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DETERMINATION OF IRON CONTENT IN DIFFERENTTYPES OF VEGETABLES GROWN IN AL-QASSIM,CENTRAL SAUDI ARABIA

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ABSTRACT

In this work sixteen plants locally grown in the sandy soil of central Saudi Arabia in Al-Qassim region have been investigated for their iron (Fe) content using computerized Shimadzu AA 620 spectrophotometer. This particular soil being devoid of minerals both macro- and micronutrients receives them from the added preparations of different types of chemicals. It was found that all 16 plants investigated in this work contained substantial amounts of Fe as is reflected by the healthy growth of the plants and by the actual amounts of Fe being determined for each of these plants. Sabanikh (*Spinacia oleracea*), carrot leaves (*Duacus carota*) and Basal (*Allium cepa*) contained 1000, 860 and 710 ppm respectively. The relatively low Fe content of pumpkin (*Cucurbita spp*) of 120 ppm may be due to the high content of carbohydrates in the plant.

INTRODUCTION

There are three main factors influencing the mineral composition in the plant (Ulysses, 1982). These are: (a) – soil parameters such as particle size, humus content, aeration, soil pH and soil water content, (b) – plant species, since plants growing together in the same soil or substrate have varying mineral composition and (c) – physiological age and part of the plant, since during the early vegetation period the rate of nutrient uptake is high thus leading to high nutrient content in the plant tissues.

Sandy soil in general is quite deficient in both macro and micronutrients, which are considered essential for healthy plant growth and also quite poor in water content. Thus, it has always been the practice in central Saudi Arabia sandy soil to add organic and mineral fertilizers in order to avail essential plant nutrients and to improve soil physical properties, especially in relation to soil particle size and water holding capacity (El-Nadi *et al* 1999).

Iron (FeII) is among the most important micronutrients required for healthy plant growth since it plays an indispensable role in biosynthesis of chlorophyll (Katayal and Sharma 1980). Iron is also involved in nitrogen fixation and electron transfer involved in oxidation reduction reactions (Fouet et al 1981). It is also a structural components of substances involved in these reactions such as the reduction of oxygen to water during respiration (Marshner 1986). Iron is involved in respiratory enzyme systems and is required in protein synthesis as well as being a constituent of hemoprotein (Fouet *et al* 1981). Moreover, it is part of iron sulphur protein (Tisdale *et al* 1985).

The symptoms of iron deficiency develop quite rapidly starting from chlorosis or yellowing of younger leaves followed by complete loss of chlorophyll, necrosis and in severe iron deficiency the whole plant becomes chlorotic and consequently dies (Del Rio *et al* 1978).

Chemical analysis of fruits and vegetables grown in Saudi Arabia., specially dates, received considerable attention during the last ten years thus vitamins, sugars, lipids and proteins have been determined for many locally grown plants (Sawaya *et al* 1983; Gamil *et al* 1980; Hussein *et al* 1976).

The importance of iron as an indispensable micronutrient to plant is also reflected in its vital role in man and animals. It is a major constituent of the blood, and is found in milk, eggs and meat. (Granick 1958; Dewar 1974)

In this work 16 locally grown vegetables in AlQassim region have been analysed for their iron content by virtue of its importance to plants, humans and animals.

MATERIALS AND METHODS

16 Saudi domestic vegetables grown in Al-Qassim region namely: *Corchorus olitorius, Eruca sativa, Portolaca oleracea, Umbillferae, Beta vulgaris, Letuca sativa, Allium cepa, Spinaciaoleracea, Vigna unquiculata, Coriandum saltvum, Solanum tuberosum, Daucus carota, Raphanus saltvum, Apium graveolens, Cucumis sativus, Mentha piperita* and *Cucurbita maxima* have analysed for iron content.

Table 1. Mean Fe content (ppm DM weight)

Local name	English name	Botanical name	Fe content
Mulukhia	Jews mallow	*Orchorus*	330 ±1.0
Girgir	Garden ruket	*Eruca sativa*	320 ±4.0
Igla	Purslane	*Portulacaeceae*	370 ±4.0
Bagdoonis	Parsely	*Ptroselenum sativum*	400 ±12.0
Saligh	Chard	*Beta vulgaris*	240 ±5.5
Khus	Lettuce	*Asteraceae*	400 ±8.5
Basal	Onion	*Allium cepa*	710 ±17.5
Sabanikh	Spinach	*Spinacca oleracea*	1000 ±20.0
Lobia	Cowpea	*Vigna unquiculata*	270 ±5.0
Kusbra	Coriander	*Coriandum sativum*	410 ±3.5
Batatis	Potato	*Solanum tuberosum*	210 ±4.5
Gazar (waragh)	Carrot	*Daucus carota*	860 ±3.0
Figil	Radish	*Raphanus sativus*	530 ±5.0
Kurfis	Celery	*Apium graveolens*	420 ±3.0
Nan a	Mint	*Mentha piperita*	510 ±15.0
Gara	Pumpkin	*Cucurbita sp*	120 ±5.0

The vegetables have been carefully collected from different location, air-dried and powdered in stainless-steel grinder. One gram of each vegetable have been accurately weighed and digested in nitric/perchloric acid

mixture in the ratio of 2:1 and diluted to 100 ml in a volumetric flask. With distilled water Fe content of each sample have been determined using computerized Shimadzu AA 620 spectrophotometer (Cantle, 1982). The instrumental setting: wavelength: 248.3 nm, lamp current 12 mA, slit width 0.2 nm and air/acetylene with flow rate of 2.2 l/min. the results are set in Table 1. Each reading corresponds to a triplicate experimental determination with its corresponding mean deviation.

