DETECTION AND MEASUREMENT OF CALCIUM LEVELS IN SELECTED INDIGENOUS MEDICINAL PLANTS OF FAMILIES UMBELLIFERAE, LEGUMINOSAE AND BORAGINACEAE

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ABSTRACT

The present study was conducted for the detection and measurement of calcium levels in indigenous medicinal plants using atomic absorption spectrophotometry. A total 14 plants were selected from families Umbelliferae, Leguminosae and Boraginaceae. The range of calcium concentration varied from the highest of 103.972mg/g to the lowest of 5.172mg/g in all the plants analyzed. *Onosma bracteatum* leaves (103.972mg/g) and *Onosma echioides* roots (91.159mg/g) have the highest calcium contents whereas it was the lowest in *Tamarindus indica* fruit (5.172mg/g). Calcium concentrations were highest in family Boraginaceae followed by Umbelliferae and Leguminosae, respectively. The calcium contents of *Onosma bracteatum* leaves from family Boragnaceae were highest (103.972mg/g) and they were the lowest (6.384mg/g) in *Cordia latifolia* fruit. *Ferula foetida* resin from the family Umbelliferae had the highest calcium contents (56.803mg/g) followed by *Carum bulbocastanum* seeds (25.083mg/g) and *Foeniculum vulgare* seeds (20.170mg/g), respectively. Within the family Leguminosae, *Glycyrrhiza glabra* root had the highest (21.990mg/g) whereas *Tamarindus indica* fruit had the lowest (5.172mg/g) calcium contents. Based on the results it is concluded that indigenous medicinal plant commonly used in local system of medicine had high concentrations of calcium and can be used as natural source of calcium.

Key Words: Measurement; Calcium; Medicinal plants; Atomic Absorption Spectrophotometry

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INTRODUCTION

Medicinal plants have been used for many years to cure a great variety of diseases. According to the World Health Organization, the use of traditional herbal medicine has spread not only in the developing countries but also in the developed ones as an alternate way to treat and prevent these diseases (WHO, 2003). The pharmacological properties of these medicinal plants are due to the presence of active constituents, which are responsible for important physiological functions in living organisms. It has been reported that trace

elements play a key role in the reactions, which leads to the formation of these active constituents (Yamashita et al., 2005).

A large number of elements are now known to be present in human body in minute quantities. Nutrition in the form of food and fluids mainly supplies the intake of these trace elements to the human body. There are number of situations in which deficiency or excess of specific elements are a primary cause of disease and has brought with it the recognition of a new medical specialty termed as "Medical Elementology". These elements in one form or the other play an important role in the field of medicines in combating disease as a curative or preventive agent (Chowdhary, 1994).

Calcium is one of the most important elements present in human body, is the main constituent of the skeleton, and is important for regulating many vital cellular activities such as nerve and muscle function, hormonal actions, blood clotting and cellular mortality (Martin et al., 1985). Clinical symptoms associated with its deficiency are osteoporosis, paralysis, increased cholesterol levels, hypertension, tachycardia, tooth decay, brittle nails and in sever cases hemorrhages. Vitamin D is essential for the absorption of calcium and where calcium deficiency is due to vitamin D deficiency, rickets occur as a predominant clinical symptom.

A normal human body contains nearly 1200g of calcium and its recommended daily dietary allowances are 1200mg for males and females of 11 to 18 years of age and pregnant and lactating women, whereas it is 800mg in males and females of 19 years and above (Masironi, 1978). Keeping in view the importance of calcium, the present study was conducted for the detection and measurement of its levels in selected indigenous medicinal plants commonly used in the indigenous system of medicine.

MATERIALS AND METHODS

Medicinal Plants:

The plants were selected on the basis of their wide use in the Unani system of medicine prevailing in Pakistan. The selected medicinal plants were purchased from the reputed crude drug dealers of the Country. The authenticity of plant materials were ascertained by various renowned drug dealers and practitioners of the Unani system of medicine. Their identity was confirmed by comparing the specimens with the herbarium samples at the National Agriculture Research Council (NARC), Islamabad, Pakistan and from the taxonomist of Pakistan Council of Scientific and Industrial Research (PCSIR), Lahore, Pakistan.

Sample Preparation:

The selected plant material was freed from the twigs and extraneous matter. The soil, grit, sand and dirt were removed by sifting through a stainless steel sieve. To remove remnants of adhering foreign matter the

samples were rapidly and thoroughly washed with distilled water and then immediately dried in a hot air oven. The dried plant samples were pulverized using a porcelain pestle and mortar, packed and sealed in polyethylene bags and stored in plastic bottles with tightly fitting lids. Plants of mucilaginous character were cleaned by initial rubbing with a clean cloth to loosen the adhering contamination, which was sifted out, and then samples were quickly rinsed with distilled water before drying.

