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Original Article

MINERAL CONTENT OF SOME EDIBLE MEDICINALLY IMPORTANT LEAFY VEGETABLES OF KAMRUP DISTRICT OF ASSAM, INDIA

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ABSTRACT

Objective: The aim of the present study was to determine the mineral components of *Amaranthus spinosus, Oxalis corniculata, Bacopa monnieri*, *Paedaria foetida* and *Centella asiatica.*

Methods: Mineral compositions of the five selected edible medicinally important leafy vegetables were evaluated following standard methods including AAS.

Results: All the examined vegetables were found to be the rich source of macroelements as well as trace minerals. Potassium was the most abundant macroelement ranging from 4570.0-16030.0 mg/kg, followed by sodium, calcium and magnesium. Among the trace elements iron was highest (184.1- 518.2 mg/kg), followed by zinc, manganese and copper.

Conclusion: From the present study it can be concluded that the plants under investigation are potential source of both macro and micronutrients and proper consumption prove to be beneficial as they cure several deficiency as well as other deadly diseases.

Keywords: Macroelements, Trace minerals, Deficiency diseases.

INTRODUCTION

Plants have been of great importance to mankind due to their medicinal as well as nutritional properties. In 1985, World Health Organization (WHO) estimated that around 80% of the population depends on medicinal plants for their primary healthcare needs in developing countries [1]. Medicinal plants contain some secondary metabolites like alkaloid, glycosides, saponins, essential oils, bitter principles, tannins and mucilages in different parts like root, stem, leaves, bark, fruit and seed, which can cure various ailments in humans and other animals [1]. Epidemiological studies indicate that increased intake of leafy vegetables is associated with decreased risk of cancers, cardiovascular disease, cataract, and other age-related diseases [2]. In India, several traditional systems of medicines have evolved such as *Ayurveda*, *Siddha* and *Unani* [1].

From the very beginning of time plants have been used as an important source of food and medicine [3]. In recent years, people have shown the wide range of interest in the field of medicinal plants especially those uses in the AYURVEDA. The number of workers tried to determine the nutritive value and mineral composition of medicinal plants, which were also being used as dietary supplements [4]. The wild edible medicinal leafy vegetables occupy an important place among food crops as these provide adequate amount of crude fiber, fats, carbohydrates, proteins, water and mineral elements like Ca, Na, Fe, P, Mg, Zn etc, in addition to vitamins and certain hormone precursors[5]. Studies have shown that vegetarians are less susceptible to disease and live longer, healthier and having stronger immunity [6], [7].

Micronutrients deficiency affects over two billion people worldwide, which results in poor health, high rate of mortality etc [8]. According to the World Health Organization (2008) iron deficiency is the most common and widespread nutritional disorder in the world [9]. Adequate intake of the edible medicinal plants is necessary as they have potential to provide nutrients present in them to the consumers and utilization of these plants can provide a solution to the problem of malnutrition to a great extent [10]. Hence, in my present study an attempt has been made to determine macro and microelements of 5 edible medicinally important leafy vegetables of Kamrup District in order to provide necessary information for their wider utilization and contribution to food security.

MATERIALS AND METHODS

Plant sample collection and Processing: All the selected plant species were collected in March 2014, from four different localities of the Kamrup district of Assam and identified by a plant taxonomist of Botany Department, Gauhati University. The fresh vegetables were washed and the edible parts were dried in the shade and then ground to fine powder. The dried powdered samples were used for determination of mineral components.

Procedure for mineral analysis

Estimation of Fe, Zn, Cu, Mn, Na, K: 0.5 gm of powdered dried plant material was taken in a crucible and converted to ash in the muffle furnace at 580°C for 3 hrs. After cooling in a desiccator 10 ml of concentrated Nitric acid, 4 ml of Perchloric acid and 1 ml of Sulphuric acid was added and digestion at high temperature was carried out until the contents of test tube become clear, then the tube was cooled and solution was transferred quantitatively to 50 ml volumetric flask and the final volume was adjusted to 50 ml by adding distilled water. The solution was used for determination of Fe, Zn, Mn, Cu through the atomic absorption spectrometry (Perkin Elmer AAnalyst 200 AAS) and Three-point calibration was done for each metal with certified AAS standards of 1000 mg/L (Merck, Germany). Na and K was estimated by using Flame photometry (FPM).

Estimation of Ca & Mg: Total hardness is defined as the sum of the calcium and magnesium concentrations in the water sample and is expressed as milligram calcium carbonate per liter. Total hardness of the water extract of plant sample was determined by EDTA complexometric titration using Eriochrome Black T indicator. Ethylenediaminetetraaacetic acid (EDTA, sodium salt) forms a chelated soluble complex when added to a solution of certain metal cations. A small amount of a dye Eriochrome Black T was added to an aqueous solution containing calcium and magnesium ions at pH of 10.0 ± 0.1, the solution becomes wine red. When EDTA was added as a titrant, calcium and magnesium were complexed, and when they were completely complexed, the solution turns from wine red to blue, marking the end point of the titration. Magnesium ion must be present to yield a satisfactory end point. To ensure this, a small amount of complexometrically neutral magnesium salt of EDTA was added to the buffer; this automatically introduced sufficient

magnesium and obviates the need for a blank correction. For calcium hardness, the same procedure was followed but the indicator used to be Murexide.

In this case, the end point was determined with change of color from purple to pink. Magnesium hardness was calculated by subtracting the value of calcium hardness from total hardness.

$$\text{Total hardness}\left(\text{as } {}^{\text{mg}}/_{\text{l}}\ CaCO_3\right) = \frac{\text{ml of EDTA used} \times 1000}{\text{ml of sample}}$$

$$\text{Calcium}, {}^{\text{mg}}/_{\text{l}} = \frac{\text{A} \times 400.8}{\text{ml of sample}}$$

Where, A= volume of EDTA used in ml

$$\text{Magnesium}, {}^{\text{mg}}/_{\text{l}} = \frac{(\text{B} - \text{A}) \times 400.8}{\text{ml of sample} \times 1.645}$$

Where, B = EDTA used for hardness (both Ca and Mg) determination.

