DOI: HTTP://DOI.ORG/10.31925/FARMACIA.2018.6.18 **ORIGINAL ARTICLE**

CHEMICAL COMPOSITION OF THE ESSENTIAL OIL FROM THE SEEDS OF THE MEDICINAL PLANT *MENTHA LONGIFOLIA* (L.) HUDS.

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Abstract

The essential oil from the seeds of *Mentha longifolia* (L.) Huds. growing wild in Iran was isolated by hydrodistillation and analysed by gas-chromatography coupled with mass spectrometry (GC-MS). The main components in seeds were piperitenone (40.9%) and piperitone (29.4%).

Rezumat

Uleiul volatil obţinut din seminţe uscate de *Mentha longofolia* (L.) Huds. Din flora spontană a Iranului, a fost izolat prin hidrodistilare şi analizat prin cromatografie de gaze cuplată cu spectrometrie de masă (GC-MS). Principalii componenţi regăsiţi în seminţe au fost piperitenona (40,9%) şi piperitona (29,4%).

Keywords: *Mentha longifolia*, *Lamiaceae*, seed, essential oil

Introduction

The native plant *Mentha longifolia* (L.) Huds. belongs to the *Lamiaceae* family and is known locally as "Pooneh" [1]. It widely grows in Asia, Eurasia, Australia, and South and North Africa [2] and in various regions of Iran. The aerial parts of *M. longifolia* have a strong aroma and are commonly used as an aromatic and medicinal plant. It has a great role in medicine including the Iranian traditional medicine as a stomach pain-relieving agent, antispasmodic, digestive and carminative [3]. Literature survey revealed several reports just on the essential oil composition of the leaves and the aerial parts of *M. longifolia* [4-6] and there was no attempt to study the essential components of the seeds up to now. Considering the significant pleasant odour of the seeds, we were prompted to investigate the essential oil composition of *M. longifolia* seeds for the first time.

Materials and Methods

Plant material

Fresh seeds of *M. longifolia* were collected in June 2015 from Meymand village, Fareghan, Hadji-Abad County, Hormozgan Province, Iran (28°18′33″N 55°54′06″E, 1500 m). The specimen was identified by R. Asadpour and a voucher was deposited in the Herbarium of Pharmaceutical Sciences Branch, Islamic Azad University (IAUPS), Tehran, Iran, under the code number 306-PMP/A. Seeds were powdered and submitted to hydrodistillation in a Clevenger-type apparatus for 3 hours. At the end of distillation, the oil was collected, dried with anhydrous Na_2SO_4, measured, and transferred to a clean glass vial and kept at a temperature of -18ºC for further analyses.

Analysis of the essential oil

Oil sample analysis was performed on a HP-6890 gas chromatograph (GC) equipped with a FID and a DB-5 capillary column, 30 m × 0.25 mm, 0.25 µm film thickness, temperature programmed as follows: 60ºC - 240ºC at 4ºC/min. The carrier gas was N_2 at a flow rate of 2.0 mL/min; injector port and detector temperature were 250ºC and 300ºC, respectively. The sample was injected by splitting and the split ratio was 1:10.

GC/MS analysis was performed on a Hewlett-Packard 6890/5972 system with a DB-5 capillary column (30 m × 0.25 mm; 0.25 µm film thickness). The operating conditions were the same conditions as described above but the carrier gas was He. Mass spectra were recorded at 70 eV. Scan mass range was from 40 - 400 m/z at a sampling rate of 1.0 scan/s. Quantitative data were obtained from the electronic integration of the FID peak areas. The components of the oil were identified by their retention time, retention indices, relative to C_9 - C_{28} n-alkanes, computer matching with the WILEY275.L library and

as well as by comparison of their mass spectra with data already available in the literature [7, 8]. The relative content of the identified components were calculated from the GC peaks areas. The analysis of the essential oil is presented as the average of three replicates.

