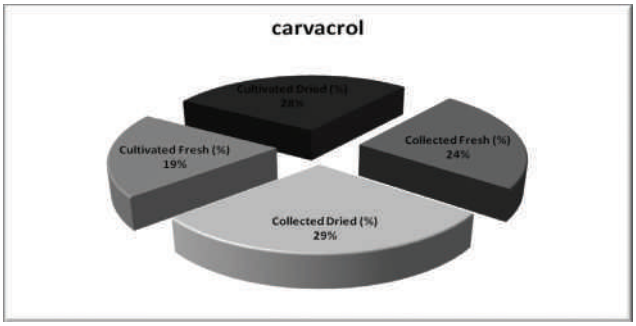

Figure 1: Carvacrol contents of collected and cultivated dried and fresh aerial parts of *Origanum majorana*.

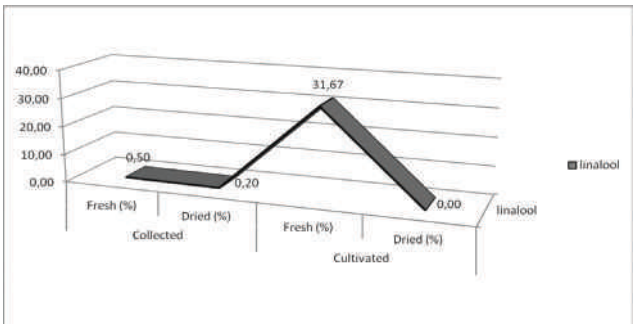

Figure 2: Linalool contents of collected and cultivated dried and fresh aerial parts of *Origanum majorana*.

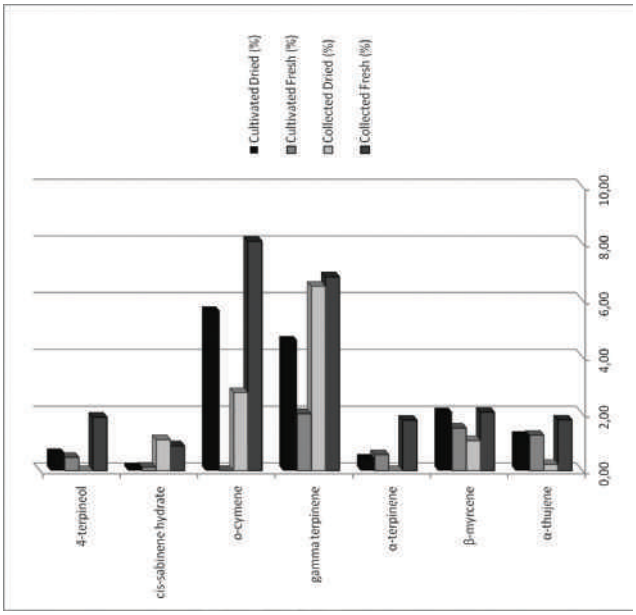

Figure 3: The major essential oil compositions of collected and cultivated dried and fresh aerial parts of *Origanum majorana*.

Table 1: The comparison of the essential oil compositions of the collected and cultivated *Origanum majorana*

