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Macro and micro element contents of some herb and condiments

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Abstract

Mineral contents of several condiment anf herbs were measured by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). Potassium contents were found between 7567 (Cinnamon) and 37781 mg/kg (Basil). Also, Ca contents ranged from 549 (turmeric) to 40059 mg/kg (urtica). While Mg contents of condiments change between 649 mg/kg (cinnamon) and 7312 mg/kg (Basil), P contents ranged from 526 mg/kg (turmeric) to 8412 mg/kg (black cumin). The highest and lowest Fe contents were found in balm (781 mg/kg) and rose (36 mg/kg) samples, respectively. While Zn contents of samples change between 5.0 (rose) and 62.1 mg/kg (black cumin, Cu contents ranged from 5.9 (turmeric) to 22.8 mg/kg (basil). The study revealed that investigated edible condiments are good source of P, K, Ca, Mg and Fe.

Keywords: condiments, herbs, mineral, heavy metal, ICP-AES

1.Introduction

Herbs and spices have been used for several purposes like culinary purposes since ancient times [1,2]. Their fruit, seed, root, bark or vegetable substances are used as flavoring or coloring food and preservative against the action of harmful bacteria or prevents their growth [3-5]. The specific uses of spices can vary depending on cultures and countries [5,-7]. In terms of structure, biological properties and role in the traditional medicine, plants are an important source of active natural products [8]. Spices stimulate the appetite and increase the flow of gastric juice. They are used in perfumery, soaps, incense, as dyes in various industries [9]. The objective of current study was to determine the mineral contents of several condiments.

2.Material and Methods

2.1.Materials

Condiments (Table 1) were provided from spice markets in Turkey. After samples were dried at 70 ^{o}C in oven, they were ground in a mortar and sieved in 10 mesh diameter. They were kept at +4 ^{o}C by analysing

2.2.Determination of mineral contents

Dried samples (about 0.5 g) were digested by using 5ml of 65% HNO_3 and 2 ml of 35% H_2O_2 in a closed microwave system (Cem-MARS Xpress). After the volumes was completed with 20 ml with ultra-deionized water, mineral contents were determined by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP AES) (Varian-Vista, Australia) [10].

2.3.Statistical analyses

Results of the research were analysed for statistical significance by analysis of variance [11].

3.Results and Discussion

The macro element compositions of several condiments and spices are given in Table 2. Mineral contents changed according to condiment types. According to results. Ca, Mg, K, P and S contents were very high in all the condiments. Cr, Cu, Mn

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and Ni contents of condiments were found low an important level (Table 3) ($p<0.05$). K contents of samples was found higher than other elements analysed, and potassium contents of samples ranged from 7567 (Cinnamon) to 37781 mg/kg (Basil) ($p<0.05$).

Table 1. Plants used in this study

General Name	Botanical name	Family	Used parts
Sage	*Salvia officinalis* L.	Labiatae	Leave+Flower
Ginger	*Zingiber officinale*	Zingiberacae	Root
Rose	*Rosa canina* L.	Rosaceae	seed
Clove	*Syzygium aromaticum*	Myrtaceae	Flower bud
Turmeric	*Curcuma longa*	Zingiberaceae	Root
Marshmallow	*Althaea officinalis*	Malvaceae	Leaves + Flower
Fennel (sweet)	*Foeniculum vulgare* subsp. *dulce*	Umbelliferae	Fruit
Thyme	*Thymbra spicata* L.	Labiatae	Leave+Flower
Tilia	*Tilia* sp. L.)	Tiliaceae	Leaves + Flower
Black cumin	*Nigella sativa* L.	Ranunculaceae	seed
Paprica	*Capsicum annuum* L.	Solanaceae	Fruit
Mint	*Mentha piperita* L.	Labiatae	Leave
Cumin	*Cuminum cyminum* L.	Umbelliferae	Fruit
Pepper (black)	*Piper nigrum* L.	Piperaceae	Fruit
Rosemary	*Rosmarinus officinalis* L.	Labiatae	Leave+Flower
Sumac	*Rhus coriaria* L.	Anacardiaceae	Pericarp
Cinnamon	*Cinnamon zeylanicum*	Lauraceae	Bark
Sesame	*Sesamum indicum* L.	Pedaliaceae	seed
Basil	*Ocimum basilicum* L.	Labiatae	Leave+Flower
Coriander	Coriandum sativum	Umbelliferae	Fruit
Muğla Sage	Salvia fruticosa	Labiatae	Leave +Flower
Scotch thistle	*Onopordum acanthium* L.)	Compositae	seed
Olive	*Olea europaea* L.	Oleaceae	Leave
Urtica	*Urtica dioica* L.	Urticaceae	Leave
Senna	*Cassia spp.*	Fabaceae	Leave
Anise	*Pimpinella anisium* L.	Umbelliferae	Fruit
Parsley	*Petroselinum crispum* L.	Umbelliferae	Leave
Basil	*Ocimum minimum* L.	Labiatae	Leave+Flower
Fenugreek	*Trigonella foenumgraecum* L.	Fabaceae	seed
Balm	*Melissa officinalis* L.	Labiatae	Leave
Fennel (bitter)	*Foeniculum vulgare* subsp. *piperitum*	Labiatae	Fruit

