

Determination of Some Essential Elements in Iraqi Medicinal Herbs

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Abstract

The trace elements in the medical herbs play an important role in the treatment of diseases. Well selected herbs samples of Iraqi herbs and collected from local markets. In this study, the concentrations of nine elements Na,K, Zn, Fe ,Co ,Cu ,Ni , Pb and Cd were determined in fourteen kinds herbs common belonging to Matricaria Chamomile Cinnamon,Pimpinella Anisum L., Zea Maize , Anethum Graveolens L., Jeft, Teucrium Polium L., Cagsia Italica,Echium Talicum L.,Ocimum Basilcum L., Galeopsis Sejetum,Nigella Sative L., Cyperus Rotundus L.,Lupinus Jaimehintoniana.The herbs samples were analysed by flameless except Na,K, in flame atomic absorption spectrophotometer in different medical herbs.The results indicated that the Na and K elements recorded the high concentrations, while the Co element recorded the low concentration in all herbs samples.

Keywords: Medicinal Herbs, Essential elements, Atomic Absorption.

Introduction

Medical herbs have been used for many years to cure a great variety of diseases. Recently, according to the World Health Organization, the use of traditional herbal medicine has spread not only in the developing countries but also in the industrialized ones, as a complementary way to treat and to prevent illnesses [1].

The pharmacological properties of the medicinal plants have been attributed to the presence of active constituents which are responsible for important physiological functions in living organisms. It has been reported that trace elements play an important role in the reactions which will lead to the formation of these active constituents [2]. However, a correlation between elemental composition of medicinal plants and their curative properties has not been established yet. Besides, element concentrations present in medicinal plants are of great importance to understand their pharmacological actions [3].

Analysis has revealed that medicinal plants are natural sources for trace elements. Micro-nutrients such as Cobalt (Co), Copper (Cu), manganese (Mn), molybdenum (Mo) and Selenium (Se) are elements necessary for maintaining the life processes in plants and animals. The required amounts of trace elements are much lower than the required amounts of macronutrients such as Ca, Mg, K, N and P. For most essential trace elements a high intake causes toxicity. Heavy metals have recently come to the forefront as dangerous substances and are considered as serious chemical health hazards for human and animals [4-6].

The level of essential elements in medicinal plants is conditional, the content being affected by the geochemical characteristics of the soil and by the ability of plants to selectively accumulate some of these elements [7]. Additional sources of these elements for plants are rainfall, atmospheric dusts, plant protection agents and fertilizers, which could be adsorbed through the leaf blades [8].

Determination of metal concentrations, especially toxic ones in medicinal plants, is of special concern since the industrial pollution of agricultural land and forests is becoming a serious ecological issue in many parts of the world [9-11].

The aim of this study was to analyze the major and trace elements content for fourteen medicinal herbs. The evaluation of these elements which were essential to humans. The analyzed major elements were K, Na and the trace elements were found to be Zn, Fe, Co, Cu, Ni, Pb, and Cd.

Material and Methods

Samples of fourteen kinds of varieties of herbs were collected from local Iraqi markets like, all samples were weighed carefully using sensitive balance (0.1 mg sensitive). One gram of each sample digestion was carried out by adding (2 ml) of concentrated nitric acid (70%), for several times. Heating was for one hour. Cooling and dilution to (25 ml) in a volumetric flask using double distilled water.

All reagents were Ultra-pure or analytical reagent (A.R) grade sixamal Germany. Distilled and deionized water was used for dilution and preparation of reagents and standards. The purity of the distilled water used for preparation of all reagents and calibration standards.

Heavy metals analysis were carried out using Shimadzu A.A.680, Flameless atomic absorption spectrophotometer except Na and K by Flame atomic absorption spectrophotometer (Shimadzu A.A.680).

Results and Discussion

The different concentrations of elements in the fourteen medicinal herbs are shown in table (1). The variation in elemental concentration is mainly attributed to the differences in botanical structure, as well as in the mineral composition of the soil in which the plants are

cultivated. Other factors responsible for a variation in elemental content is preferential absorbability of the plant use of fertilizers, irrigation water and climatologica conditions [12].