		Collected	Cultivated	Collected	Cultivated	Collected		Cultivated	
RI	Compounds	Fresh (%)	Fresh (%)	Dried (%)	Dried (%)	Fresh (%)	Dried (%)	Fresh (%)	Dried (%)
1009	methyl 2-methylbutanoate	0,13	0,00	0,00	0,07	0,12	0,00	0,00	0,05
1022	α-pinene	0,98	0,41	0,12	0,70	0,98	0,12	0,41	0,70
1026	α-thujene	1,79	1,24	0,21	1,24	1,79	0,21	1,26	1,24
1067	camphene	0,33	0,07	0,04	0,14	0,33	0,04	0,07	0,14
1111	β-pinene	0,23	0,12	0,09	0,18	0,25	0,09	0,12	0,18
1123	sabinene	0,07	0,14	0,00	0,04	0,07	0,00	0,14	0,04
1149	delta-3-carene	0,12	0,08	0,00	0,10	0,12	0,00	0,08	0,10
1163	β-myrcene	2,04	1,51	1,07	2,07	2,06	1,07	1,51	2,07
1166	α-phellandrene	0,29	0,18	0,09	0,08	0,29	0,07	0,17	0,08
1179	α-terpinene	1,79	0,57	0,00	0,44	1,79	0,00	0,57	0,44
1180	delta-2-carene	0,00	0,00	0,98	0,00	0,00	0,55	0,00	0,00
1197	limonene	0,33	0,13	0,16	0,20	0,33	0,16	0,13	0,20
1203	β-phellandrene	0,65	0,00	0,00	0,33	0,65	0,00	0,00	0,33
1204	1,8-cineole	0,00	0,02	0,00	0,00	0,00	0,00	0,01	0,00
1205	sabinene	0,00	0,10	0,21	0,00	0,00	0,21	0,10	0,00
1211	trans-2-hexenal	0,00	0,00	0,00	0,04	0,00	0,00	0,00	0,04
1224	**gamma terpinene**	6,84	2,02	6,51	4,60	6,84	6,51	2,02	4,60
1226	β-ocimene	0,15	0,00	0,07	0,08	0,15	0,07	0,00	0,08
1227	1,3,6-octatriene,3,7-dimethyl	0,00	0,00	0,00	0,07	0,00	0,00	0,00	0,07
1237	*p*-cymene	0,00	2,45	0,00	0,00	0,00	0,00	2,45	0,00
1238	***o*-cymene**	**8,09**	**0,00**	2,76	5,64	8,08	2,76	0,00	5,64
1243	α-terpinolene	0,15	0,06	0,04	0,16	0,15	0,04	0,05	0,14
1292	3-hexen-1-ol	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,02
1294	3-octanol	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,02
1439	2-allytoluene	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,01
1440	cis-linalool oxide	0,00	0,03	0,00	0,00	0,00	0,00	0,02	0,00
1444	1-octen-3-ol	0,24	0,09	0,11	0,17	0,24	0,09	0,07	0,15
1460	cis-sabinene hydrate	0,86	0,11	1,10	0,13	0,88	1,11	0,13	0,13
1523	camphor	0,03	0,00	0,00	0,00	0,03	0,00	0,00	0,00
1539	linalool	0,51	31,68	0,21	0,00	0,51	0,21	31,68	0,00
1546	trans sabinene hydrate	0,26	0,57	0,23	0,59	0,26	0,23	0,57	0,59
1562	2-cyclo hexen-1-ol, 1 methyl-4-(1-methylethyl)-trans	0,07	0,00	0,00	0,00	0,07	0,00	0,00	0,00
1565	trans 2-cyclohexen-1-ol, 1 methyl-4-(1-methyl ethyl)	0,00	0,00	0,00	0,03	0,00	0,00	0,00	0,03
1604	4-terpineol	1,89	0,48	0,00	0,64	1,89	0,00	0,48	0,64
1605	trans caryophyllene	0,00	0,43	1,04	0,06	0,00	1,04	0,43	0,06
1616	aromadendrene	0,17	0,00	0,00	0,00	0,17	0,00	0,00	0,00
1617	cis dihydro carvone	0,00	0,05	0,06	0,03	0,00	0,00	0,05	0,03
1628	1-terpineol	0,04	0,00	0,00	0,00	0,04	0,00	0,00	0,00
1638	trans dihydro carvone	0,00	0,00	0,03	0,00	0,00	0,05	0,00	0,00

continued...