Table 2. Macro element contents of condiments (mg/Kg) (dw basis) (n:3)

Condiment	Ca	Mg	K	P	S
Sage	15259 ± 338	3525 ± 58	14734 ± 159	935 ± 27	1358 ± 54
Ginger	1549 ± 30	3242 ± 16	30259 ± 444	3101 ± 87	8117 ± 206
Rose	8533 ± 182	2288 ± 65	12758 ± 418	1422 ± 24	894 ± 50
Clove	9375 ± 234	3581 ± 52	20049 ± 354	1251 ± 25	1665 ± 29
Turmeric	549 ± 22	1740 ± 18	15195 ± 559	526 ± 18	1238 ± 98
Marshmallow	19228 ± 266	5143 ± 38	27798 ± 159	4158 ± 35	4258 ± 110
Fennel (sweet)	11373 ± 593	5147 ± 165	25222 ± 272	6734 ± 158	3324 ± 41
Thyme	23116 ± 330	2638 ± 63	23385 ± 508	1384 ± 51	2375 ± 62
Tilia	11568 ± 479	2640 ± 65	20528 ± 599	2580 ± 107	1343 ± 93
Black cumin	7406 ± 312	3201 ± 102	11447 ± 303	8412 ± 103	3190 ± 151
Paprica	1238 ± 57	1751 ± 81	26965 ± 1896	4098 ± 97	2219 ± 184
Mint	16121 ± 173	4928 ± 45	33513 ± 251	5305 ± 60	5544 ± 247
Cumin	15483 ± 150	4359 ± 53	25756 ± 265	4423 ± 108	3625 ± 117
Pepper (black)	6270 ± 81	2684 ± 80	22537 ± 623	2100 ± 108	1459 ± 47
Rosemary	24123 ± 85	4490 ± 36	13698 ± 606	1776 ± 58	2630 ± 51
Sumac	4666 ± 86	715 ± 23	16195 ± 224	1005 ± 9	741 ± 25
Cinnamon	15341 ± 208	649 ± 18	7567 ± 85	798 ± 14	1852 ± 130
Sesame	234 ± 13	4125 ± 156	5788 ± 317	8145 ± 93	3775 ± 201
Basil	32525 ± 584	7312 ± 35	37781 ± 175	5852 ± 48	3310 ± 150
Coriander	8878 ± 166	3791 ± 118	24578 ± 821	5747 ± 170	2678 ± 109
Muğla Sage	12757 ± 349	2751 ± 87	24062 ± 233	983 ± 19	2527 ± 142
Scotch thistle	10856 ± 215	3821 ± 95	11906 ± 209	5418 ± 174	2034 ± 53
Olive	28737 ± 178	2871 ± 52	17047 ± 550	1268 ± 30	1738 ± 79
Urtica	40059 ± 945	4548 ± 69	35041 ± 435	7426 ± 106	6557 ± 162
Senna	34678 ± 468	4568 ± 26	16176 ± 229	1647 ± 17	2675 ± 194
Anise	10250 ± 74	4212 ± 89	26187 ± 781	6910 ± 196	4427 ± 74
Parsley	12098 ± 216	5286 ± 52	20816 ± 631	4661 ± 85	3725 ± 95
Basil	30074 ± 443	6387 ± 41	37443 ± 283	3951 ± 44	3831 ± 43
Fenugreek	1211 ± 60	2123 ± 101	16550 ± 341	5457 ± 231	2572 ± 130
Balm	23133 ± 1060	5234 ± 206	25692 ± 708	3249 ± 57	3280 ± 216
Fennel (bitter)	17428 ± 557	3848 ± 38	23678 ± 553	3126 ± 34	3414 ± 164