The major elements that K and Na content were observed in Figs 1,2 were high in Matricaria Chanomile (450.00, 67.96 ppm) and low in Cinnamon (13.29 ,5.85 ppm) respectively . It is important here to note that the regulation of potassium is intimately involved with that of sodium and the two are largely interdependent. Sodium is essential for regulation of osmotic pressure of the body and helps to maintain acid- base and water balance of the body .Its deficiency causes loss of body weight and nerves disorder. Potassium is accumulated within human cells bY the action of the Na^+ , K^+ AT pase (Sodium pump) and it is an activator of some enzymes; in Particular Co-enzyme is for normal growth and muscle function [13]. It helps in the protein and carbohydrate metabolism. Potassium deficiency causes nervous disorder, diabetes, and poor muscular control resulting in Paralysis.

The elements as Zn and Fe are essential trace elements (micro nutrients) for living organisms. Zinc is relatively non-toxic [14]. Zinc deficiency is characterized by recurrent infections, lack of immunity and poor growth .Growth retardation skin changes, poor appetite and mental lethargy are some of the manifestations of chronically zinc-deficien human subjects [14].Zinc is necessary for the growth and multiplication of cells (enzymes) responsible for DNA and RNA synthesis for skin integrity, bone metabolism and functioning of taste and eyesight [15]. It is a constituent of many enzymes and insulin. Zinc deficiency causes weight loss. Pregnant and lactating women require (20 to 25) mg, while normal adult require 15mg of zinc every day.Fig. (3) shows the concentrations of zinc in samples studies that range between (0.216-29.09)ppm . The smaller quantity was determined for Cinnamon (0.216 ppm) and the higher for Ocimum Basilcum L. (29.09 ppm).

Iron occupies a unique role in the metabolic process. The role of iron in the body is clearly associated with hemoglobin and the transfer of oxygen from lungs to the tissue cells [16]. Iron deficiency is the most prevalent nutritional deficiency in humans and is commonly caused by insufficient dietary intake, excessive menstrual flow or multiple births [17].In this case, it results especially an anemia. In various medical herbs samples analyzed, the Fe content was observed in fig.(4) that the maximum in Matricaria Chamomile (6.87 ppm) and minimum in Cinnamon (0.47 ppm). Hence the use of Matricaria Chamomile in general tonic preparation may be advised to compensate for an iron deficiency.

Cobalt is found in plants and animals bodies essential element for the herbs, which is able to synthesize vitamin B_{12} , which is the main source of Co in animal foods. Nevertheless , only a Part of Co in food derived from animals is present in the from of cobalamines, The recommended daily intake of vitamin B_{12} for adults is 3 mg (0.13 mg Co),taking into account that only 50%is absorbed in the intestine [15].Cobalt is widely distributed throughout the body and highest concentrations are usually found in liver , kindneys and bones. Deficiency of vitamin B_{12} produces a genetic defect and failure of gastric mucosa. Vitamin B_{12} is essential for the maturation of red blood cells. and normal functioning of all cells in humans, deficiency of vitamin B_{12} leads to a megaloblastic anemia. Cobalt also plays an important role in thyroid metabolism in humans. The Co Concentration ranged between (0.0004ppm) in Pimpinella Anisuml, Jeft , Cagsia Italica , Ocimum Basilcum L. and(0.002ppm) in Matricaria Chamomile,on the other hand , Co were not detectable in Anethum Graveolens L. , Cyperus Rotundus L and Lupinus Jaimehintoniana .

Copper is one of many metals that are essential to life, despite being as inherently toxic as nonessential trace heavy metals (Cadmium, Lead). Copper deficiency in humans is a rare exception, and would not occur if Cu Content were more than 2mg in the daily diet [18]. For analysed samples Cyperus Rotundus L. has the highest content in copper (0.24ppm), followed by Lupinus Jaimehintoniana (0.22ppm), Jeft has the smallest copper concentration (0.021ppm).

Nickel is an essential element for animal nutrition. The Nickel requirement of humans has been estimated to be (25-35) $\mu\text{g/day}$ [19]. Matricaria Chamomile has the great content in Nickel (0.45ppm). Galeopsis Sejetum has the smallest content in Ni (0.0014 ppm).

Lead is not an essential element for life and it is very toxic for the nervous system and for the kidneys [18]. The low content was determined for Zea Maize and Niegella Sativa L. (0.027 ppm). and the highest for Teucrium Polium L. (0.64 ppm).

