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Research Article

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Determination the minerals contents of the roots of four medicinal plants as Asaudian indigenous plants using Flame Atomic Absorption Spectroscopy (FAAS)

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ABSTRACT

Eight elements (S, Cd, P, K, Mg, Ca, Mo and Cr) were determined in four selected medicinal plants namely; Poupulus nigra, Ocimum basilicum, Taraxacum officinale and Convallaria maialis by using Flame Atomic Absorption Spectroscopy (FAAS). These elements has the highest concentration such as Ca (442 ppm), Mg (42 ppm), P (14.24 ppm) and Cd (14.4 ppm). The highest concentration of K (842 ppm) and S (1428 ppm) was found in Taraxacum afficincale. The highest concentration of Cr (13.10 ppm) and Mo (9.2 ppm) was found in Poupulus nigra. Such information could be helpful in standardization of herbal products since the Saudian medicinal plants play an important role in maintenance of human health.

Keywords: Minerals content, Flame Atomic Absorption Spectroscopy, medicinal plants.

INTRODUCTION

Medicinal plants are widely used to treat many human diseases [1, 2]. The human body needs a number of minerals in order to maintain good health [3, 4]. Macro and microelements influence biochemical processes in the human organism. Active constituents of medicinal plants i.e. metabolic products of plant cells and a number of mineral elements play an important role in the metabolism [5]. Some mineral elements remain chelated with organic ligands and make them bioavailable to the body system [6]. Kolasani *et. al*., 2011 concluded that the medicinal values of some plant species used in homoepathic system may be due to the presence of Ca, Cr, K and P [7]. These elements also take part in neurochemical transmission and serve as constituents of biological molecules and it is of major interest to establish the levels of some metallic elements in common used plants because at elevated levels, these metals could be dangerous and toxic [14, 15]. Determination of metals in medicinal plants is a part of quality control to establish their purity, safety and efficacy according to the World Health Organization (WHO) [16]. Although several attempts have been reported for determination of metal contents of medicinal and aromatic plants from all over the world [17].

Most of the medicinal plants were used after soaking in water and thus only this water extract is taken for the cure of disease. However, some are taken as a whole in the form of powder mixed with milk, honey and yoghurt or eaten as a fruit. The objective of this investigation is to determine the trace amounts of the metals and concentration of

some micro - and macro elements in selected medicinal plants extensively used in the preparation of herbal products which must be used in native medicine.

EXPERIMENTAL SECTION

Plant materials

Four medicinal plants namely; *Poupulus nigra*, *Ocimum basilicum*, *Taraxacum officinale* and *Convallaria maialis* were purchased from the local markets in Jeddah city of the Kingdoum of Saudi Arabia. Botanical identification and authentication were performed at Department of Botany, Faculty of Science, Taif University, KSA. The identification and the medicinal uses of the plants were shown in Table 1.

Samples preparation

Samples were washed with deionized water and allowed to dry in an oven at 65 ^{o}C for 48 hours. 0.50 gram of each plant sample was accurately weighed then ground with a Wiley mill for 3 minutes and sieved through a 0.5 mm diameter sieve supplied with the mill. The powdered plant sample was pressed to a pellet of 25 mm diameter and 1.0 gram mass using a 25 ton hydraulic press.

Flame Atomic Absorption Spectroscopy (FAAS)

FAAS analysis of the pellets was performed using an ARL Quant'X spectrometer. This system comprises three main units, the sample chamber, X-ray excitation and X-ray detection subsystems. The Quant' X system includes the following functional components: an aluminum or a cellulose X-ray filter, a Rh-anode X-ray tube with an operational range between 8 and 12 KV and a current intensity between 0.32-0.34 mA. Emergent X-rays are detected by a Si (Li) detector cooled with nitrogen. Accurate energy and efficiency calibrations of the spectrometer were made using a standard source supplied by the International Energy Agency (IAEA), Vienna, Austria. The spectrum acquisition time was 120 seconds for each sample and the dead time was around 50%. Treatments of the data were performed by using the WINTRACE software version 4.1 build 9. Triplicate experiments were performed for each plant sample.

RESULTS AND DISCUSSION

The trace elements present in the medicinal plants will play significant roles in the formation of active constituents responsible for the curative properties. Moreover, some of these elements are very important for human body.[18]. In this study, a total of eight elements (S, Cd, P, K, Mg, Ca, Mo and Cr) were determined in the powdered medicinal plant samples by using Flame Atomic Absorption Spectroscopy (FAAS) method. The mean concentrations of various metals in the plant samples were shown in Table 2. The current study revealed that all the metals were accumulated to greater or lesser extents by all four investigated plant species[12]. Cd concentrations varied from 1.8 to 14.4 ppm, wich showed that they contained large amounts of nutrients and were rich in K and Ca. The high concentration of potassium in plants will be very important for enzyme activation, photosynthesis, water use efficiency, starch formation and protein synthesis. Potassium participates actively in the maintenance of the cardiac rhythm [19,20]. The concentrations of potassium were in the range 400-842 ppm and calcium concentrations were in the range 200-442 ppm.

