

Heavy Metal Contents of Melissa Which is Sold in Herbalists

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ABSTRACT

The purpose of this study is to determine the heavy metal content that is important in human health and the plants sold as *Melissa* L. in herbalists. Plant samples were purchased from 14 different herbalist and specimens were identified by Flora of Turkey. Heavy metal contents (Fe, Co, Mn, Zn, Al, Cd) and some nutrients (Na, K, Ca, Mg) were identified by the ICP-OES method. As a result of the diagnoses, 4 of 14 samples were *Melissa officinalis* L. and others were identified as *Lippia citriodora*. According to ICP analysis, Zn, Cd and Co were not found in any sample. Other elements were found to be Al 200.93-695.29 mg/kg, Fe 4.51-339.37 mg/kg, Mn 1.61-73.59 mg/kg, Mg 3611.17-10001.73 mg/kg, Ca 9727.78-25435.9 mg/kg, K 10484.44-21975.71 mg/kg, Na 176.78-524.97 mg/kg, respectively. Fe, Ca and Mg has been found above the level of toxic effects in terms of human health, while other elements were within the optimum limit.

Keywords: *Melissa*, ICP, Heavy Metal, Herbalists, Turkey.

INTRODUCTION

Lamiaceae is a family of flowering plants which contains about 236 genera and 7200 species.¹ *Melissa officinalis* L. (Lemon balm), is a member of Lamiaceae, is one of the important medicinal plant species. Lemon balm is distributed in Mediterranean countries including the coastal regions of Turkey and southern Alpine regions.^{2,3} Three subspecies of *M. officinalis* growing in Turkey; subsp. *officinalis*, subsp. *inodora* and subsp. *altissima*. Besides, only subsp. *officinalis* has commercial value and the characteristic odor of lemon.^{4,5,6} Lemon balm (*M. officinalis* L.), in other words “bee herb or sweet balm” is a medicinal plant from ancient time until now and is used for the treatment of mental and CNS diseases, cardiovascular and respiratory problems, various cancers, and as a memory enhancer, cardiogenic, anti-depressant, sleeping aid and antidote in folk medicine.^{7,8,9} In addition, recent data have supported *M. officinalis* has a protective role against Alzheimer disease.^{10,11} Dried or fresh leaves and the top aerial

section of the plant are the parts which are used as medicine.

Heavy metal contents of the medicinal herbs change depend on climatic factors, plant species, vegetation period, air pollution, and other environmental factors.^{12,13} The certain permissible limits of metallic and non-metallic elements are necessary for the healthy human body. However, medicinal treatments with herbs and their extracts could be dangerous not only for the pharmacological side effects but also contents of heavy metals and other impurities.¹⁴ Thus medicinal raw materials should be controlled for the levels of the contaminant.^{15,16} In Turkey, herbalists collect the wild medicinal plants without growing and developing controls. The factor is the major reason for the species extinction.

The purpose of the study is to determine the heavy metal contents of *Melissa* sold in the herbalists for human health. The mineral contents of *Melissa* were evaluated for Fe

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(iron), Co (cobalt), Mn (manganese), Zn (zinc), Al (aluminium), Cd (cadmium), Na (sodium), K (potassium), Ca (calcium), and Mg (magnesium). The results have been compared with weighted values found in plants as well as settled limits for herbal medicines and derived products. The measurements were performed with an inductively coupled plasma optical emission spectrometer (ICP-OES).

MATERIAL AND METHODS

Plant material

Plant samples were purchased from 14 different herbalists in Turkey and identification of the specimens were made with Flora of Turkey (Table 1).⁴

The compositions of the 14 different herbal species were evaluated for heavy metal contents (Fe, Co, Mn, Zn, Al, Cd) and some nutrients (Na, K, Ca, Mg) with ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry) technique.

RESULTS AND DISCUSSION

Due to the volatile oil content as *Melissa* 2 different species are sold in herbalists, Turkey. According to botanical diagnoses, 4 samples were identified as *M. officinalis* and others were *Lippia citriodora* of the 14 plant samples. Depending to ICP analysis, Zn, Cd and Co were not

Number	Herbalist Name
1	Yemen Baharat- Denizli
2	Temiz iş- Ege Bölgesi
3	Temiz iş- Ege Bölgesi
4	Asya Baharat- İzmir
5	Şifa Baharat- Uludağ (Bursa)
6	Murat Baharat- Karden baharat
7	Eskişehir Baharat- Konya
8	Nasip Baharat- Eskişehir
9	Doğa Baharat- İzmir
10	Hisarlı kuru kahve- Eskişehir
11	Flamingo Baharat- Didim (Aydın)
12	Flamingo Baharat- Antalya
13	Arifoğlu Baharat- Eskişehir
14	Korkuteli Baharat- Denizli

found in any sample, and other found elements were Al 200.93-695.29 mg/kg, Fe 4.51-339.37 mg/kg, Mn 1.61-73.59 mg/kg, Mg 3611.17-10001.73 mg/kg, Ca 9727.78-25435.9 mg/kg, K 10484.44-21975.71 mg/kg, Na 176.78-524.97 mg/kg, respectively (Table 2).

