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Mineral contents of some plants used as condiments in Turkey

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Abstract

Mineral contents of thirty-two plants used as condiments in Turkey were determined by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). All materials contained high amounts of Al, Ba, Ca, Fe, K, Mg, P and S. The highest levels of Ca, Fe, K, Mg and S were found in *Thymus vulgaris, Lavandula officinalis* L., *Anethum graveolens* L., *Ocimum basilicum* L. and *Sinapis alba* L., respectively. Bi, Cd, Li, Pb and Se contents of condiments were found to be very low. This work attempts to contribute to knowledge of the nutritional properties of these plants. These results may be useful for the evaluation of dietary information.

Keywords: Spice; Condiments; Mineral contents

1. Introduction

In the earlier part of this century, scientists could qualitatively detect small amounts of several mineral elements in living organisms. The trace elements found in living organisms may be essential, i.e. indispensable for growth and health, or they may be nonessential, fortuitious reminders of our geochemical origins or indicators of environmental exposure. Herbs and spices, grown wildly in various regions of the world, have been used for several purposes since ancient times. Several uses of these plants are known for culinary purposes. In addition, they are also used in folk medicine as antiscorbutic, antispasmodic, tonic, carminative agents against bronchitis, ulcers and as diuretics, depuratives, vermifuges. Also, some species are used as tea, flavouring agents in several regions (Baytop, 1984; Koedam, 1986; Yeşilada & Ezer, 1989).

Some modern cultures still consume wild plants as a normal spice and herb source, obtaining fairly good amounts of several nutrients, and it is widely accepted that herbs are significant nutritional sources of minerals. Furthermore, other nutrients, such as carotenoids and phenols, are found in larger quantities in these plants (Guil et al., 1997). The nutritional and medicinal properties of these plants may be interlinked through phytochemicals, both nutrient and non-nutrient (Ranhotra, Leinen, Vinas, & Lorenz, 1998).

Although spices are used primarily for their desirable flavour and odour, they may play other important roles in food systems. From antiquity, in addition to spices and their derivatives being used for flavouring foods and beverages and for medication, they have also been highly valued for their use as antimicrobials (Koedam, 1986; Özcan, 1998; Özcan and Boyraz, 2000).

Human, as well as animal, studies originally showed that optimal intakes of elements such as sodium, potassium, magnesium, calcium, manganese, copper, zinc and iodine could reduce individual risk factors, including those related to cardiovascular disease (Anke et al., 1984; Mertz, 1982; Sanchez-Castillo et al., 1998).

Throughout the world, there is increasing interest in the importance of dietary minerals in the prevention of several diseases. Minerals are of critical importance in the diet, even though they comprise only 4–6% of the human body. Major minerals are those required in amounts greater than 100 mg per day and they represent 1% or less of bodyweight. These include calcium, phosphorus, magnesium, sulfur, potassium, chloride and sodium. Trace minerals are essential in much smaller amounts, less than 100 mg per day, and make up less than 0.01% of bodyweight. Essential trace elements are zinc, iron, silicon, manganese, copper, fluoride, iodine and chromium. The major

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minerals serve as structural components of tissues and function in cellular and basal metabolism and water and acid-base balance (Macrae, Robinson, & Sadler, 1993a; Nielsen, 1984; Smith, 1988).

Several studies have been carried out on edible wild plants (Chiej, 1992; Ezeala, 1985; Guerreno, Martirey, & Irosa, 1998; Gupta & Wagle, 1998; Özcan & Akgül, 1998; Özcan et al., 1998). But, limited studies on mineral contents of condiments were made (Akgül, 1993; Khanum, Sudarshanakrishna, Semwal, & Vishwanathan, 2001; Okeke, 1998; Özcan & Akgül, 1998). The aim of this study was to determine the mineral contents of several condiments used for several purposes in Turkey.

2. Material and methods

2.1. Materials

Condiments were purchased from local markets in Konya in Turkey. The dried materials were then ground in a mortar and the ground material sealed in bottles for storage until analysis. The common, scientific and family names of the spices are given in Table 1.