RESULTS AND DISCUSSION

The iron content of each of the sixteen plants investigated in this work is included in Table 1 in which each value corresponds to an average three separate determinations. The results very clearly indicate that all vegetables studied here have substantial amounts of iron but to varying extents. The highest value for iron content is in *Spinacia oleracea* (spinach) (1000 ppm). carrot leaves (*Daucus carota*) comes next by containing 860 ppm followed by anion 710 ppm of iron. The lowest value obtained for pumpkin *Cucurbita spp.* of 120 ppm may be due to high content of sugar in this plant. Most of these vegetables are taken by man in a raw and uncooked form which allows direct absorption of iron. However, those vegetables which are subjected to heat in the cooking process also maintain their iron content unchanged due to the involatile nature of iron and its inertness towards chemical denaturing.

A striking feature of this project is that iron added to sandy soil in form of ferrous sulphate or in chelated form can easily be absorbed and assimilated by plants as evidenced by both the healthy growth of these plants and by the estimated amounts of iron in the mature plants investigated in this work.

It has always been the fact of life that consumers after purchase of fresh fruits and vegetables which restore their physical appearance and that are known for their nutritive value. Thus the presence of abnormal spots or colours or any other kind of deformation repel the consumer from purchasing that particular defective fruit or vegetables. The deficiency of iron in plants, fortunately, very clearly manifest itself in the appearance of the plant like for instance the yellowing of leaves or stems and in general malgrowth of the plant.

The plants investigated in this project all enjoy high degree of healthy growth and show no signs at all of iron deficiency as is also evidenced by the reasonably high content of iron actually determined for these plants.

Such frequent determination of mineral content in edible plants is of vital importance especially those ones that constitute an integral and indispensable role for both human and animal nutrition

REFERENCES

Cantle, J. E. (1982). Atomic Absorption Spectrophotometry El sevier Scientific pub. comp., Determination of Iron, p .179:181

Del Rio, L. A., Gomez, M.m yanez, J. Leal, A. and Lopoz, J. (1978). Plant Soil, 49, 343 – 363.

Dewar, W. A., Teaque, P. W. and Dawnil, J.N. (1974). British Poultry Science, 15, 119.

El-Nadi, A. H., Al-Redhaiman, K. N. and Salad, M. (1999). Determination of selenium in sixteen vegetable plants grown in Al-Qassim region of central Saudi Arabia. Journal of Agricultural Science Mansoura University, 24 (7): 3719 – 3723.

Fouet, R. H., Murphy, L. S. and Donahue, R. L. (1981). Fertilizers and Soil Amendments Practice Hall. Wood Cliff, England N. J.

Gamil, A. M., Fouad, S. A. and Al-Khal, I. (1980). The chemical composition of 15 varieties of dates grown in Saudi Arabia. Saudi Biological Society, 4th Symposium, Journal of Fruits, Vegetables and Nuts 13, 7B 71.

Granick, S. (1958). In: Trace Elements, C. A. Lamb, O. G. Bentley and J. M. Beattie editors. Academic Press, New York 365.

Hussein, F., Mostafa, S. and El-zeid, A. (1976). Compositional changes during growth and ripening of Barhee and Sukhari dates grown in Saudi Arabia. Research and Development Department, Ministry of Agriculture and Water, Saudi Arabia.

Katayal, A. H. and Sharma, S. (1980). A new technique of plant analysis to resolve iron chlorosis. Plant Soil, 55, 105 – 119.

`Marcher, H. (1986). Mineral Nutrition of Higher Plants. Academic Press, Orlando, USA.

Sawaya, W. N., Khalil, J. K., Safi, W. N., Al-Shalhat, A. (1983). Physical and chemical characteristics of three Saudi date cultivar at various stages of development. Regional Agriculture and water Research Centre, Ministry of Agriculture and Water Riyadh.

Tisdale, S. L., Nelson, W. L. and Beaton, J. d. (1985). Soil Fertility and Fertilizers, 4th edit. MacMillan, New York.

Ulysses S. Jones (1982). Fertilizers and Soil Fertility, 2nd edit. Reston Publishing Company, USA, 270 – 272.

تقدير كمية الحديد في عينات مختلفة من الخضر بالمنطقة الوسطي - القصيم – المملكة العربية السعودية

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أجريت دراسة معملية لتقدير كمية الحديد في بعض محاصيل الخضر التي تنمو في منطقة القصيم و هي الملوخية و الجرجير و الرجلة و البقدونس و السلق و الخس و البصل الأخضر و السبانخ و اللوبيا و الكسبرة و البطاطس و الجزر و الفجل و الكرفس و النعناع و القرع. و قد تبين أن كل هذه الخضر تنمو بصورة جيدة و تتمتع باحتوائها على قدر كبير من عنصر الحديد الذي يحتاج إليه كل من الإنسان و الحيوان في غذائه. و تحتوي هذه الخضر على هذا العنصر بدرجات متفاوتة و نسبة لعدم توفر هذا العنصر للنبات في التربة الرملية فقد جرت العادة على إضافة مركبات الحديد لهذه التربة و تبين أيضا سهولة امتصاصه بواسطة هذه النباتات من هذه المركبات.