Results and Discussion

The hydrodistillation of *M. longifolia* seeds resulted in a pale yellow oil with pleasant odour and yield of 4.0% (v/w) based on the fresh weight. Figure 1 shows the gas chromatogram of *M. longifolia* seed essential oil. Table I presents the list of compounds with a concentration over 0.1% of the total peak concentration. According to Table I, eighteen components were identified in the seeds essential oil which represented about 95.5% of the total composition. The major constituents of *M. longifolia* seed oil were characterized as piperitenone (40.9%) and piperitone (29.4%). The studied essential oil comprised fourteen monoterpenoids (92.9%) and four sesquiterpenoids (2.6%).

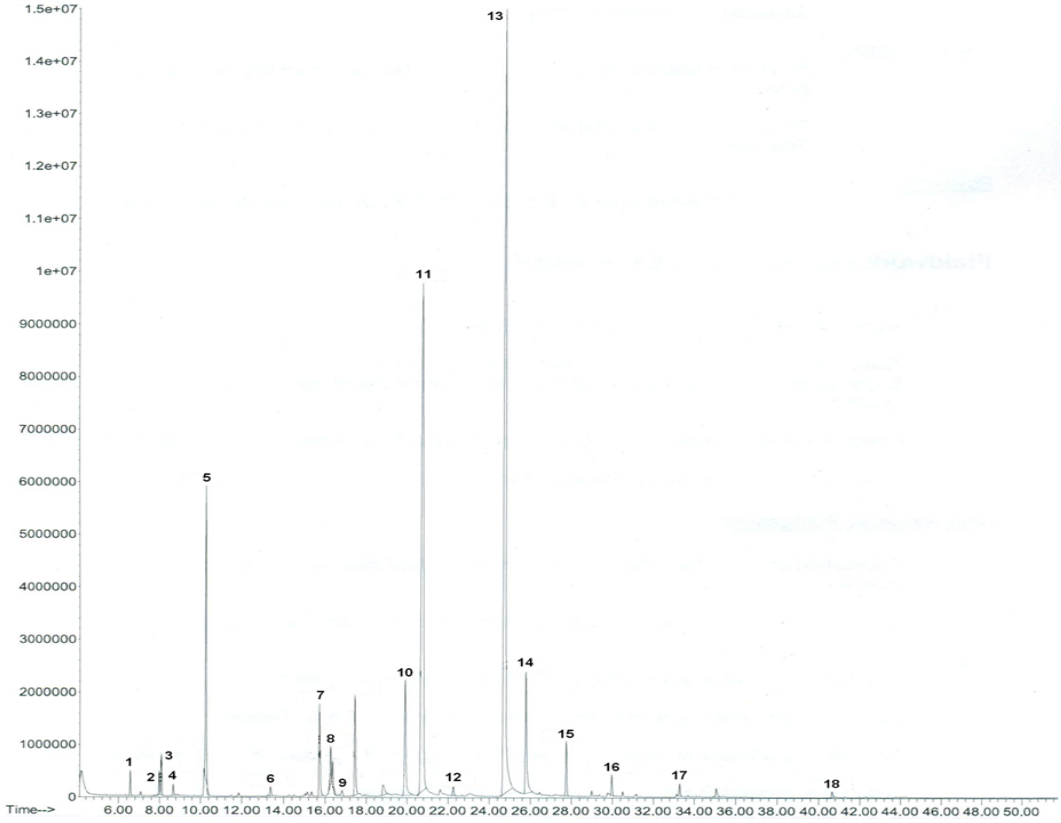

Figure 1.
The gas chromatogram of *M. longifolia* seeds essential oil

Table I
GC-MS analysis of *M. longifolia* seeds essential oil

Compound[a]	KI[b]	KI[c]	Percentage
1. α-Pinene	942	939	0.5
2. Sabinene	972	975	0.4
3. β-Pinene	976	979	0.9
4. β-Myrcene	996	991	0.3
5. 1,8-Cineol	1028	1031	6.8
6. Linalool	1101	1097	0.3
7. Menthone	1149	1153	2.7
8. Borneol	1166	1169	1.0
9. Terpinene-4-ol	1179	1177	0.2
10. Pulegone	1241	1237	4.6
11. Piperitone	1255	1253	29.4