*mean±standard deviation

Table 3. Micro element contents of condiments (mg/Kg) (dw basis) (n:3)

Condiments	B	Cr	Cu	Fe	Mn	Ni	Zn
Sage	39.2 ± 0.8	0.38 ± 0.07	7.2 ± 0.1	112 ± 2	6.8 ± 0.4	0.99 ± 0.07	14.9 ± 0.4
Ginger	8.4 ± 0.5	1.67 ± 0.03	9.6 ± 0.4	436 ± 14	413.1 ± 7.4	2.12 ± 0.22	16.1 ± 0.2
Rose	18.4 ± 1.3	0.16 ± 0.03	6.4 ± 0.3	36 ± 2	30.3 ± 0.5	1.18 ± 0.16	5.0 ± 0.2
Clove	27.3 ± 2.2	0.23 ± 0.04	11.9 ± 0.7	72 ± 4	624.3 ± 12.6	0.12 ± 0.01	9.6 ± 0.2
Turmeric	6.4 ± 0.4	0.67 ± 0.05	5.9 ± 0.2	182 ± 6	201.7 ± 3.9	1.77 ± 0.10	11.4 ± 1.2
Marshmallow	38.1 ± 1.1	1.07 ± 0.13	10.0 ± 0.3	235 ± 4	29.8 ± 0.1	4.00 ± 0.34	23.7 ± 0.7
Fennel (sweet)	34.3 ± 1.7	0.71 ± 0.05	15.2 ± 0.7	87 ± 3	47.2 ± 2.0	2.76 ± 0.10	26.1 ± 2.3
Thyme	48.0 ± 2.6	0.35 ± 0.04	11.2 ± 0.2	111 ± 3	79.3 ± 3.1	0.50 ± 0.09	19.6 ± 0.8
Tilia	23.3 ± 1.0	0.13 ± 0.03	11.8 ± 0.5	59 ± 4	29.9 ± 0.5	0.20 ± 0.03	18.1 ± 1.4
Black cumin	23.2 ± 2.1	0.24 ± 0.04	14.9 ± 1.0	119 ± 2	25.9 ± 1.8	1.81 ± 0.04	62.1 ± 2.8
Paprica	12.0 ± 1.2	0.18 ± 0.03	9.8 ± 0.8	58 ± 2	3.6 ± 0.3	0.26 ± 0.03	16.2 ± 1.0
Mint	29.7 ± 0.6	0.76 ± 0.04	14.0 ± 0.2	190 ± 4	62.7 ± 1.0	1.52 ± 0.09	26.4 ± 0.8
Cumin	30.2 ± 2.3	2.62 ± 0.25	14.5 ± 0.5	337 ± 3	34.1 ± 0.9	5.80 ± 0.58	36.6 ± 1.8
Pepper (black)	14.7 ± 0.3	0.99 ± 0.18	17.7 ± 1.1	290 ± 3	65.0 ± 1.3	2.83 ± 0.37	17.5 ± 1.0
Rosemary	48.1 ± 2.5	0.46 ± 0.05	6.4 ± 0.4	136 ± 4	56.2 ± 0.4	2.10 ± 0.22	19.7 ± 1.2
Sumac	24.8 ± 0.3	0.77 ± 0.06	8.3 ±0.5	381 ± 6	4.0 ± 0.3	1.39 ± 0.24	8.4 ± 0.5
Cinnamon	15.8 ± 0.3	0.10 ± 0.02	7.4 ± 0.6	74 ± 2	193.1 ± 6.4	0.68 ± 0.06	17.0 ± 1.1
Sesame	13.7 ± 1.2	0.26 ± 0.03	19.5 ± 0.6	73 ± 4	13.4 ± 0.8	1.58 ± 0.32	50.9 ± 2.3
Basil	34.1 ± 1.4	0.38 ± 0.05	13.6 ± 1.2	119 ± 1	78.8 ± 1.5	2.43 ± 0.29	21.4 ± 1.0
Coriander	24.0 ± 1.7	0.31 ± 0.06	17.3 ± 1.0	83 ± 4	23.4 ± 1.4	0.88 ± 0.06	39.2 ± 2.2
Muğla Sage	35.6 ± 1.3	1.64 ± 0.26	9.0 ± 0.2	527 ± 11	42.1 ± 2.1	2.26 ± 0.11	39.2 ± 0.6
Scotch thistle	18.8 ± 1.3	0.19 ± 0.03	19.4 ± 0.6	63 ± 2	15.9 ± 0.4	0.97 ± 0.14	39.9 ± 2.6
Olive	22.2 ± 2.0	0.81 ± 0.07	7.8 ± 0.5	173 ± 4	50.1 ± 1.5	2.45 ± 0.45	14.9 ± 0.9
Urtica	40.4 ± 2.0	0.59 ± 0.05	12.0 ± 0.7	245 ± 8	40.4 ± 1.0	0.57 ± 0.05	29.9 ± 0.1
Senna	51.1 ± 2.0	0.92 ± 0.20	7.9 ± 0.3	313 ± 9	35.0 ± 0.4	0.54 ± 0.11	16.5 ± 1.7
Anise	24.8 ± 1.8	0.56 ± 0.04	10.7 ± 0.7	171 ± 5	20.6 ± 1.0	2.24 ± 0.37	36.9 ± 1.6
Parsley	29.3 ± 1.4	0.37 ± 0.07	20.8 ± 0.2	188 ± 9	38.7 ± 0.8	2.99 ± 0.39	50.9 ± 2.4
Basil	34.4 ± 1.2	0.85 ± 0.01	22.8 ± 0.1	560 ± 10	102.9 ± 0.2	1.08 ± 0.19	38.0 ± 1.0
Fenugreek	16.0 ± 0.5	0.16 ± 0.02	15.8 ± 0.7	89 ±5	12.6 ± 1.2	2.31 ± 0.13	32.5 ± 1.8
Balm	26.7 ± 1.2	1.68 ± 0.17	15.4 ± 0.4	781 ± 29	46.0 ± 4.1	2.04 ± 0.14	29.0 ± 1.3
Fennel (bitter)	26.2 ± 3.8	0.25 ± 0.02	12.1 ± 0.2	82 ± 6	27.1 ± 0.8	0.83 ± 0.11	24.6 ± 1.0