Table 1
Plants used in experiment

General name	Botanical name	Family	Used parts
Anise	*Pimpinella anisum* L.	Umbelliferae	Fruit
Basil	*Ocimum basilicum* L.	Labiatae	Leaf + flower
Black cumin	*Nigella sativa* L.	Ranunculaceae	Seed
Black thyme	*Thymbra spicata* L.	Labiatae	Leaf + flower
Capers	*Capparis spinosa* L.	Capparaceae	Buds
Capsicum	*Capsicum frutescens* L.	Solanaceae	Fruit
Caraway	*Carum carvi* L.	Umbelliferae	Fruit
Coriander	*Coriandrum sativum* L.	Umbelliferae	Fruit
Cumin	*Cuminum cyminum* L.	Umbelliferae	Fruit
Dill	*Anethum graveolens* L.	Umbelliferae	Fruit
Fennel (bitter)	*Foeniculum vulgare* L.	Umbelliferae	Leaf
Fennel (sweet)	*Foeniculum vulgare* L.	Umbelliferae	Fruit
Fenugreek	*Trigonella foenum-graecum* L.	Leguminosae	Seed
Laurel	*Laurus nobilis* L	Lauraceae	Leaf
Lavender	*Lavandula officinalis* L.	Labiatae	Leaf + flower
Mahaleb	*Cerasus mahaleb* L.	Rosaceae	Seed
Melisa	*Melissa officinalis* L.	Labiatae	Leaf + flower
Mustard	*Sinapis alba* L.	Cruciferae	Seed
Mountain tea	*Sideritis congesta* L.	Labiatae	Leaf + flower
Oregano	*Origanum vulgare* L.	Labiatae	Leaf + flower
Paprika	*Capsicum annuum* L.	Solanaceae	Fruit
Parsley	*Petroselinum crispum* (Mill.)	Umbelliferae	Fruit
Pickling herb	*Echinophora tenuifolia* L.	Umbelliferae	Leaf
Poppy	*Papaver somniferum* L.	Papaveraceae	Seed
Rosemary	*Rosmarinus officinalis* L.	Labiatae	Leaf
Sage	*Salvia fruticosa* L.	Labiatae	Leaf + flower
Sahlep	*Orchis spp.*	Orchidaceae	Bulb
Savory	*Satureja hortensis* L.	Labiatae	Leaf + flower
Savory, Grit	*Satureja thymbra* L.	Labiatae	Leaf + flower
Spearmint	*Mentha spicata* L.	Labiatae	Leaf + flower
Sumac	*Rhus coriaria* L.	Anacardiaceae	Fruit
Thyme	*Thymus vulgaris* L.	Labiatae	Leaf + flower

2.2. Methods

2.2.1. Determination of mineral contents

About 0.5 g dried and ground sample was put into a burning cup and 15 ml pure HNO_3 were added. The sample was incinerated in a MARS 5 Microvawe Oven at 200 °C and dissolved ash was diluted to a certain volume with water. Concentrations were determined with an ICP-AES (Skujins, 1998).

Working conditions of the ICP-AES were:

Instrument	ICP-AES (Varian-Vista
RF Power	0.7–1.5 kw (1.2–1.3 kw for Axial)
Plazma gas flow rate (Ar)	10.5–15 l/min (radial) 15 l/min (axial)
Auxiliary gas flow rate (Ar)	1.5 l/min
Viewing height	5–12 mm
Copy and reading time	1–5 s (max 60 s)
Copy time	3 s (max 100 s)

3. Results and discussion

The mineral compositions of condiments are shown in Table 2. The results of the analyses were established to give nutrient values per 100 g of used portion of dried weight. Mineral elements were found to vary widely depending on the different spices.

According to results, Al, Ba, Ca, Fe, K, Mg, P and S contents were very high in all the condiments. Bi, Cd, Li, Pb and Se contents of condiments were very low. In addition, B, Mn, Na and Zn elements were found in a similar range for all of plants.

The level of Ca of *Thymus vulgaris* in this wosk was found to be higher than those of others. Potassium content was high in most cases and ranged from 2384 ppm sahlep (*Orchis* spp.) to 35723 ppm dill (*Anethum graveolens* L.). Iron content ranged from 46.7 ppm caraway (*Carum carvi* L.) to 1229 ppm (*Lavandula officinalis* L.). Selenium content varied from 0.15 ppm in savory (*Satureja hortensis* L.) to 5.03 ppm in mustard (*Sinapis alba* L.). Zinc contents of spices were found in similarly small percentages in all the species analyzed, ranging from 5.54 ppm sumac (*Rhus coriaria* L.) to 49.7 ppm in black cumin (*Nigella sativa* L.). Magnesium was found to be high, ranging from 1210 ppm in sahlep (*Orchis* spp.) to 5738 ppm in basil (*Ocimum basilicum* L.). Cr content was found to be very similar to that of other species. On the other hand, among these plants, S was found in large amounts in *Sinapis alba* L.. Phosphorus content ranged from 391 ppm in sumac (*Rhus coriaria* L.) to 5795 in poppy (*Papaver somniferum* L.).

