Volatile Compounds Composition Of *Elsholtzia ciliata* Fresh, Frozen And Dried Herbal Materials

Lauryna Pudžiuvelytė[1], Mantas Stankevičius[2], Audrius Sigitas Maruška[2], Saulė Velžienė[1], Giedrė Kasparavičienė[1], Ona Ragažinskienė[2], Lolita Kuršvietienė[3] and Jurga Bernatonienė[1]

[1] *Department of Drugs Technology and Social Pharmacy, Lithuanian University of Health Sciences, Kaunas, Lithuania*
[2] *Department of Biology, Vytautas Magnus University, Kaunas, Lithuania*
[3]*Department of Biochemistry, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania*

INTRODUCTION

A flowering plant *Elsholtzia ciliata* (Thunb.) Hylander of the family *Lamiaceae* is native to Asia and is also found in Europe, Africa, North America, India [1, 2]. *E. ciliata* is widely used in folk medicine for antibacterial, anticancer and anti-inflammatory properties [3]. In traditional Chinese medicine the herb has been used to treat the common cold, headaches, pharyngitis, fever, edema, diarrhea, rheumatic arthritis, digestion disorders, nephritises [1, 4]. The major chemical constituents in *Elsholtzia* are flavonoids, phenylpropanoids, phytosterols, cyanogenic glycosides and triterpenes [1, 5].

The aim of this study was to obtained chemical composition of the volatile compounds from fresh, frozen and dried *E. ciliata* herbal materials. The samples were prepared by dynamic headspace solid-phase micro extraction (SPME) and analyzed by gas chromatography-mass spectrometry method (GC-MS).

MATERIAL AND METHODS

E. Ciliata aerial parts were collected in Vilnius, Lithuania, in July 2016 and were purchased as fresh and dried herbs from "Žolynų namai" (Vilnius, Lithuania). Fresh and dried materials were mechanically ground in a laboratory mill to a homogenous powder or paste. A sample of fresh herb was frozen in a freezer (-18°C) until preparation of extracts and SPME by GC-MS method.

Samples for gas chromatography analysis were prepared using SPME. Extraction *of E. ciliata* volatiles was performed on 65 µm PDMS/DVB (polydimethylsiloxane/divinylbenzene) Stable Flex fibre (Supelco, Bellefonte, USA). 10 mg of fresh, frozen and dried samples were added into 10 mL vials and placed in the AOC-5000 autosampler. The samples were thermostated for 10 min at 40 °C and the fiber was exposed in the headspace.