*mean±standard deviation

Also, Ca contents were found 549 (turmeric) and 40059 mg/kg (urtica). While Mg contents of condiments change between mg/kg (cinnamon) and 7312 mg/kg (Basil), P contents ranged from 526 (turmeric) to 8412 mg/kg (black cumin) ($p<0.05$) (Table 2). In addition, S contents of condiments changed between 741 mg/kg (sumac) and 8117 mg/kg (ginger). The highest and lowest Fe contents of samples weres found in balm (781 mg/kg) and rose (36 mg/kg) samples, respectively. While Zn contents of condiments are determined between 5.0 (rose) and 62.1 mg/kg (black cumin), Cu contents of samples were found between 5.9 (turmeric) and 22.8 mg/kg (basil) (Table 3).

In previous study, Özcan [12] reported that sahlep (*Orchis* spp.) and dill (*Anethum graveolens* L.) contained 2384 ppm and 35723 ppm potassium, respectively. According top the same researcher, while iron content change between 46.7 ppm caraway (*Carum carvi* L.) and 1229 ppm (*Lavandula officinalis* L.), selenium content varied from 0.15ppm in savory (*Satureja hortensis* L.) to 5.03 ppm in mustard (*Sinapis alba* L.). Also, zinc contents of spices were found between 5.54 ppm sumac (*Rhus coriaria* L.) and 49.7 ppm in black cumin (*Nigella sativa* L.) [12]. In previous study, the result shows that the anise seed contained 2027.10±14.0 mg/kg phosphorous, 5.40±2.0 mg/kg Iron, 270.10±7.0mg/kg Magnesium, 602.8±4.0 mg/kg calcium, 365.10±3.0 mg/kg sodium and 887.80±11.0 mg/kg potassium. Also, Fenugreek seeds contained 2950.0±17.5 mg/kg phosphorous and 124.82±2.0 mg/kg potassium [13]. In other study, K content was vfound low in *T. spicata* (1200.99 ppm), *R. canina* (5316.84 ppm) and *C. angustifolia* (6728.64 ppm), but was very high in *M. chamomilla* (27497.81 ppm), *C. casia* (29167.53 ppm) and green tea (28890.93 ppm), and also *C. casia* (11733.96 ppm), *F. vulgare* (10145.48 ppm) and green tea (12698.05 ppm) was rich in P [14]. Our results shownt partly differences with literature values conducted on different spice and herbs. These differences might be due to growth conditions, geographical variations and analytical procedures. The most of inorganic elements which may contribute to biological processes [15]. This study supports to contribute to knowledge of the nutritional properties of these plants. In addition, knowledge of the mineral contents, as condiments is of great interest.

