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Estimation of minerals, nitrate and nitrite contents of medicinal and aromatic plants used as spices, condiments and herbal tea

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Abstract

In this study, the minor and major mineral contents of 31 kinds of medicinal and aromatic plant collected from the south region of Turkey in 2004 year were established by inductively coupled plasma atomic emission spectrometry (ICP-AES). The samples were composed of Al, Ca, Fe, K, Mg, Na, P and Zn. The highest mineral concentration were measured between 57.70–2962.74 mg/kg Al, 1160.04–16452.88 mg/kg Ca, 44.83–1799.5 mg/kg Fe, 3570.73–27669.72 mg/kg K, 477.17–4313.59 mg/kg Mg, 1102.62–20912.33 mg/kg Na, 443.60–9367.80 mg/kg P and 7.18–48.36 mg/kg Zn. The highest values of Ca, K and P were established in *F. vulgare* (bitter fennel) (16452.88 mg/kg), *O. minumum* (basil) (27669.72 mg/kg) and *F. vulgare* (bitter fennel) (9367.80 mg/kg), respectively. The heavy metal contents were determined too low in all samples.

Nitrate and nitrite contents of samples were analysed using the phenolicdisulphonic acid method and the diazotisation method of the American Public Health Association, respectively. These nitrate and nitrite values were established to vary widely depending on the different plant species. While nitrate contents were high in most cases and varied from 12.15 mg/kg lime flover (*Tilia corata*) to 238.85 mg/kg myrtle (*M. communis*), nitrite contents were established between 3.69 mg/kg sesame (*S. indicum*) to 52.70 mg/kg basil (*O. minumum*). Generally, nitrate contents of samples were found very high compared with nitrite values.

Keywords: Medicinal and aromatic plant; Minerals; Nitrate and nitrite contents

1. Introduction

Edible wild and culture plants are found in countries with rather varied climates. Plants greens and seeds were important foods in the traditional diet of the first European farmers. They consumed plants that today are no longer generally considered for nutrition (Guil, Martirey, & Irosa, 1998; Wells, 1984). Some modern culture still consume wild plants as a normal food source, obtaining fairly good amounts of several nutritients, and it is widely accepted that leafy green vegetables are significant nutritional sources of minerals (Kuhnlein, 1990). The main contrast for the nutritional exploitation of these species is the presence of certain anti-nutritional and toxic substances such as nitrates, oxalate, and saponin (Gupta & Wagle, 1998). Nevertheless, these principles are also found in commercial leafy green vegetables (Guil, Torija, & Rodriguez-Garcia, 1997).

Consumers are convinced that they need more and better nutrients than their diets provide. Nutritional deficiency may lead to diseases and nutritional deficiencies. Dietary supplements which increase the total dietary intake of one or more essential vitamin or minerals are very common (Ivey & Elmen, 1986; Obiajunwa, Adebajo, & Omobuwajo, 2002). Mixtures of medicinal plants are prescribed by the traditional healers for diseases ranging from common cold to maloria, arthritis, ulcers, etc. (Obiajunwa et al., 2002). Minor elements have very important functions and it is believed a key component of proteins such as haemoprotein and haemoglobin which play role in biochemical functions and essential enzyme system even in low doses. These

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elements are present in plants due to industrial development and pollution of biosphere (Chen, 1992; Hay, 1984; Tolonen, 1990). Most wild plants leaves are used in salad and meat product (Wetherilt, 1992). Many countries are rich in plants contained mineral and other nutrition elements (Freiberger et al., 1998; Khader & Rama, 1998; Yıldırım, Dursun, & Turan, 2001). Essential and trace element contents of 20 medicinal plants were determined in Niger. These elements were detected in concentrations between 0.182 and 77.400 ppm (Obiajunwa et al., 2002). Turan, Kordali, Zengin, Dursun, and Sezen (2003) reported macro- and micro-element contents of some wild culinary herbs in East Anatolian Region of Turkey. Also in other study, mineral contents of 32 plants used as condiments in Turkey were determined by inductively coupled plasma atomic emission spectrometry (ICP-AES) (Özcan, 2004).