Compound[a]	KI[b]	KI[c]	Percentage
12. Bornyl acetate	1287	1289	0.3
13. Piperitenone	1339	1343	40.9
14. Piperitenone oxide	1372	1369	4.6
15. trans-Caryophyllene	1418	1419	1.5
16. Germacrene D	1489	1485	0.5
17. Caryophyllene oxide	1579	1583	0.4
18. 6,10,14-trimethyl-2-pentadecanone	1843	1840	0.2
Total			95.5

[a]Compounds listed in the order of elution. [b]KI (Kovats index) measured relative to *n*-alkanes (C_9 - C_{28}) on the non-polar DB-5 column. [c]KI, (Kovats index) from literature.

Piperitenone as the major component of the studied oil is a monoterpene ketone and is found to be one of the main metabolites of the potent hepatotoxin, pulegone [9]. The presence of a high amount of piperitenone compared to the low content of pulegone (4.6%) in *M. longofolia* seed oil is considerable and demonstrates a characteristic metabolic pathway in the seed cells in which piperitenone could highly be metabolized from pulegone.

Six reports on the analysis of *M. longofolia* aerial part oils collected from different parts of Iran have been published [4-6]. A comparison of the results with the literature showed differences between *M. longofolia* seed oil and that of *M. longofolia* aerial parts collected at full flowering stage.

Table II

Essential oil main components of the aerial parts of six *M. longifolia* collected at full flowering stage from different regions in Iran comparing with those of the seed oil (> 5%)

Compound	*M. longifolia* seed	A	B	C	D	E	F
Piperitenone	40.9	43.9	–	–	–	–	–
Piperitone	29.4	–	–	–	–	–	–
1,8-Cineol	6.8	–	–	14.3	13.4	7.7	7.3
Tripal	–	14.3	–	–	–	–	–
Oxathiane	–	9.3	–	–	–	–	–
Piperitenone oxide	–	5.9	–	–	59.7	38.0	54.2
Carvone	–	–	72.3	62.3	–	–	–
Limonene	–	–	19.3	–	–	–	–
Pulegone	–	–	–	–	7.6	31.1	–
α-Terpineol	–	–	–	–	–	6.0	–

A = *M. longifolia* aerial parts collected from Sarayan, South Khorasan Province, Southeast of Iran [4]; B = *M. longifolia* aerial parts collected from Ghazvin Province, North of Iran [5]; C = *M. longifolia* aerial parts collected from Ardebil Province, Northwest of Iran [5]; D = *M. longifolia* aerial parts collected from Shahrekord, West of Iran [6]; E = *M. longifolia* aerial parts collected from Isfahan Province, Central of Iran [6]; F = *M. longifolia* aerial parts collected from Yasuj, West of Iran [6].

Table II shows the main compounds of *M. longofolia* seed oil and those of six other *M. longofolia* aerial parts. The presence of piperitenone, the major component in the seed oil, in the aerial parts of *M. longofolia* oil collected from the Southeast of Iran with nearly the same amounts is characteristic. Piperitenone oxide has been reported as the main component of the oils in the aerial parts of three studied species collected from the West and central parts of Iran. This component exists in the seed oil in very low amounts. The oil of *M. longofolia* collected from North of Iran is completely different from that of the seeds and the absence of all three seed oil major components in it is noticeable. Plant organ and vegetative cycle stage are the main reasons for differences in *M. longofolia* aerial parts and seeds essential oil compositions.

Conclusions

This paper presents the essential oil composition of *M. longifolia* seeds for the first time. Due to the presence of piperitenone and piperitone as the major components of the seeds oil, future studies on the biological and pharmacological properties of the oil are suggested.

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