Table 2
Mineral contents of plants (mg/kg)

Plant name	Al	B	Ba	Bi	Ca	Cd	Cr	Cu	Fe	K	Li
Cumin	77.2	39.8	80.5	0.44	10386	–	9.00	5.43	129	17196	0.33
Dill	85.8	40.0	111	–	11750	0.14	8.97	6.98	161	35723	0.49
Minth	308	47.6	372	–	11326	–	10.0	8.48	414	24758	1.47
Savory	153	33.3	119	–	11333	–	8.26	5.83	203	13660	0.26
Mustard	13.6	22.7	78.5	–	8352	0.14	7.83	5.05	108	7384.5	0.30
Sage	423	37.8	147	–	11131	–	10.1	4.67	565	11568	0.46
Caraway	15.2	0.28	27.7	–	6781	0.03	3.11	3.95	46.7	5343.4	0.04
Mahaleb	22.4	14.4	75.6	–	9354	0.03	8.60	14.0	96.9	6562.9	0.06
Capers	22.7	18.9	10.5	3.01	8313	0.13	9.29	9.52	90.3	23394	0.53
Fennel (bitter)	29.1	41.2	69.1	–	11567	0.02	7.81	9.87	97.2	16649	0.19
Thyme	385	58.8	370	5.73	12455	–	8.76	4.88	405	8470.2	0.38
Laurel	97.9	30.9	47.6	–	10761	–	11.0	3.17	174	4937.3	0.31
Black thyme	96.7	50.7	122	–	11416	–	7.55	6.77	140	16546	0.18
Mountain tea	267	28.0	272	–	10485	–	10.3	7.84	393.08	11391	0.31
Sumac	620	14.0	93.4	–	9576	–	8.78	3.02	695.13	7600	0.52
Lavender	1064	14.1	66.6	–	10622	–	19.1	10.70	1229.2	17623	0.68
Melisa	334	32.1	292	–	11720	0.03	8.60	13.97	96.93	6563	0.06
Coriander	442	21.3	56.7	–	10360	–	9.10	11.52	163.49	12525	0.55
Fennel (sweet)	80.0	40.0	33.2	0.98	10301	–	7.33	12.4	116	20192	0.17
Fenugreek	41.8	20.61	20.8	0.89	5744	0.07	7.74	12.5	118	9913	0.34
Black cumin	398	31.51	150	2.64	9062	0.01	7.80	11.3	181	6932	0.47
Paprika	335	27.96	75.7	0.76	7204	0.03	8.43	8.94	301	19343	1.00
Anise	492	44.83	191	–	10135	0.09	9.11	8.76	211	15614	0.40
Basil	426	31.75	455	–	12363	–	7.95	8.05	503	24811	0.73
Rosemary	486	37.78	95.5	–	10899	–	8.93	6.66	547	9356	0.69
Oregano	118	16.83	79.8	–	10473	0.02	7.43	6.65	159	19625	0.19
Capsicum	467	51.90	49.7	33.34	6330	0.04	11.2	8.38	296	19829	1.24
Sahlep	11.2	22.92	12.5	4.14	3006	–	8.04	2.82	73.5	2384	0.11
Pickling herb	265	61.40	309	–	10628	–	7.42	12.4	131	17374	1.28
Girit savory	547	33.35	258	–	11198	–	9.19	11.8	703	15014	0.62
Parsley	394	48.92	171	44.82	11134	–	6.95	8.02	406	15254	2.99
Poppy	19.6	30.31	118	3.00	10583	–	6.34	14.4	91.1	5906	0.09