A = EDTA used for calcium determination for the volume of sample.

RESULTS AND DISCUSSION

The edible parts of the 5 selected plants contain minerals like Na, K, Zn, Cu, Fe, Ca, Mg & Mn in varying amount and are shown in the following Table 1. Considering the recommended dietary allowance (RDA) for minerals: calcium (1000 mg/day); magnesium (400 mg/day) and iron (8 mg/day), these leafy vegetables could cover RDA and contribute substantially for improving human diet (FND, 2005) [2]. The edible medicinal leafy vegetables under investigation contained high amount of K (4570.0-16030.0 mg/kg) and Na (1380.0- 5010.0 mg/kg) with highest value (16030.0 mg/kg; 5010 mg/kg) for *P. foetida* and *B. monnieri* respectively. All the analysed plants were excellent sources of Ca, ranging from 414.7 mg/kg (*O. corniculata*) to 1347.1 mg/ kg (*A. spinosus*). Mg was quantified high in *C. asiatica* (614.8 mg/kg) while high amount of Mn was detected in *P. foetida.* Zn was detected higher in *A. spinosus* (172.4 mg/kg) when compared to other leafy vegetables under investigation. The Fe content of the medicinal leafy vegetables varied from 184.1 mg/kg (*C. asiatica*) –518.2 mg/kg (*O. corniculata*). The medicinal plants contained relatively less amount of Cu (7.0mg/kg – 54.7 mg/kg) when compared to other minerals. Mg & Ca content in *Ipomoea aquatica*, *Alternanthera sessilis*, *Amaranthus viridis* and *Houttuynia cordata* was reported higher than the above mentioned plants [8]. Na, Zn, Cu & Mn content was found to be less when compared to studied plants [8]. In an earlier study, it was found that amount of Cu in *C. asiatica* was 7.8 mg/kg, but in my present investigation 14.2 mg/kg Cu was detected. However, Ca content in this plant was found to be less when compared to earlier study [8].

Table 1: Mineral composition of the selected edible medicinal leafy vegetables of Kamrup district

Name of plants	Minerals (mg/kg)							
	Fe	**Cu**	**Zn**	**Mn**	**Mg**	**Ca**	**Na**	**K**
A. spinosus	324.8	7.1	172.4	47.1	451.2	1347.1	1380.0	4570.0
O. corniculata	518.2	54.7	84.3	68.9	161.8	414.7	1640.0	5940.0
B. monnieri	371.6	7.0	68.7	78.4	347.6	724.8	5010.0	13600.0
P. foetida	421.7	42.7	29.3	191.5	452.7	1102.7	1430.0	16030.0
C. asiatica	184.1	14.2	37.4	75.9	614.8	1246.8	1790.0	9540.0

Regular dietary use of *O. corniculata, A. spinosus C. asiatica,, B. monnieri, P. foetida plants* is so much beneficial for the people who have diabetic complications because the micronutrients present in these plants (Fe, Zn, Mg, Cu, Na and K) can activate B-cells of the pancreas [11]. Fe is an essential mineral and vital component of proteins (Haemoglobin) involved in oxygen transport, act as cofactor in neurotransmitter synthesis [12]. Consumption of Fe rich plants like*, A. sessilis, P. foetida* and *O. corniculata* can improve anemic conditions [13]. Consumption of all the edible medicinal plants under study would probably reduce high blood pressure diseases because the ratio of Na/K in all the plants was less than one. Na/K ratio less than one is recommended [14]. Na and K maintains osmotic and water balance as well as membrane potentials [15], [16]. The high Zn content indicates that the plant can play a valuable role in management of diabetes [11]. Zn undernutrition or defiency impair cellular mediators of innate immunity such as phagocytosis, N K cells activity, impair growth & gonadal function [17], [18]. Cu rich plants increase formation of red blood cells, synthesis of haemoglobin, development of fetus etc [19].

Cu has a role in energy production, wound healing, taste sensation, skin and hair color. An appreciable quantity of Mg can be obtained by using A. spinosus *and C. asiatica* in our regular diet which involve in many enzymatic reactions of oxidative metabolism of nutrients and cell constituent synthesis, transmission of nerve impulses, body temperature regulation, detoxification, energy production and the formation of healthy bones and teeth [19]. Calcium is a component of bones; plays a role in signal transduction in hormonal action, muscle contraction, blood clotting, structural role in proteins [20]. Mn is also required for normal insulin synthesis and secretion, enzyme metabolism etc [11]. Consumption of the studied edible medicinal leafy vegetables in the diet is considered good because the minerals present in these plants can cure a variety of diseases.

CONCLUSION

The results of the present study for the first time establish that all the edible parts of the leafy vegetables under investigation contains a number of nutritionally important minerals (Na, K, Ca, Mg, Fe, Zn, Cu and Mn) that have been linked to the promotion of good health. As it has been proved by earlier workers that these elements are highly beneficial in treating various diseases, it is advisable that proper consumption of plants like *A. spinosus*, *O. corniculata*, *P. foetida*, *B. monnieri* and *C. asiatica* could help in reduction of deficiency diseases. So it can be concluded that regular consumption of these plants can provide a solution to the problem of malnutrition to a great extent and cure deadly diseases. Edible medicinal plants can be utilized at the time of food deficit or cultivated as a source of food material for an ever increasing population.

CONFLICT OF INTERESTS

Declared None

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