Sulfur is an essential element for human beings and animals and is an essential component of hemoglobin. It facilitates the oxidation of carbohydrates, protein and fat to control body weight, which is very important factor in diabetes. The S concentrations varied from 24 to 1428 ppm. According to FAO/WHO, the concentration of S in *Ocimum basilicum* was found to exceed the maximum permissible limit [21]. However, previous study [22] showed that *Ocimum basilicum* dried roots and ethanol extract induced toxic effect in rats and they suggested that the apparent lack of clinical signs of acute toxicities in human when administered the extract orally, may be a reflection of the low dose administration as well as short duration of exposure. Moreover, the root was rich in tannins [23] suggesting that sulfur can be found chelated with tannic acid and this subsequent chelation may be eliminated faster from the body as compared to non-chelated iron [24]. Nevertheless, the safety of this plant in the traditional medicine should be verified by much further testing, including *in vivo* experiments and clinical studies. According to Perry [27], Cr, Mg and P have important roles in the metabolism of cholesterol as well as heart

diseases. The presence of Cr and Mg in plants may be correlated with therapeutic properties against diabetic and cardiovascular diseases [28]. The toxic effects of Cr intake is skin rash, nose irritations, bleeds, upset stomach, kidney and liver damage. Cr deficiency is characterized by disturbance in glucose lipids and protein metabolism [29]. The daily intake of Cr 0.24-0.48 mg has been recommended for adults by United State National Academy of Sciences [30]. The Cr concentrations varied from 2.80 to 13.10 ppm, most samples being in the 7.31-10.3 ppm range.

Phosphorus is the component of more than 240 enzymes [31] and its deficiency in the organism is accompanied by multisystem dysfunction. Besides, P is responsible for sperm manufacture, fetus development and proper function of immune response [32-34]. The P concentrations varied from 2.61 to 14.24 ppm.

Molybdenum concentrations varied from 0.82 to 9.2 ppm, most samples having concentrations between 0.51 and 0.72 ppm had the highest Mo concentration. Although Mo is required in minute quantity for body as it is mostly present in the pancreas and hence plays an important role in the production of insulin. Its deficiency results in the disorder of liver [35] and the daily intake shouldn't exceed 1.0 mg since beyond this level is toxic [35-36]. Magnesium is considered as a non-essential element for living organisms [36]. The concentrations of this element varied from 1. 42 to 42 ppm.

Table 1. Plant; Local name, family and medicinal uses

Plant name	Local name	Family	Medicinal uses
Ocimum basilicum	Sweet basil	Lamiaceae	Headache, cough, antihypertensive
Poupulus nigra	Lombardy Poplar	Salicaceae	borers, cytospora canker , bacterial wetwood
Taraxacum officinale	Dandelion	Asteraceae	dandelion wine, salads
Convallaria maialis	Saffron	Asparagaceae	Rapid bone, fracture healing

Table 2. Total content of elements in plant samples in ppm

Plant name	S	Cd	P	K	Mg	Ca	Mo	Cr
Ocimum basilicum	399±8	326±4	7.28±1	1±0.5	150±3	3.56±0.8	13.3±0.6	7.60±0.2
Poupulus nigra	810±14	8107±9	18.11±0.5	15.9±1	200±4	4.7±0.2	8.84±0.2	3.77±0.6
Taraxacum officinale	1545±2	3059±9	15.5±2	9.79±1	1426±8	0.57±0.01	1.98±0.3	3.54±0.2
Convallaria maialis	1139±9	200±2	5.85±0.6	8.1±0.5	29±1	2.06±0.1	6.63±0.2	0.69±0.0.3

CONCLUSION

The minerals content present in medicinal plants studied are a source of biologically important elements, which may play part in the observed therapeutic properties of these plants. Moreover, with the exception of S concentration in *Ocimum basilicum* all of the detected values for metallic elements in plants studied here are below the WHO permissible levels and may not constitute a health hazard for consumers.

REFERENCES

[1] Shylaja, P., Gothandam, K.M., Karthikeyan, S., *Res. Pharm.*, **2004**; 1. (22-32).
[2] Basgel, S., and Erdemoğlu, S. B., *Sci. Total Environ.*, **2006**; 359. (82-89).
[3] Nafiu, M.O., Akanji, M. A., and Yakubu, M. T., *Bioresearch Bull.*, **2011**; **5**. (342-347).
[4] Ajasa, A. M. O., Bello, M.O., Ibrahim, A. O., Ogunwande, I. A., and Olawore, N. O., *Food Chem.*, **2004**; **85**. (67–71).
[5] Balaji, T., Acharya, R. N., Nair, A. G. C., Reddy, A. V. R., Rao, K.S., Naidu, G. R. K., and Manohar, S. B., *J. Radioanal Nucl. Chem.*, **2000**; **243**. (783-788).
[6] Kolasani, A., Xyper, H., and Millikan, M., *Food Chem.*, **2011**; **127**. (1465-1471).
[7] Choudhury, R. P., and Garg, A. N., *Food Chem.*, **2007**; **104**. (1454-1463).
[8] Vartika, R., Poonam, K., Sayyada, K., Rawat, A. K. S., and Shanta, M., *Pharm. Biol.*, **2001**; **39**. (384-387).