Sample Pretreatment:

For determination of calcium contents, the samples of plant materials in triplicate were subjected to the dry ashing procedure (AOAC, 1984). The samples were incinerated initially on a low flame and then in a muffle furnace with temperature maintained at 500^0C for 5-6 hours. Finally, the calcium was eluted with a small portion of distilled water and volume of solution was made up to 50ml with constant shaking. The solutions prepared by this technique were transferred to pre-cleaned tightly stoppered polyethylene bottles till final analysis.

Atomic Absorption Spectrophotometry:

Flame atomic absorption Spectrophotometry was used as the analytical method for the detection and measurement of calcium in the pretreated plants sample solutions (Hussain et al., 2006). The absorption readings were taken in Flame atomic absorption Spectrophotometer (Polarized Zeeman Hitachi-2000) at 422.70nm wavelength and 7.5mA lamp current using 2.6nm slits. The standard curve was drawn using the know reference solution of calcium. The sample stock solutions were diluted further to obtain appropriate concentrations that fell within the range of analytical concentrations of the standard solution of calcium. To eliminate the chances of ionization of calcium the dilutions of both the standard stock and unknown sample solutions were prepared in lanthanum chloride spectral buffer. The calcium levels investigated in the selected medicinal plants were quantified in mg/g of the plant materials on dry weight basis.

RESULTS AND DISCUSSION

Development of highly sophisticated and sensitive analytical techniques has provided researchers with the opportunities to evaluate the qualitative and quantitative medicinal values of the plant kingdom. One such investigational sphere of interest since the recent past has been on plant Elementology. A number of medicinal plants of known and recognized clinical value in the indigenous system of medicine have been selected by researchers to determine the presence of elements. Such plants provide a wealth of resources for the availability of elements in natural environment. The present study is also a continuation of such investigations. Total 14 indigenous medicinal plants of three different families were used to study their levels of calcium using atomic absorption Spectrophotometry.

Table 1: Family wise detail of selected indigenous medicinal plants

Sr. No.	Names of Plants		Family
	Botanical Name	Common English Names	
1	*Carum bulbocastanum*	Black Caraway, Bulbous Caraway	Umbelliferae
2	*Carum copticum*	The Bishop's weed, Ajava seeds	Umbelliferae
3	*Coriandrum sativum*	Coriander	Umbelliferae
4	*Cuminum cyminum*	Cumin	Umbelliferae
5	*Ferula foetida*	Asafoetida	Umbelliferae
6	*Foeniculum vulgare*	Fennel, Finkel, Sweet Fennel	Umbelliferae
7	*Peucedanum graveolens*	Indian Dill, Pakistani Dill, Dill Seed	Umbelliferae
8	*Butea monosperma*	The flame of the forest, Butea gum tree	Leguminosae
9	*Cassia fistula*	Indian Laburnum, Purging Cassia	Leguminosae
10	*Glycyrrhiza glabra*	Liquorice, Sweet wood	Leguminosae
11	*Tamarindus indica*	Tamarind Tree	Leguminosae
12	*Cordia latifolia*	Sebestan Plum	Boraginaceae
13	*Onosma bracteatum* (Fruit) *Onosma bracteatum* (Leaves)	Borage, Beebread, Bee plant	Boraginaceae
14	*Onosma echioides*	Alkanet Root	Boraginaceae

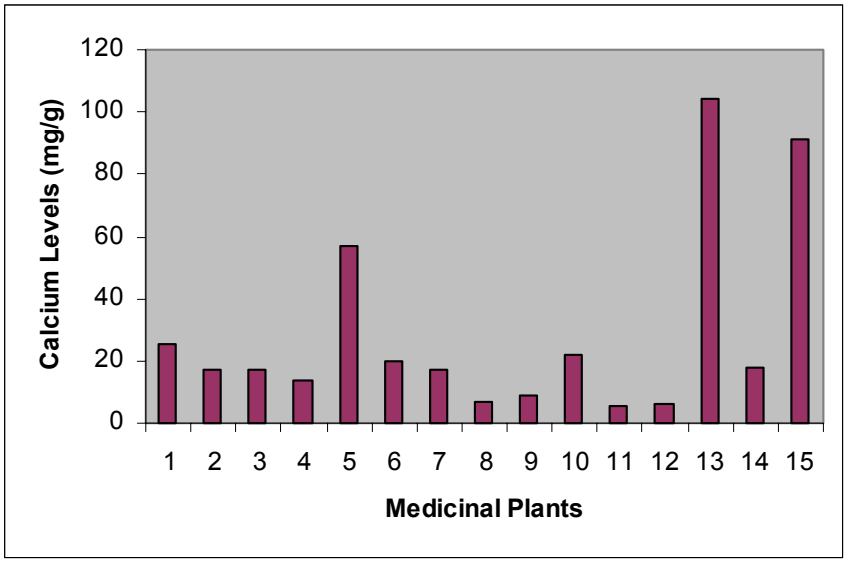
The family wise detail of selected medicinal plants along with their common names is given in Table 1. The range of calcium concentration varied from highest of 103.972mg/g to the lowest of 5.172mg/g in all the plants analyzed. The mean calcium concentrations in order of their decreasing levels are given in Table 2. *Onosma bracteatum* leaves (103.972mg/g) and *Onosma echioides* roots (91.159mg/g) had the highest calcium contents whereas it was the lowest in *Tamarindus indica* fruit (5.172mg/g). The calcium contents of all other plants were in between this highest and lowest range.