Found rates of the Fe, Ca and Mg was above the toxic levels for human health, while other elements were within the optimum limit. The recommended intakes of essential secondary plant nutrients / trace elements

Sample	Zn	Al	Cd	Co	Fe	Mn	Mg	Ca	K	Na
1. (<i>L. citriodora</i>)	-	608.61	-	-	303.45	20.83	4737.71	23950.28	10485.44	321.09
2. (<i>M. officinalis</i>)	-	494.97	-	-	146.78	73.59	7694.17	25435.9	11106.63	247.02
3. (<i>L. citriodora</i>)	-	342.74	-	-	69.34	-	3839.11	12493.94	-	219.61
4. (<i>L. citriodora</i>)	-	259.01	-	-	6.14	-	3819.44	17804.36	13849.05	218.10
5. (<i>L. citriodora</i>)	-	258.53	-	-	-	-	4322.73	17055.14	12450.88	235.41
6. (<i>L. citriodora</i>)	-	200.93	-	-	75.57	1.61	4407.18	18593.94	15603.35	280.58
7. (<i>M. officinalis</i>)	-	521.50	-	-	90.36	-	5623.95	9727.78	15102.37	199.10
8. (<i>L. citriodora</i>)	-	678.62	-	-	339.37	14.13	5515.28	25013.01	-	176.78
9. (<i>L. citriodora</i>)	-	695.29	-	-	106.84	-	4356.32	18874.56	14510.77	217.94
10. (<i>L. citriodora</i>)	-	380.95	-	-	-	-	4341.19	16507.05	15070.32	229.14
11. (<i>L. citriodora</i>)	-	448.52	-	-	-	-	4224.65	20628.89	17842.49	467.44
12. (<i>L. citriodora</i>)	-	648.96	-	-	38.81	19.83	10001.73	23150.44	15539.38	207.16
13. (<i>M. officinalis</i>)	-	461.91	-	-	-	-	3611.17	12770.96	18557.25	524.97
14. (<i>M. officinalis</i>)	-	535.57	-	-	4.51	-	5014.65	16674.36	21975.71	213.82

(Zn, Fe, Mn, Cu, Cr and Ni) do not exceed to 0.01% of body weight.¹⁷

The daily intake of Fe is 10 mg for an adult male, 15-18 mg for females and 27-30 mg for pregnant women.¹⁸ The daily intake of Mg is 300-420 mg in adults.¹⁹ Medicinal raw plant materials do not have any standardization establish permissible levels for metals. Only World Health Organization (WHO) mentions maximum permissible levels for As, Cd, and Pb which amount to 1.0, 0.3 and 10 mg/kg, respectively in raw materials.²⁰

According to the Turkish Food Codex (TFC), the maximum levels of As, Cu, Zn, Cd, and Pb may not exceed 0.1, 2.2, 0.01, and 0.1 mg/kg (ppm), respectively, in food.²¹

Pellerano *et al.* (2011) stated the concentration of fourteen micro and macro minerals of 5 different medicinal plants taken from regional markets, mainly in San Luis province (Argentina) in both crude drugs and infusions and reported the highest Mg (4.03 mg g⁻¹), K (16.90 mg g⁻¹) and Fe (0.97 mg g⁻¹) concentration for *M. officinalis*.²²

CONCLUSION

Even though some of the samples sold in the herbalist are packaged and labelled, some have been turned into bundles and some have been sold out in pieces. It has been determined that some of these samples sold as *Melissa* do not belong to *M. officinalis*.

In order to determine the quality of medical plants and to prevent human health from adversely affecting them, it is necessary to determine the heavy metal concentrations and make them a criterion for selling.

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CONFLICT OF INTEREST

None

ABBREVIATION USED

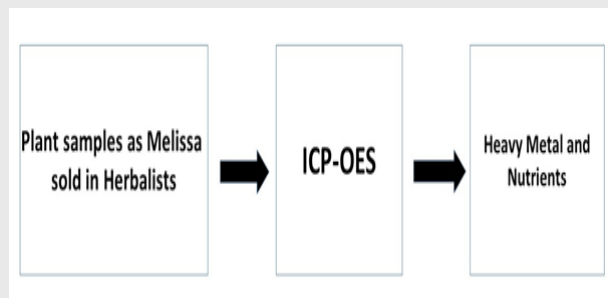
Mg/kg: miligram/kilogram; Mg g⁻¹: miligram/gram ; µg/gr: microgram/gram; mg: miligram; ppm: Parts per million; CNS: Central Nervous System; Fe: iron; Co: cobalt; Mn: manganese; Zn: zinc; Al: aluminium; Cd: cadmium; Na: sodium; K: potassium; Ca: calcium; Mg:

magnesium; As: arsenic; ICP-OES: Inductively Coupled Plasma-Optical Emission Spectrometry; WHO: World Health Organization ; TFC: Turkish Food Codex

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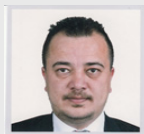
PICTORIAL ABSTRACT



SUMMARY

- Plant samples were purchased from 14 different herbalists in Turkey
- Identification of the specimens were made with Flora of Turkey
- Heavy metal contents (Fe, Co, Mn, Zn, Al, Cd) and some nutrients (Na, K, Ca, Mg) with ICP-OES
- 2 different species were identified (*M. officinalis* and *L. citriodora*)
- Fe, Ca and Mg was above the toxic levels for human health

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