

Mineral Elements Analysis of Selected Ethnomedicinally Valued Plants From Assam, India

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Elemental compositions of the leaves of five ethnomedicinally important plants viz., *Hydrocotyl javanica*, *Litsea polyantha*, *Melastoma malabathricum*, *Paederia foetida* and *Vitex nigundo* were studied from Dibrugarh, India. The study revealed good percentage of mineral element in the plants. Nitrogen, phosphorus, potassium and magnesium are major constituents in comparison to calcium, zinc, copper and manganese in all the species. Since the aboriginal people of the study area are using these plants in their traditional health care system, cultivation and consumption of these plants should be encouraged for partial fulfillment of their nutritional requirement.

Key Words: Mineral elements, Ethnomedicinal plants, Nutrient values.

INTRODUCTION

Essential micro and macro elements constitute the basic building blocks of human body. The greatest source of these elements is through the food and medicine we take. These elements affect all aspects of our growth, development and reproductive functions. Very high concentration or lack of adequate quantities of these elements in our food and medicine can cause health problems. A state of deficiency of essential minerals is much more likely to affect a person than is a state of vitamin deficiency. Individuals on a low caloric diet, elderly patients on certain types of medications like diuretics and woman in a term of pregnancy are at an increased risk of suffering from such mineral deficiency. A mineral deficiency is also likely to effect the vegetarian people living on crops grown in an area where the soil is deficient in certain minerals. Plant materials form a major portion of human diet. Therefore, their mineral composition is important. Minerals have specific role in many enzyme systems necessary for digestion and regulation of the human body. According to WHO, 80 % of people rely on herbal medicine for their healthcare system. In the present study, five indigenously important medicinal plants- *Hydrocotyl javanica*, *Litsea polyantha*, *Melastoma malabathricum*, *Paederia foetida* and *Vitex nigundo* were taken for investigation from a biodiversity hot-spot region of Assam, India.

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Hydrocotyl javanica Thunb. (Apiaceae) is an annual herb of damp habitats. Whole plant is used as brain tonic, ailment of liver trouble, diarrhea and dysentery. *Litsea polyantha* Juss. (Lauraceae) is a handsome tree. Bark is used in diarrhea, pain, bruises and applied to fracture of animal bones. Leaves are used as substitute food material for eri and silk worm. *Melastoma malabathricum* Linn. (Melastomaceae) is a shrub of forested wastelands. Leaves are used to treat diarrhea and dysentery, wash for ulcers, to prevent scarring from smallpox, to treat piles and also in treatment of haemorrhoids. Young shoot is used as tooth-brush. *Paederia foetida* Linn. (Rubiaceae) is a perennial woody creeper. It is good for liver, kidney trouble and diarrhea. Very good for children and for woman after child birth. Decoction of leaves increases appetite, good remedy for rheumatic pain.

Vitex nigundo Linn. (Verbenaceae) is a small tree. A decoction of the tender leaves administered in the seasonal fevers, relief body pain and rheumatic pain and also used as insecticide. All these plants are frequently used by various ethnic groups of Assam in their healthcare system¹⁻⁵. Very delicious traditional discs are also prepared from *Paederia foetida* and *Hydrocotyl javanica* and that are believed to have good effect on human body. Several reports are available about the mineral elements present in plants and their role in human body⁶⁻¹¹.

EXPERIMENTAL

The plants grow naturally by seed in the warm humid climate of Dibrugarh, India. The soil of the area is acidic in nature with pH value ranges from 5.5-6.3. Plant materials are collected from the Botanical Garden of Dibrugarh University, Dibrugarh. Leaves of *H. javanica*, *L. polyantha*, *M. malabathricum*, *P. foetida* and *V. nigundo* were taken for mineral composition study.

Materials were collected in the morning hours, shade dried and powdered to pass through 1 mm mesh. Ash of shed dried plant material were prepared by taking 1 g of each sample and keeping it in muffle furnace at 550 °C till constant weight. The major constituent of ash was dissolved in 10 % HCl (5 mL) and evaporated to dryness on water bath. Again 10 % HCl (5 mL) was added and evaporated to dryness. The material was filtered through Whatman paper No. 40. The residue was made chloride free (tested with silver nitrate) by washing with hot water. The filtrate was diluted to 50 mL and used to estimate metal contents by using standard methods *e.g.*, phosphorus measured spectrophotometrically, potassium and calcium by flame photometer. The minerals *viz.*, Mg, Zn, Cu, Fe and Mn were determined by atomic absorption spectrophotometry. Total Kjeldahl nitrogen was analyzed in 0.5 g shed dried powder.

RESULTS AND DISCUSSION

Mainly leaves of all the studied species are used by various ethnic groups of Assam in their traditional health care system. Curries of *P. foetida* are routinely given to the woman after child birth. Therefore the main emphasis has been given to leaves. Nutritionally the leaves of the plants have functional contribution to the

mineral intake, which is evident from the results presented in Table-1. Elemental analysis of leaves showed nitrogen, phosphorus, potassium and magnesium are major constituents in comparison to calcium, zinc, copper and manganese. In case of *H. javanica*, *L. polyantha*, *M. malabathricum* and *V. nigundo*, nitrogen was the most abundant element followed by potassium and in case of *P. foetida*, potassium was the most abundant element followed by nitrogen.