Table 2: Calcium contents of selected indigenous medicinal plants

Sr. No.	Name of Plant	Parts used	Weight on dry basis (mg)	Weight of ash (mg)	Calcium Concentrations (mg/g) ±SD*
1	*Onosma bracteatum*	Leaves	4091.2	993.0	103.972±5.919
2	*Onosma echioides*	Roots	4845.0	555.1	91.159±0.880
3	*Ferula foetida*	Resin	5004.4	1479.1	56.803±3.356
4	*Carum bulbocastanum*	Fruit	4713.8	287.2	25.083±0.943
5	*Glycyrrhiza glabra*	Roots	5017.3	327.3	21.990±0.862
6	*Foeniculum vulgare*	Seeds	5011.8	398.9	20.170±1.557
7	*Onosma bracteatum*	Fruit	4507.3	468.5	17.561±0.647
8	*Carum copticum*	Fruit	5001.2	321.6	17.364±1.007
9	*Coriandrum sativum*	Seeds	5018.9	308.3	17.232±1.469
10	*Peucedanum graveolens*	Seeds	5003.0	315.4	16.913±1.014
11	*Cuminum cyminum*	Seeds	5031.2	301.3	13.757±0.728
12	*Cassia fistula*	Fruit Pulp	5000.8	228.4	8.618±0.109
13	*Butea monosperma*	Resin	5003.1	181.5	6.841±0.395
14	*Cordia latifolia*	Fruit	4843.4	475.5	6.384±0.20
15	*Tamarindus indica*	Fruit Pulp	5007.3	224.1	5.172±0.261

**Mean ± Standard Deviation for 6 samples analyzed for each plant*

Figure 1: Family wise distribution of calcium levels in selected medicinal plants



According to the family wise distribution, calcium concentrations were highest in Boraginaceae followed by Umbelliferae and Leguminosae, respectively (Figure 1). The calcium contents of *Onosma bracteatum* leaves from family Boragnaceae were highest (103.972mg/g) and they were the lowest (6.384mg/g) in *Cordia latifolia* fruit. *Ferula foetida* resin from the family Umbelliferae had the highest calcium contents (56.803mg/g) followed by *Carum bulbocastanum* seeds (25.083mg/g), *Foeniculum vulgare* seeds (20.170mg/g), while the rest of the medicinal plants belonging to this family contained calcium in the close range of 13.757 to 17.364mg/g. Within the family Leguminosae, *Glycyrrhiza glabra* root had the highest (21.990mg/g) whereas *Tamarindus indica* fruit had the lowest (5.172mg/g) of calcium contents.

The values of calcium in some medicinal plants used in present study were significantly higher than those reported in previous studies (Ahmad et al., 1985). The geochemical environment strongly influences the trace element contents of plants, which presumably explain the wide difference of calcium concentrations observed in the previous and present studies.

One common nutrient postulated to be protective against hypertension, osteoporosis and colon cancer is calcium (Holbrook and Connor, 1991). Significant diastolic blood pressure reducing effect of calcium in hypertensive subjects has been reported (Knight and Keith, 1992). The high levels of calcium in medicinal plants used in present study could be the possible contributory factor for this particular therapeutic effect. The *Onosma bracteatum* leaves used in the Unani system of medicine as a remedy for cardiac palpitation and irritation of stomach could also be attributed to its high calcium contents (103.972mg/g).

CONCLUSION

Based on the results of the present study it is concluded that the selected indigenous medicinal plant commonly used in local system of medicine had high concentrations of calcium. The calcium contents are more in family Boraginaceae followed by Umbelliferae and Leguminosae, respectively. *Onosma bracteatum* leaves had the highest (103.972mg/g) whereas *Tamarindus indica* fruit had the lowest (5.172mg/g) calcium contents. The therapeutic effect of these plants may be significantly contributed by the presence of high calcium contents naturally present in them. Moreover, these medicinal plants may be used to provide a natural and cost-effective source of calcium in of using some costly multi-mineral formulations.

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