Cadmium concentration ranged between (0.0046 ppm) in Niegella Sativa L. and (0.13 ppm) in Echium Talicum L. The Cd requirement is (0.006 mg /day) in finished herbal products [20]. After comparison; metal limits in the studied medicinal plants with those proposed by WHO [19], it was found that all studied plants accumulate Cd above this limit. Cd causes both acute and chronic poisoning, adverse effect on kidney, liver, vascular and immune system [20].

In this study, we can observe that the Matricaria Chamomile shows the high concentrations of Na, K, Fe, Co, and Ni in all sample studies but the Cinnamon show the low concentrations of Na, K, Fe and Zn, while Echium Talicum L., Teucrium polium L., recorded the high concentrations of Cd and Pb respectively and the Nigella Sativa L., Zea Maize recorded the lowest values of Cd and Pb. Pimpinella Anisum L., Jeft, Cagisia Italica, Ocimum Basilicum L., shows the similar values (0.0004ppm) this the low values of Co.

Accuracy and precision

The accuracy and precision of the results were also evaluated by analyzing each herb sample was found, by standard deviation and relative standard deviation percentage for each element, as shown in table (2). The accuracy of the results ($\pm 0.05\%$).

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Table (1): Concentrations mg/L(ppm) of essential elements in medical herbs

No	Name of the herbs	Na	K	Zn	Fe	Co	Cu	Ni	Pb	Cd
1	Matricaria Chamomile	67.960	450.00	1.250	6.870	0.002	0.140	0.450	0.046	0.010
2	Cinnamon	5.850	13.290	0.216	0.470	0.0009	0.068	0.110	0.042	0.024
3	Pimpinella Anisum L.	8.510	47.460	0.650	1.260	0.0004	0.041	0.012	0.250	0.066
4	Zea Maize	6.800	87.340	0.790	0.788	0.0009	0.044	0.017	0.027	0.076
5	Anethum Graveolens L.	13.820	86.390	0.990	1.280	Nil	0.051	0.023	0.110	0.018
6	Ventouse (Jeft)	6.100	37.68	1.770	0.560	0.0004	0.021	0.007	0.240	0.082
7	Teucrium Polium L.	16.870	91.130	0.760	1.840	0.0009	0.085	0.057	0.640	0.079
8	Cassia Italica	9.530	38.540	3.390	1.150	0.0004	0.220	0.100	0.220	0.078
9	Echium Talicum L.	9.140	151.00	0.680	2.020	0.0019	0.088	0.037	0.500	0.130
10	Ocimum Basilum L.	7.180	40.820	29.090	0.470	0.0004	0.077	0.030	0.10	0.030
11	Galeopsis Sejetum	10.070	21.450	0.860	1.014	0.0009	0.180	0.0014	0.054	0.078
12	Nigella Sativa L.	9.680	28.000	0.770	0.610	0.0009	0.190	0.0093	0.027	0.0046
13	Cyperus Rotundus L.	18.820	29.900	0.420	1.059	Nil	0.240	0.008	0.093	0.026
14	Lupinus Jaimehintoniana	12.670	37.020	0.710	0.490	Nil	0.220	0.014	0.034	0.029

Table (2): The standard deviation and relative standard deviation for each metal.

Metal	S.D	% R.S.D.
Na	0.1	0.147
K	0.071	0.157
Zn	0.1	0.343
Fe	0.071	1.029
Co	0.0158	790.56
Cu	0.0316	13.176
Ni	0.0707	15.71
Pb	0.0316	4.941
Cd	0.0158	790.56