Table 1: Cont'd									
1639	dihydrocarvone	0,05	0,00	0,00	0,00	0,07	0,00	0,00	0,00
1682	α-humulene	0,08	0,00	0,10	0,00	0,08	0,10	0,00	0,00
1690	geranial	0,02	0,00	0,00	0,00	0,02	0,00	0,00	0,00
1701	α-terpineol	0,65	0,24	0,32	0,14	0,65	0,32	0,24	0,14
1707	ledene	0,04	0,00	0,00	0,00	0,04	0,00	0,00	0,00
1710	linalyl-propionate	0,00	0,00	0,00	0,11	0,00	0,00	0,00	0,11
1719	borneol	0,65	0,03	0,06	0,29	0,67	0,06	0,03	0,28
1724	β-copaene	0,00	0,00	0,14	0,00	0,00	0,14	0,00	0,00
1749	bicyclogermacrene	0,02	0,00	0,06	0,00	0,02	0,06	0,00	0,00
1751	carvone	0,09	0,25	0,00	0,09	0,07	0,00º	0,25	0,07
1795	methyl solicylate	0,00	0,00	0,02	0,00	0,00	0,02	0,00	0,00
1854	cuminol	0,04	0,00	0,00	0,00	0,04	0,00	0,00	0,02
1855	para-cymen-8-ol	0,00	0,00	0,02	0,00	0,00	0,02	0,00	0,00
1882	carvacryl acetate	0,00	0,00	0,02	0,00	0,00	0,02	0,00	0,00
1891	thymol acetate	0,00	0,00	0,00	0,02	0,00	0,00	0,00	0,01
1941	4-hydroxy-3-(1-methylethyl) benzaldehyde	0,10	0,00	0,00	0,00	0,04	0,00	0,00	0,00
2009	caryophyllene oxide	0,21	0,06	0,09	0,33	0,21	0,09	0,06	0,33
2038	farnesol	0,00	0,00	0,02	0,00	0,00	0,01	0,00	0,00
2051	trans-nerolidol	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,02
2089	elemol	0,00	0,00	0,00	0,00	0,00	0,03	0,00	0,00
2141	spathulenol	0,08	0,05	0,07	0,07	0,10	0,09	0,07	0,09
2187	thymol	0,57	0,38	0,51	0,68	0,57	0,51	0,38	0,69
2223	carvacrol	69,50	56,40	83,47	80,34	69,50	83,47	56,40	80,34
2292	durenol	0,02	0,00	0,00	0,00	0,02	0,00	0,00	0,00
2438	Di 9-methyl-9phenyl-9.10-dihydrophenenthrene	0,04	0,00	0,00	0,00	0,04	0,00	0,00	0,00
2439	S-indacene-1.7-dione,2,3,5,6-tetrahydro-3,3,4,5,5,8-hexamethyl	0,00	0,00	0,07	0,00	0,00	0,07	0,00	0,00
2860	cuminol	0,00	0,00	0,00	0,33	0,00	0,00	0,00	0,35

dried and fresh *Origanum majorana* (collected and cultivated) with respect to their EO compositions. While, the oil yields of the the collected marjoram was determined to be 2,5 ml both in dried and fresh aerial parts, the yields of the cultivated plants for fresh and dried parts were 3.6 ml and 5 ml, respectively. It can be easily seen that cultivation had positive effects on the EO yield. Drying of the material also increased the oil yield in the cultivated marjoram. The cultivation of marjoram will provide more profit (bring to profit) than collected plants. Because, in smaller area or fields, production can be controlled easily.

EO composition may vary considerably between aromatic plant species and varieties, and within the same variety from different enviromental areas Besides EO yields, in this research the differences with respect to composition and components were determined between the cultivated and collected plants. On the other hand, in this study, it was determined that the EO compositions varied with respect to be fresh or dry of the plant parts. While there were 42 and 35 of EO components were observed in the fresh and dried parts of the collected marjoram, respectively; in the cultivated plants there were 30 and 40 components detected.