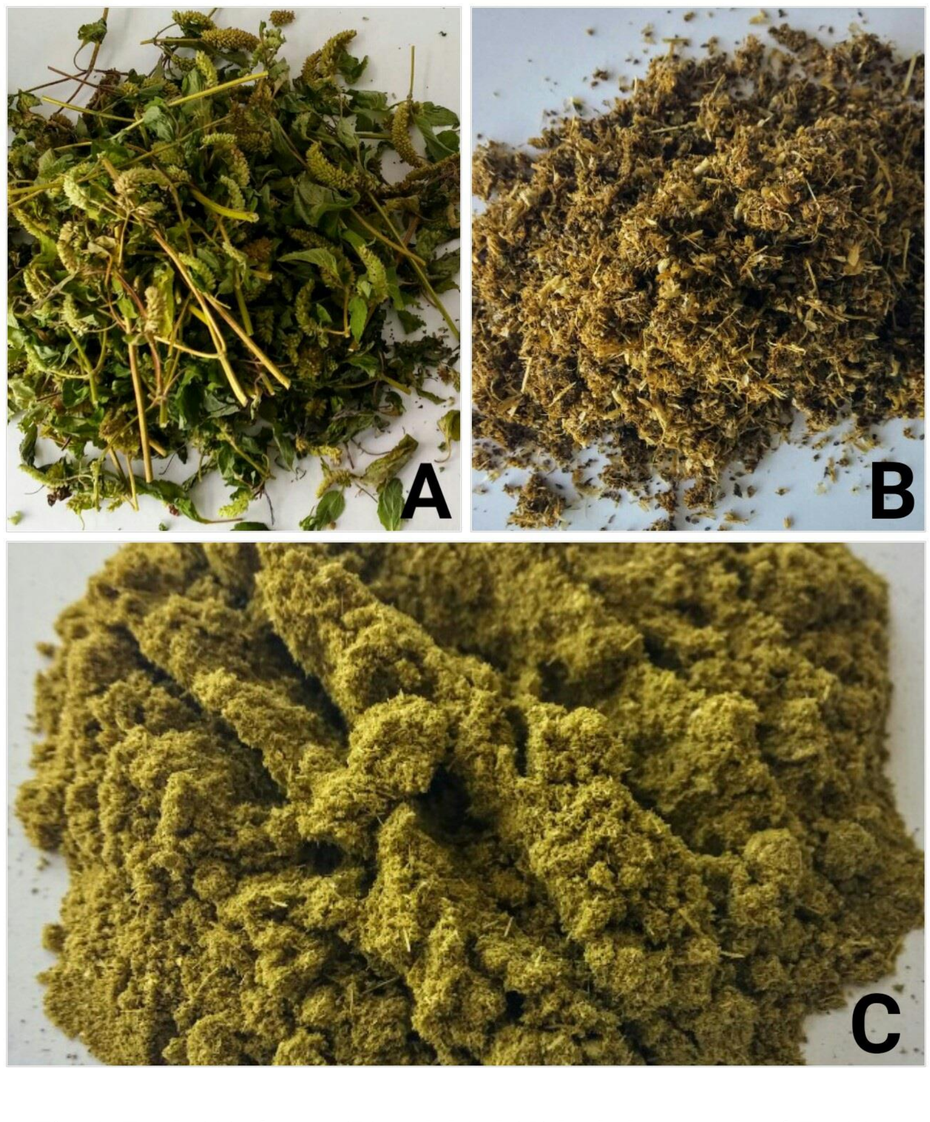

Fig. 1. Fresh (A), frozen (B) and dried (C) herbal materials of *E. ciliata* areal parts.

RESULTS AND DISCUSSION

Using GC-MS analysis sixteen different compounds have been obtained from all SPME samples. Dehydroelsholtzia ketone, elsholtzia ketone, beta-bourbonene, caryophyllene, alpha-caryophyllene, germacrene D and alpha-farnesene were identified and found to be predominant compounds in fresh, frozen and dried herbal samples. The major amounts of ketones were found in dried herbal samples and made up 21.94% (dehydroelsholtzia ketone) and 71.34% (elsholtzia ketone) of headspace SPME composition.

Sesquiterpenes were obtained from dried (3.3%), frozen (1.73%) and fresh (1.95%) *E. ciliata* samples. Predominant sesquiterpenes were α-caryophyllene and β-bourbonene in fresh (1.04% and 0.53%), frozen (0.84% and 0.49%) and dried (1.6% and 0.97%) herbal materials.

Table 1. Headspace SPME composition of fresh, frozen and dried *E. ciliata* herbal materials.

Compounds	Fresh (%)	Frozen (%)	Dried (%)	Retention index
3-Methyl-3-oxetanemethanol	-	0.22	-	935
3-Octanol	-	0.11	-	944
Eucalyptol	-	0.38	-	963
2-Propenoic acid, 2-methyl-, ethenyl ester	0.12	0.16	-	1052
Elsholtzia ketone	23.09	33.64	24.94	1067
2,3-Dimethyl-5-(2,6,10-trimethylundecyl) furan	-	-	0.26	1082
5-Methyl-furan-2-carboxylic acid (1H-[1,2,4]triazol-3-yl)-amide	0.28	0.23	-	1083
Dehydroelsholtzia ketone	72.64	63.31	71.34	1118
Artemizia ketone	1.83	-	-	1123
Beta-Bourbonene	0.53	0.49	0.97	1152
Caryophyllene	0.23	0.23	0.42	1167
Alpha-Caryophyllene	1.04	0.84	1.60	1181
Germacrene D	0.07	0.09	0.14	1193
Alpha-Farnesene	0.08	0.08	0.17	1199
1,3,6,10-Dodecatetraene, 3,7,11-trimethyl-, (Z,E)-	0.09	-	-	1205
(S)-3,4-Dimethylpentanol	-	-	0.08	1256
Sesquiterpenes	1.95	1.73	3.3	
Oxygenated monoterpenes	-	0.38	-	
Ketones	97.01	96.95	96.28	
Other	0.49	0.72	0.34	
Total	99.45	99.78	99.92	

CONCLUSION

Dehydroelsholtzia and elsholtzia ketones are predominant compounds in *E. ciliata* fresh, frozen and dried herbal materials. Sesquiterpenes are the second major group of compounds which were obtained. Data of this study will be valuable for future experiments with *E. ciliata* herbal materials.

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Corresponding author: jurga.bernatoniene@lsmuni.lt