4.Conclusion

These spices have the potential of contributing tothe nutritional and health needs of their consumers. Condiments are very important for human nutrient due to their more consumption in recent years. As a result, minerals are due to many physiologic and metabolic functions. K, P and Mg were detected at

significant levels in condiment and herbs. A significant levels of Ca, Fe, Mn and Zn were also present in the condiments. The study revealed that investigated edible condiments are good source of P, K, Ca, Mg and Fe.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

References

1. Baytop, T., Treatment with plants in Turkey (Tu¨rkiye'de Bitkilerle Tedavi, vol. 40. I . İstanbul: I . İstanbul Univ in Turkish, **1984**
2. Koedam, A., Volatile oil composition of Greek mountain tea (*Sideritis* spp.). *Journal of Science Food Agriculture*, **1986**, *36*, 681–684.
3. Bitting, J. & Sherman, P.W., Antimicrobial Functions of Spices—Why Some Like It Hot, *Quarterly Review of Biology*, **1998**, *73*, 3-49.
4. Susheela, U.R., Handbook of Spices, Seasoning, and Flavorings," TECHNOMIC Publishing Co., Inc., Lancas-ter, **2000**, 329.
5. Bouba, A.A., Njintang, N.Y., Foyet, H.S., Scher, J., Montet, D., & Mbofung, C.M.F., Proximate Composition, Mineral and Vitamin Content of Some Wild Plants Used as Spices in Cameroon. *Food and Nutrition Sciences*, **2012**, *3*, 423-432
6. Barakat, A.A., Maslat, A.O., & AL-Kofahi, M.M., Element Analysis and Biological Studies on Ten Orien-tal Spices Using XRF and Ames Test. *Journal of Trace Element Medicine Biology* **2003**, *17*, 85-90.
7. Takruri, H.R.H. & Dameh, A.F.M., Study of the nutritional value of black cumin seeds (*Nigella sativa* L). *Journal of the Science of Food and Agriculture*, **1998**, *76*, 404-410.
8. Virgili, F., Scaccini, C., Packer, L., & Rimbach, G., *Cardiovascular disease and nutritional phenolics*. In: Pokorny J, Yanishlieva N, Gordon M (Eds.), Antioxidants in Food. Wood head Publishing Ltd., Cambridge, **2001**, 87–99.
9. Onyesom, I., & Okoh, P.N., Qualitative analysis of nitrate and nitrite contents in vegetables commonly consumed in Delta State, Nigeria. *British Journal of Nutrition*, **2006**, *96*(5), 902-905.
10. Skujins S., Handbook for ICP-AES (Varıan-Vista). A hort Guıde To Vista Series ICP-AES Operation.Varian Int.AG Zug.Version 1.0., **1998**, *29*. Switzerland.
11. Püskülcü, H., & Ikiz, F., Introdiction to Statistic. Bilgehan Presss, p 333, Bornova, Izmir, Turkey (in Turkish), **1989**.
12. Özcan, M., Mineral contents of some plants used as condiments in Turkey. *Food Chemistry*, **2004**, *84*, 437 – 440.
13. Kumaravel, S., Alagusundaram, K., Determination of Mineral Content in Indian Spices by ICP-OES. *Oriental Journal of Chemistry*, **201**4, *30*, 631-636.
14. Özcan, M.M.,Unver, A.,,Uçar,T., & Arslan, D., Mineral content of some herbs and herbal teas by infusion and decoction. *Food Chemistry*, **2008**, *106*, 1120–1127
15. Macrae, R., Robinson, R. K., & Sadler, M. J. (eds.)., *Encyclopaedia of food science, food technology and nutrition*, vol. 5. San Diego, CA: Academic Press INC, 1993.