TABLE-1
PERCENTAGE COMPOSITION OF ESSENTIAL NUTRIENTS IN CERTAIN
ETHNOMEDICINALLY VALUED PLANTS OF ASSAM, INDIA

Element	Percentage				
	<i>H. javanica</i>	<i>L. polyantha</i>	<i>M. malabathricum</i>	<i>P. foetida</i>	<i>V. nigundo</i>
Nitrogen	1.9600	1.8200	1.3300	0.1400	1.2600
Phosphorus	0.1700	0.1500	0.1100	0.1300	0.1500
Potassium	0.9500	0.4500	0.3000	0.8000	0.7500
Calcium	0.0600	0.0400	0.0900	0.0100	0.0200
Magnesium	0.1800	0.1400	0.1300	0.1400	0.1300
Zinc	0.0178	0.0061	0.0040	0.0055	0.0112
Copper	0.0063	0.0067	0.0059	0.0081	0.0060
Iron	0.1156	0.0605	0.0252	0.0347	0.2630
Manganese	0.0155	0.1110	0.1244	0.0130	0.0106

The leaves of *H. javanica*, *L. polyantha*, *M. malabathricum* and *V. nigundo* are rich in nitrogen content but in *P. foetida* it is moderate. The highest nitrogen level was recorded for *H. javanica* (1.96) while *P. foetida* gave the lowest (0.14). Nitrogen plays important role in digestion of food and growth in human body¹¹.

Phosphorus content was moderate in all the species ranged from 0.11 in *M. malabathricum* to 0.17 in *H. javanica*. Phosphorus plays a significant role in CNS functions. It is required for the healthy formation of bones and teeth, also a part of body's energy storage system and helps with maintaining healthy blood sugar levels. Excess intake of phosphorus leading to osteoporosis¹¹.

Potassium content of leaf of all the species was moderate and the concentration obtained ranged from 0.3 in *M. malabathricum* to 0.95 in *H. javanica*. Potassium plays an important role in the treatment of diabetes. Basically potassium has its effect on the secretion of insulin. They are capable of adapting the rate of metabolism of amino acids, fatty acids and ketone bodies. All these energetic substrates are metabolized and generate ATP which closes K⁺-ATP channel and the raise intracellular Ca²⁺ concentration, which eventually causes insulin release. Other than ATP, metabolically sensitive K⁺-ATP channel and Ca²⁺ plays essential roles in nutrient induced insulin release. Excess of potassium can produce neurological disturbances. Sudden death that can occur in fasting, anorexia nervosa or starvation is often a result of heart failure caused by potassium deficiency¹¹.

The percentage of copper was quite low in all the studied material. Copper plays an important role in CNS function. Deficiency of copper results in hypertension, anemia, bacterial infection, rheumatoid arthritis, *etc*¹¹.

Zinc was higher in *H. javanica* and *V. nigundo* but lower in other three species. The zinc values obtained from 0.004 in *M. malabathricum* to 0.0178 in *H. javanica*. Zinc is a component of many metalloenzymes, including some enzymes which play central role in nucleic acid metabolism. In addition, zinc is a membrane stabilizer and a stimulator of the immune response. Its deficiency leads to impaired growth and malnutrition¹¹.

Calcium content was moderate in all the species ranged from 0.01 in *P. foetida* to 0.09 in *M. malabathricum*. Calcium plays a major role in CNS function. Calcium constitutes a large proportion of the bone, human blood and extracellular fluid. It is necessary for the normal functions of cardiac muscles, blood coagulation and milk clotting and the regulation of cell permeability¹¹.

Iron content was higher in *H. javanica* but moderate in rest of the species. Concentration of iron ranged from 0.0252 in *M. malabathricum* to 0.1156 in *H. javanica*. Iron plays significant roles in oxygen transport in the body. Iron deficiency results in sweating, palpitation of the heart, rapid pulse, prolonged sleep, cessation of the menses and aversion to eating and heavy feeling of the body. Lack of iron can lead to a shortened attention span, a reduction in cognitive functions, minimal brain dysfunction and hyperactivity¹¹.

Magnesium content was also moderate in all the studied species, ranged from 0.13 in *M. malabathricum* and *V. nigundo* to 0.18 in *H. javanica*. Magnesium is a key element in cellular metabolism. It is required in the plasma and extra cellular fluid, where it helps to maintain osmotic equilibrium. It is required in many enzymes catalyzed reactions, especially those in which nucleotides participate where the reactive species is the magnesium salt, *e.g.*, MgATP₂. Lack of magnesium is associated with abnormal irritability of muscle and convulsions and excess magnesium with depression of the central nervous system¹¹.

Manganese was higher in *L. polyantha* and *M. malabathricum*, but moderate in *H. javanica*, *P. foetida* and *V. nigundo*, the level of manganese ranged from 0.0106 in *V. nigundo* to 0.124 in *M. malabathricum*. Manganese is essential for hemoglobin formation, but excess is harmful. Manganese also supports the immune system, regulates blood sugar levels and is involved in the production of energy and cell reproduction and also important for bone growth¹¹.

The present investigation revealed that all the studied material has suitable concentration of mineral elements. *H. javanica* is particularly very good for those who require high protein and also as a fodder. The leaves of these species may be a potential source of essential micronutrients.

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