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EVALUATION OF TRACE ELEMENTS IN *KAEMPFERIA ROTUNDA*, *COSTUS SPECIOSUS* AND *ALPINIA GALANGA* BY AAS METHOD

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ABSTRACT

The main objective of the study is to evaluate the trace element such as Fe, Ca, Zn, Cu, Mn, Ni, Mg and Cr present in the rhizome of *Kaempferia rotunda, Costus speciosus* and *Alpinia galanga* of zinziberaceae family collected from Kangmong village, Imphal west district, Manipur, using Graphite furnace-atomic absorption spectrophotometer (GF-AAS), Analytik Jena Vario-6 model. The results showed that trace element concentrations in *Kaempferia rotunda were* as follow: Ni, 0.096±0.002ppm, Mg, 0.87±0.005ppm, Cr, 0.07±0.002ppm, Fe, 1.22±0.005ppm, Ca, 0.46±0.01ppm, Zn, 0.14±0.003ppm, Cu, 0.9±0.003ppm and Mn, 0.26±0.002. Concentration of trace element in *Costus speciosus* are as: Ni, 0.053±0.004 ppm, Mg, 0.58±0.003 ppm, Cr, 0.26±0.008 ppm, Fe, 0.86±0.008ppm Ca, 0.47±0.21 ppm Zn, 0.16±0.001 ppm Cu, 0.11±0.03ppm and Mn, 0.36±0.007ppm. *Alpinia galanga* content element as: Ni, 0.038±0.009ppm, Mg, 0.17±0.007ppm, Cr, 0.14±0.009ppm, Fe, 5.40±0.003ppm, Ca, 0.53±0.13ppm, Zn, 0.23±0.001ppm, Cu, 0.12±0.03ppm, Mn, 0.23±0.001ppm respectively. These results provide justification for the medicinal usage in the treatment of different diseases and can give the importance about the herbal drugs prepared from these plant materials in herbal remedies and in pharmaceutical companies.

KEYWORDS Trace element, *Kaempferia rotunda*, *Costus speciosus, Alpinia galanga,* AAS

INTRODUCTION

Medicinal plants have been increasingly used in food additives, pharmaceuticals, cosmetics and other products (1, 2). In developing countries, thousands of rural communities still depend mainly on folklore medicine to cure disease. Some medicinal plants are more efficient to treat infectious disease than synthetic antibiotics. Due to their proximity, reliability and age long practice, people still depend largely on traditional medicine for their health care (3). As reported by World Health Organization (2003), large number of the world population lack access to adequate health care services, hence people to rely on medicinal plants which are available and affordable (4). Various researchers have reported that a large number of plants posses some potential in the treatment of several disease (5, 6). Medicinal plants contain both organic and inorganic constituents and many medicinal plants are found to be rich one or more individual elements, thereby providing a possible link therapeutic action of the medicine (7, 8). Elements form the basic building blocks of our lives. They combine in one another in diff. proportion to form everything; from the air that we breathe, the food we eat, to the wood that we use to build our homes, the fir woods we used for cooking. Human bodies consume these elements through daily functioning. The greatest source of these elements is through the food we eat (9).The human body requires a number of mineral in order to maintain to good health. A number of minerals essential to human nutrition are accumulated in diff. parts of plants as it accumulates minerals essential for growth from environments (10). Trace elements play an important role in the formation of bioactive compounds. They are intimately involved in the physiological function and are important co-factors in the production of enzymes. It also plays both curative and preventive in combating disease. Deficiency of trace elements in human subjects can occurred under the most practical dietary conditions and in many diseased statuses (11). Human body requires both metallic and non-metallic elements with a certain permissible limits for growth and good health. Therefore, analysis of element composition in food and related products is essential for understanding their nutritive importance. So the present studies deals with the determination of mineral element present in three species of zinziberaceae family available in Manipur.

Alpinia galanga (family, *zingiberaceae*) is a rhizomatous herb. Rhizomes and flowers of *Alpinia galanga* were used in food item by local peoples of Manipur. In addition its rhizome is used for cough, indigestion, dysentery and food poisoning. Fresh juice of the rhizomes is also used for the treatment of ringworm. Seeds of *Alpinia galanga* are used for colic, diarrhoea and vomiting (12)

Kaempferia rotunda is a rhizomatous aromatic herb. Rhizomes and roots are applied for proper hair growth; used as an ingredient of an indigenous hair lotion; rhizome is locally applied for the treatment of tumour. For removing coagulated blood from body rhizomes are taken internally and also used in abdominal pain and gastric troubles (13).