Plant name	Mg	Mn	N	N	P	Pb	S	Se	Sr	V	Zn
Cumin	4625	19.4	10.9	11.8	2851	–	2098	1.41	26.4	11.8	18.6
Dill	4628	42.6	477	10.2	1745	–	5699	1.65	75.4	18.1	17.7
Minth	5267	97.9	21.7	10.8	2292	–	3064	1.12	153	11.7	18.7
Savory	4138	21.90	118	6.76	745	–	1615	0.15	27.1	9.69	29.1
Mustard	4526	20.1	6.05	4.59	5503	–	8555	5.03	19.9	11.5	38.3
Sage	4182	38.8	37.6	9.00	672	0.51	1714	1.44	17.8	5.08	28.7
Caraway	2313	10.60	4.74	13.9	1853	–	738.	–	7.08	3.24	14.0
Mahaleb	4303	14.0	8.82	5.00	3807	–	1696	–	32.0	10.5	24.1
Capers	4390	15.1	19.4	13.7	4437	1.30	12896	–	90.4	9.71	42.9
Fennel (bitter)	3991.6	48.2	29.7	9.98	2383	–	2413	2.05	25.0	15.8	26.6
Thyme	4359	22.4	9.70	7.40	888	–	1543	1.50	27.4	10.1	14.3
Laurel	3195	32.6	26.7	30.7	676	–	1229	0.17	40.8	6.04	21.9
Black,thyme	3381	68.9	28.2	31.8	1004	–	1593	2.52	16.4	9.57	19.7
Mountain tea	3085	42.3	14.7	17.1	1283	4.17	1088	–	23.5	2.61	22.2
Sumac	2330	21.4	51.3	5.50	391	1.37	494	–	23.5	0.25	5.54
Lavander	4596	50.1	54.2	28.0	1459	4.73	1253	–	28.3	2.26	25.9
Melisa	5550	40.7	11.9	10.2	1356	1.13	2020	–	116	15.3	12.3
Coriander	4415	32.3	26.5	17.9	2282	–	1673	2.46	31.8	3.89	28.2
Fennel(sweet)	5159	38.1	45.2	8.33	3284	–	2479	0.48	33.5	15.0	15.4
Fenugreek	2812	16.0	45.2	6.27	3212	3.01	2101	–	21.4	3.32	26.6
Black cumin	3788	33.5	8.81	9.92	4504	–	2051	3.24	28.3	1.41	49.7
Paprika	3882	29.0	13.8	10.3	2061	–	1844	0.72	12.3	1.43	18.5
Anise	3525	37.2	17.4	14.1	2034	–	1870	2.02	20.5	2.16	33.3
Basil	5738	117	20.7	21.8	4960	2.10	1923	–	142	19.7	13.7
Rosemary	3868	41.2	25.6	9.45	418	8.36	1030	–	39.6	3.88	15.6
Oregano	3268	25.5	21.2	6.36	1609	0.49	1947	–	9.93	4.11	19.3
Capsicum	4432	32.4	61.2	25.9	1485	–	1789	1.80	10.90	1.92	17.3
Sahlep	1210	4.85	28.1	4.80	605	–	999	2.48	11.4	1.08	7.33
Pickling herb	5625	51.8	33.0	28.0	2963	–	2035	2.23	110	14.0	22.8
Girit savory	4591	70.4	11.8	128	1467	–	1728	1.51	30.6	5.64	31.4
Parsley	5022	50.9	10.2	6.63	1175	–	1389	3.21	139	8.26	26.3
Poppy	4256	56.1	8.69	4.63	5795	–	2113	2.88	70.6	13.9	42.5

K, Mg, Mn and Na contents of *C. spinosa* buds, determined in this study were low with respect to results of Özcan and Akgül (1998). Our some results of mineral contents of condiments show minor differences when compared with literature (Akgül, 1993). These differences might be due to growth conditions, genetic factors, geographical variations and analytical procedures (Guil et al., 1998; Özcan & Akgül, 1998).

Calcium is the major component of bone and assists in teeth development (Brody, 1994). The Mg, Fe and P levels are adequate. The importance of these elements can not be overemphasized because many enzymes require them as cofactors (Akpanabiatu, Bassey, & Kronemann, 1998). The essential role of selenium (Se) for human health has been well established in recent years (Foster, Chaplin, & Sumar, 1998; NRC, 1989). Selenium has an active role as a modulator in inflammatory and immune responses (Neve, 1991). Other inorganic elements which may contribute to biological processes, but which have not been established as essential, are barium, bromine, cadmium, lead and lithium (Macrae, Robinson, & Sadler, 1993a). Cadmium and lead are best known for their toxicological properties (Macrae, Robinson, & Sadler, 1993b). Decreasing of these toxic element contents is an advantage. Lithium is another element with beneficial pharmacological properties; it has been used effectively in the treatment of manic depressive disorders. There is evidence to suggest that lithium is also an essential element (Macrae et al., 1993b).

The highest mineral contents were Al, Ba, Ca, Fe, K, Mg, P and S. This work attempts to contribute to knowledge of the nutritional properties of these plants. In addition, knowledge of the mineral contents, as condiments is of great interest.

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