The results clearly showed that the highest EO content was carvacrol both in collected and cultivated fresh (69.49 % and 56.39 %) and dried (83.46 % and 80.33 %) aerial parts. It can be stated (said) that drying of the plant material had positive effect on the rate of carvacrol. On the other hand, linalool was the second dominating

Photo 1: *Origanum majorana* general view.

Photo 2: *Origanum majorana* flowers.

Photo 3: *Origanum majorana herb.*

content and although it was detected in significantly in cultivated fresh parts (31.67 %), there were not observed in cultivated fresh part. On the contrast of carvacrol, drying of the material had negative effect on the linalool content. Carvacrol and linalool contents were also presented in Figures 1 and 2

Regarding the essential oil compositions of the dried and fresh aerial parts of collected and cultivated marjoram, the results for comparison of the major components in accordance with the plant were also presented in Figure 3. According to the Figure, o-cymene and gamma-terpinene were the major contents in the collected dried and fresh part and cultivated dried part. In the collected dried part

o-cymene and gamma-terpinene were observed at the rate of 2.75 % and 6.50 % respectively, while the contents were detected at the rate of 8.08 % and 6.83 % in the collected fresh part. Besides collected plant, in the cultivated dried part, the contents were detected at the rate of 5.63 % and 4.59 %, respectively.

The objective of the study to compare of differences between the EO compounds and compositions varied according to be the plant fresh or dry and collected or cultivated.

CONCLUSION

The results of this study demonstrate that the aim of the study to compare of differences between the EO compounds and compositions varied according to be the plant fresh or dry and collected or cultivated. It was observed that carvacrol and linalool were the major EO contents.

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CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

ABBREVIATION USED

EO: Essential oil; GC-MS: Gas Chromatography-Mass Spectrophotometry; h: hours; ml: milliliter; OME: *Origanum majorana L.* Essential oil; RI: Retention Indices.

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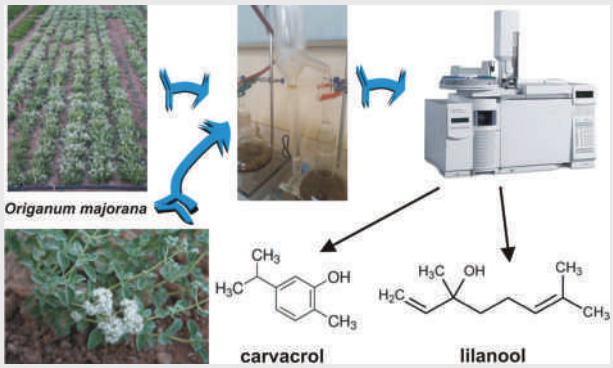
SUMMARY

- The genus *Origanum* L. is a member of Lamiaceae family. *Origanum majorana* is a perennial herb aerial parts of *Origanum majorana* L. oil is used as a spice and condiment. The fresh or dried highly aromatic leaves and flowering tops of marjoram (*Origanum majorana* L.) are widely used to flavour many foods. In Turkish cuisine, oregano is mostly used for flavoring of meat, especially for mutton and lamb. In barbecue and kebab restaurants, it can be usually found on table, together with paprika, salt and pepper. As a result of the studies done, the volatile oil components of wet and dry specimens of *Origanum majorana* plant cultivated and from nature were compared. The aim of the study to compare of differences between the EO compounds and compositions varied according to be the plant fresh or dry and collected or cultivated.
- The results clearly showed that the highest EO content was carvacrol both in collected and cultivated fresh (69.49 % and 56.39 %) and dried (83.46 % and 80.33 %) aerial parts. Alsa, in the collected at nature dried part o-cymene and gamma-terpinene were observed at the rate of 2.75 % and 6.50 % respectively, while the contents were detected at the rate of 8.08 % and 6.83 % in the collected fresh part. Besides collected plant, in the cultivated dried part, the contents were detected at the rate of 5.63 % and 4.59 %, respectively.

PICTORIAL ABSTRACT



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