Costus speciosus is a rhizomatous flowering herbs, flowering time in India is August to October. It has antioxidant, antifungal, antituberculosis and oestrogenic activity. The rhizome extract is used as tonic and useful in reliv1ing burning sensation, constipation, asthma, bronchitis, leprosy, anaemia and other skin alignments (14). It is also used internally for eye and ear infections.

MATERIAL AND METHODS

Collection and identification of the plant sample

The samples (rhizome) of *Keampferia rotunda*, *Costus speciosus* and *Alpinia galanga* were collected from Kangmong village, Imphal west district, Manipur, India, during Jan.-Mar. 2015 and identified by Prof. P. Kumar Singh, Advance Studies Centre , Life Science Department, Manipur University, Imphal, India.

Sample preparation

The three collected samples were washed many times in running water, for removing impurities, lastly by distilled water, cut into thin slice separately. It was then oven dried at 450C and then subjected to grinding separately for powder formation. The powders of the three samples were stored in three different air tight glass containers and used for further analysis.

Sample Digestion

For the digestion of plant sample, 0.5g sample(s) was weighed and was digested for 3 h at 85°C with concentrated HNO3: HCl (3:1) mixture. Then concentrated $HClO_4$ (1 mL) was added to enhance **Plant** the oxidation properties in the digestion. The solutions were filtered and diluted to 50 mL with distilled water. The blank

solution was taken as the same procedure without addition of the sample (15).

Reagents and Chemicals

All chemicals are of analytical grade purchased from S.D. Fine-Chem. Ltd. and Qualigens, Fischer Scientific, India. The ultrapure deionised water (Millipore S.A., France) was used for the preparation of standards and modifier solutions. The stock standard solutions were purchased from Sigma Aldrich chemical company for calibration by preparing standard solutions.

Instrumentation

An Analytik Jena AAS Vario-6 Graphite furnace spectrometer furnished with PC-controlled 6-piece lamp turret, where hallow cathode lamps are mounted as line radiator along with a deuterium hallow cathode lamp for compensation of the background absorption and argon gas supply, was used for all of the absorption measurements. The hollow cathode lamps fitted for specific element that has to be analyzed with their respective wavelength and the slit width adjusted accordingly. Signal measurement was done in peak area/peak height and calibration was in linear mode. The sample injection volume is 20 μL. The typical heating program of GF-AAS is drying (injection of the sample into the filter furnace), pyrolysis, atomization, and cleansing.

RESULT AND DISCUSSION

Analysis of the eight trace elements, namely, Mg, Ca, Cr, Mn, Fe, Ni, Cu and Zn, was performed in triplicate samples of the rhizomes of *Kaempferia rotunda*, *Costus speciosus* and *Alpinia galanga* collected from Manipur. The elemental level analysed in samples of *Keampferia rotunda, Costus speciosus* and *Alpinia galanga* were given in Table 1.

Nickel

Present in the three samples ranges in the increasing order 0.038±0.009 ppm, 0.053±0.004 ppm and 0.096±0.002 ppm respectively in Alpinia galanga, Costus specious and Keampferia rotunda. These values are below the permissible limit. Toxicity of Ni in human being is not very common occurrence as its absorption by the body is very low (16).

Magnesium

The amount of magnesium present in these three species is 0.17±0.007ppm, 0.58±0.003 and 0.87±0.005 ppm respectively in Alpinia galanga, Costus specious and Keamferia rotunda. Magnesium activates pyruvic acid carboxylase, pyruvic acid oxidase, and the condensing enzyme for the reactions in the citric acid cycle and also is an essential activator for the phosphate-transferring enzymes myokinase, diphosphopyridinenucleotide kinase, and creatine kinase. It is also a constituent of bones, teeth, enzyme cofactor, kinases, etc. (17).

Chromium

Chromium present in *Keampferia rotunda*, *Alpinia galanga* and *Costus* specious are at the concentrations 0.07±0.002ppm, 0.14±0.009ppm and 0.26±0.008ppm respectively. Chromium is an important trace mineral that is necessary for normal functioning of insulin, a hormone that maintains blood sugar levels and is also essential for metabolism of carbohydrates, proteins and fats. Deficiency of chromium causes an insulin resistance, impairs in glucose tolerance and may be a risk factor in atherosclerotic disease (18).