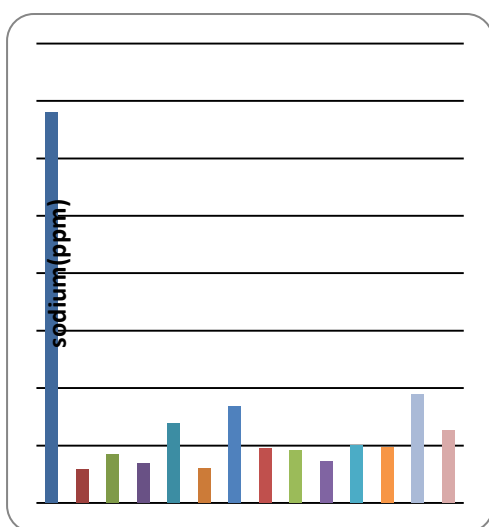


Fig. (1): Concentration of sodium in herbs samples

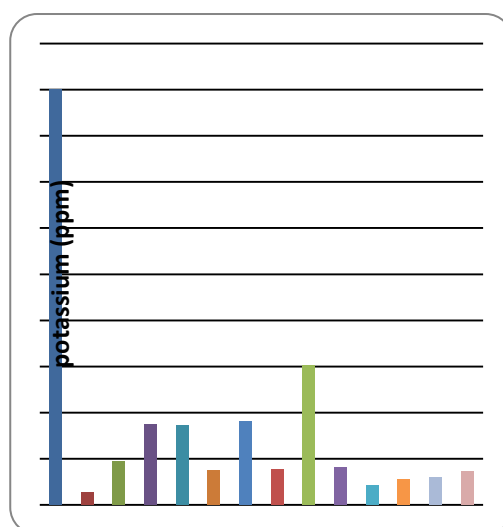


Fig. (2): Concentration of potassium in herbs samples

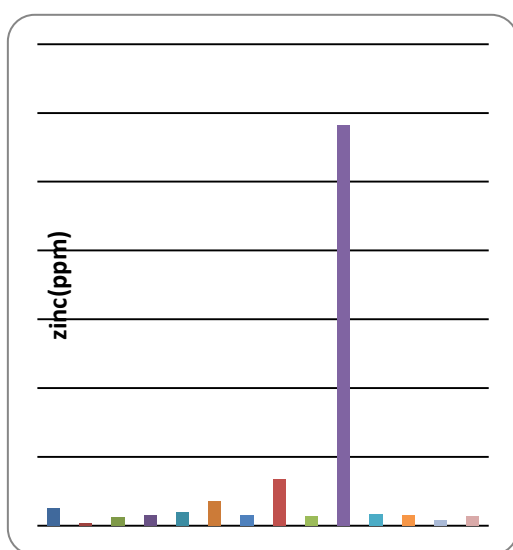


Fig. (3): Concentration of zinc in herbs samples

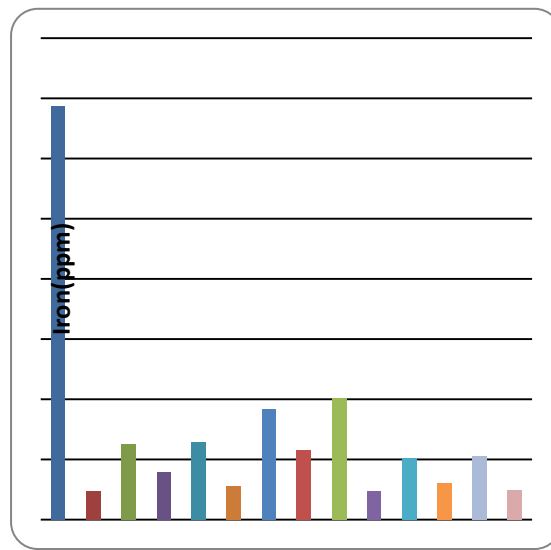


Fig. (4): Concentration of iron in herbs samples

تعيين بعض العناصر الأساسية في نماذج من الاعشاب الطبية العراقية

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الخلاصة

ان العناصر الأساسية الموجودة في الاعشاب الطبية المستعملة في علاج الامراض مهمة ولها دور اساسي في هذه المعالجة. تضمنت الدراسة تعيين تراكيز بعض العناصر الأساسية، وهي: الصوديوم، والبوتاسيوم، والزنك، والحديد، والكوبلت، والنحاس، والنيكل، والرصاص، والكاديوم في مجموعة من الاعشاب الطبية التي جمعت من الاسواق المحلية في العراق، والتي تضمنت اربع عشر نموذجاً متنوعاً وهي على التوالي البابونك، والدارسين، والينسون وكفشة الذرة، وحبّة الحلوة، والجفت، والجعدة، والسمنكين والورد ماوي، وبذور الريحان، والخوبة، وحبّة السوداء، والسعد، والترمز. حلت العناصر باستخدام تقنية الامتصاص الذري اللهبّي وغير اللهبّي. تشير النتائج الى ان تركيز عنصري الصوديوم والبوتاسيوم عال نسبياً، في حين سجل عنصر الكوبلت اقل التراكيز مقارنة بتراكيز العناصر النزرّة الاخرى ولجميع نماذج الاعشاب.

الكلمات المفتاحية: الاعشاب الطبية، العناصر الأساسية، طيف الامتصاص الذري.