[9] Mayer, M. L., and Vyklicky, L., *J. Physiol*., **1989**; **415**. (351-365).
[10] Bahadur, A., Chaudhry, Z., Jan, G., Danish, M., Rehman, A. Ahmad, R., Khan, A., Khalid, S., Irfan U., Shah, Z., Ali, F., Mushtaq, T., and Gul Jan, F., *J. Pharm. Pharmacol*., **2011**; **5**. (1157-1161).
[11] Kumari, M., Gupta, S., Lakshmi, A., and Prakash, J., *Food Chem*., **2004**; **86**. (217-222).
[12] Leterme, P., Buldgen, A., Estrada, F., and Linda, A. M., *Food Chem*., **2006**; **95**. (644-652).
[13] Cobanoglu, U., Demir, H., Sayir, F., Duran, M., and Mergan, D., *Asian Pacific J*., **2010**; **11**. (1383-1388).
[14] Joo, N., Kim, S., Jung, Y., and Kim, K., *Bio. Trace Elem. Res*., 20**0**9; **129**. (28-35).
[15] Schumacher, M., Bosque, M. A., Domingo, J. L., and Corbella, J., *Bull. Environ. Contam. Toxicol*., **1991**; **46**. (320-328).
[16] Jabeen, S., Shah, M. T., Khan, S., and Hayat, M. Q., *J. Med. Plant Res*., **2010**; **4**. (559-566).
[17] WHO, Expert committee on specification for pharmaceuticals preparation. WHO technical report series 823, *Report Geneva* WHO, **1992**; **32**. pp: (44-54).
[18] Gjorgieva, D., Kadifkova-Panovska, T., Baeva, K., and Stafilov, T., *J. Sci. Res*., **2011**; **7**. (109-114).
[19] Pytlakowska, K., Kita, A., Janoska, P., Połowniak, M., and Kozik, V., *Food Chem*., **2012**; **135**. (494-501).
[20] Martin Jr, D. W., Mayers, P. A., Rodwell, V. W., and Granner, D. K., Harper's Review of Biochemistry, 20th ed., Lange Medical Publications, California, **1985**; pp. (651-660).
[21] Barceloux, G. D., Manganese, Nickel, *Clin. Toxicol*., **1999**; **37**. (294-299).
[22] FAO/WHO Contaminants. In Codex Alimentarius, Vol. XVII, Edition 1. FAO/WHO, Codex Alimentarius Commision, Rome. **1984**; pp (244-248).
[23] Yagi, S., Yagi, A. I., Abdel Gadir, E. H., Henry, M., Chapleur, Y., and Laurain-Mattar, D., *J. Ethnopharmacol*., **2011**; **137**. (796-801).
[24] Yagi, S., Chrétien, F., Duval, R. E., Fontanay, S., Maldini, M., Piacente, S. S., Henry, M., Chapleur, Y., and Laurain-Mattar, D., *South Afr. J. Botany*., **2012**; **78**. (228-234).
[25] Delazar, A., Babaei, H., and Rezazadeh, H., *DARU*., **2003**; **11(2)**: (245-248).
[26] Perry, H. M., Hypertension and true geochemical environments in relation to health and diseases. New York: Academic Press., **1997**; pp. (351-363).
[27] McGrath, S. P., and Smith, S., Chromium and Nickel in heavy metals in soils. In Alloway, B. J. (ed.), Blackie, Glasgow, **1990**; p.(125).
[28] Waston, D., Safety of chemicals in food, chemical contaminants, Ellis Publications, New York, **1993**; p. (109).
[29] Zinpro, C., *Trace Miner Focus*., **2000**; **6**. (1-8).
[30] Serfor-Armah, Y., Nyarko, B. J. B., Akaho, E. H. K., Kyere, A. W. K., Osae, S., and Oppong-Boachie, K., *J. Trace Microprobe Tech*., **2002**; **20**. (419-427).
[31] Pendias, A. K., and Pendias, H., Trace Elements in Soils and Plants. 2nd ed., CRC Press, Boca Raton, FL, USA., **1998**; p. (365).
[32] Berdanier, C. D., 1994. Advanced Nutrition - Micronutrients. CRC Press, New York., **1992**; p.(655).
[33] Underwood, E. J., Trace Elements in Human and Animal Nutrition. 3rd ed. Academic Press, New York., **1971**; p. (442).
[34] Aisha, A. A., Nassar, Z.D., Siddiqui, M.J., Abu-Salah, K.M., Alrokayanm, S.A., Ismail, Z., *Asian J. Biol. Sci*., **2002**; **4**. (282-290).
[35] Chaturved, A., Bhawani, G., Agarwal, P.K., Goel, S., Singh, A., Goel, R. K., *Indian J. Physiol. Pharmacol*., 2009; 53. (16-24).