Iron

Iron concentration is highest in *Alpinia galanga* (5.40±0.003 ppm), lowest in *Costus specious* (0.86±0.003 ppm) and *Kaemferia rotunda* content 1.22±0.005 ppm of iron. These concentrations are beyond the permissible level. Permissible level of iron in edible plants is 20ppm (WHO). Iron is essential for formation of hemoglobin, which carry oxygen around the body (19). Deficiency of iron causes anemia, weakness, depression, poor resistance to infections (20).

Calcium

The level of calcium in *Alpinia galanga, Costus specious* and *Kaempferia rotunda* are in the decreasing order, 0.53±0.13ppm, 0.46±0.21 ppm and 0.46±0.01 respectively. Calcium is the main component of bones and teeth. It takes important role on cell membranes and on 7muscles, by regulating endo-exoenzymes and blood pressure (21). Calcium fluxes are also important mediators of hormonal effects on target organs through several intracellular signalling pathways (22). Deficiency of calcium causes rickets, back pain, osteoporosis, indigestion, irritability, premenstrual tension and cramping of uterus (23).

Zinc

Zinc level on the three samples, *Alpinia galanga, Costus specious* and *Keampferia rotunda* are in the order 0.23±0.001ppm, 0.16±0.001ppm and 0.14±0.003ppm respectively. Zinc takes part a central role in the immune system, affecting a number of aspects of cellular and hormonal immunity (24. It is a constituent of many enzymes like lactate dehydrogenase, alcohol dehydrogenase, glutamic dehydrogenase, DNA and RNA polymerase etc. Zn dependent enzymes are involved in macronutrient metabolism and cell replication (25). Vitamins A and E metabolism and bioavailability are dependent on zinc status (26).

Copper

Copper is a component of the metalloenzymes, which take part in the catecholaminergic pathway-monoamine oxidase, dopamine β-hydroxylase, and tyrosine hydroxylase (27). Cu deficiency has been associated with cardiac abnormalities in human and animal; causes anaemia and neutropenia (28). The concentration of Cu in *Alpinia galanga, Costus speciosus* and *Kaemferia rotunda* are; 0.12±0.03 ppm, 0.11±0.03ppm and0.9±0.003 ppm respectively.

Manganese

Manganese content in the plant samples ranges from 0.23±0.001 (*Alpinia galanga*), 0.26±0.002 (*Kaempferia rotunda*) and 0.36±0.007 (Costus speciosus). Mn is an essential ubiquitous trace element required for normal growth, development, and cellular homeostasis (29).

The presence of these mineral elements could thus indicate that these plants could be useful in the management of diseases where deficiencies of these metal ions are an important mechanism for the disease pathogenesis and progression. It is thus possible that these minerals play a role in the therapeutic properties of this plant as claimed by the traditional practitioners.

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Table 1. Concentration of elements in ppm of *Alpinia galanga, Costus speciosus* and *Keampferia rotunda*

Samples	Elements							
	Ni	Mg	Cr	Fe	Ca	Zn	Cu	Mn
Keamferia rotunda	0.096 ±0.002 ppm	0.87± 0.005 ppm	0.07± 0.002 ppm	1.22± 0.005 ppm	0.46± 0.01 ppm	0.14± 0.003 ppm	0.9±0 .003 ppm	0.26± 0.002 ppm
Costus specious	0.053 ±0.004 ppm	0.58± 0.003 ppm	0.26± 0.008 ppm	0.86± 0.008 ppm	0.47± 0.21 ppm	0.16± 0.001 ppm	0.11± 0.03 ppm	0.36± 0.007 ppm
Alpinia galanga	0.038 ±0.009 ppm	0.17± 0.007 ppm	0.14± 0.009 ppm	5.40± 0.003 ppm	0.53± 0.13 ppm	0.23± 0.001 ppm	0.12± 0.03 ppm	0.23± 0.001 ppm

Not: 1ppm = 1mg/kg

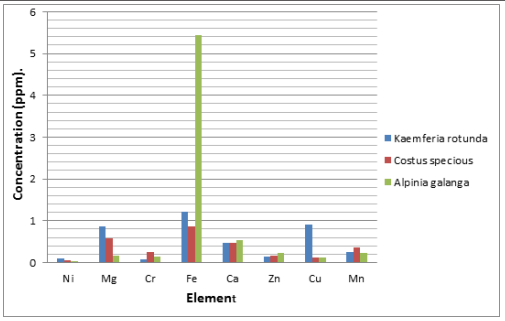

Fig.1 Graph showing diff. concentration of element present in *Alpinia galanga, Costus speciosus* and *Kaempferia rotunda*

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