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, vermifurges. Also, some species are used as tea, flavouring agents in several regions (Baytop, 1984; Koedam, 1986; Yeşilada & Ezer, 1989). The nutritional and medicinal properties of these plants may be inter-link through phytochemicals, both nutrient and non-nutrient (Ranhotra, Leinen, Vinas, & Lorenz, 1998). Several studies have been carried out on edible wild plants (Chen, 1992; Guil et al., 1998; Özcan & Akgul, 1998; Özcan, Akgul, Bağcï, & Dural, 1998). But, limited studies were carried out on mineral, nitrate and nitrite contents of medicinal and aromatic plants growing in Turkey. So, it may be useful to know their content in the main edible plants collected for nutritional purposes in Turkey. The aim of this work was to establish the mineral, nitrate and nitrite contents of several herb and spices used for several purposes in Turkey.

2. Materials and methods

2.1. Materials

The plants used in experiment were collected from the south region of Turkey in June and July 2004 year. Sumac was harvested in September 2004. Blackpeper, cinnamon and clove were bought from local market. Fruit and seeds were collected during mature stage. Sampling technique was performed as replication. 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 plants are given in Table 1.

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 added. The sample was incinerated in a MARS 5 Microwave Oven at 200 °C and dissolved ash was diluted to a certain volume with ultra pure water. Concentrations were determined with an ICP-AES (Skujins, 1998).

Working conditions of the ICP-AES were

Instrument	ICP-AES (Varian-Vista 0.7–1.2 kW); (1.2–1.3 kW for axial)
Plasma 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)

Table 1
Medicinal and aromatic plants used in experiment

General name	Botanical name	Family	Used parts
Ajowan	*Carum copticum*	Umbelliferae	Fruit
Anise	*Pimpirella anisum* L.	Umbelliferae	Fruit
Balm	*Melissa officinalis*	Labiatae	Leave
Basil	*Ocimum minumum*	Labiatae	Leave + flower
Bitter fennel	*Foeniculum vulgare* ssp. *piperitum*	Umbelliferae	Fruit
Bitter fennel	*F. vulgare* ssp.*piperitum*	Umbelliferae	Leave
Black cumin	*Nigella sativa*	Ranunculaceae	Seed
Black pepper	*Piper nigrum*	Piperaceae	Fruit
Calamus	*Acorus calamus*	Araceae	Rhizom
Camomile	*Matricaria chamomilla*	Compositae	Flower
Caper	*Capparis ovata*	Capparaceae	Bud
Capsicum	*Capsicum frutescens*	Solanaceae	Fruit
Cinnamon	*Cinnamomum zeylanicum*	Lauraceae	Bark
Clove	*Syzygium aromaticum*	Myrtaceae	Flower
Cumin	*Cuminum cyminum*	Umbelliferae	Fruit
Fennel	*F. vulgare*	Umbelliferae	Fruit
Laurel	*Laurusnobilis*	Lauraceae	Leave
Lime flower	*Tilia cordata*	Tiliaceae	Leaf + flower
Liquorice	*Glycyrrhiza glabra* L.	Leguminasae	Root
Mint	*Mentha piperita* L.	Labiatae	Leave
Mustard	*Brassica alba*	Cruciferae	Seed
Myrtle	*Myrtus communis*	Myrtaceae	Leave
Pickling herb	*Echinophora tenuifolia*	Umbelliferae	Leave
Rosemary	*Rosmarinus officinalis*	Labiatae	Leave
Sage	*Salvia aucheri*	Labiatae	Leave
Sage	*Salvia fruticase* L.	Labiatae	Leave
Savory, sater	*Satureja hortensis*	Labiatae	Leave
Sesame	*Sesamum indicum*	Pedaliaceae	Seed
Sumac	*Rhus coriaria*	Aracordiaceae	Fruit
Thyme (black)	*Thymbra spicata* L.	Labiatae	Flower + leave
Wormwood	*Artemisia absinthium* L.	Compositae	Flower