Determination of Mineral Composition and Metal Content of Nutraceutically Valued Plant-Embelia basal

Gayatri S. Kamble1, Rasika C. Torane1, Anjali D. Ruikar1, Nirmala R. Deshpande1 and Jyoti P. Salvekar2*

Dr. T. R. Ingle Research laboratory, Department of chemistry, S. P. College, Tilak Road, Pune 411 030, Maharashtra, India

Received on: 20-05-2010; Revised on: 16-06-2010; Accepted on:15-07-2010

ABSTRACT

Embelia basal (R. & S.) A. DC, a shrub from family Myrsinaceae is a well known traditional medicine from ancient times. Various species of Embelia are used in Ayurveda for therapeutic purposes. Embelia basal contains health promoting factors such as minerals and metals in different concentrations which is used in indigenous medicines. Fruits of Embelia basal are quantified using atomic absorption spectrophotometer. Metal analysis of fruits shows the presence of vital essential minerals. The majority of the plant material is rich in some essential minerals like Fe, K, Zn, Cu, Mg, Ca, Al, Mn along with N and P. O2 which are known to be beneficial for health. The quantitative metal analysis shows the presence of trace amount of Nickel and Cobalt. The present study provides fundamental data on the availability of some essential minerals, which can be useful to provide dietary information for designing value added foods and for food biofortification. These results may help in the development of new drug formulations.

Keywords: Embelia basal, Minerals, Metals, Nutraceutical

INTRODUCTION

Some medicinally important plants are a rich source of essential nutritional elements. Plants and their products have always played a substantial role in human welfare by satisfying various essential needs ranging from food to medicines. Currently, functional foods or the nutraceuticals of plant origin have gained in popularity and constitute a major share of the health care market1. Natural products are having a great importance in Ayurveda. Literature survey revealed that various species of Embelia, family Myrsinaceae are used in Ayurveda for therapeutic purposes1. One of the species, Embelia ribes is used exhaustively in Ayurveda for the treatment of various diseases like pyorrhea, diarrhea, flatulence and for the treatment of cough2. It is used as an antifertility drug and shows antibacterial activity3. Fresh juice is cooling, diuretic and laxative4. Fruits are acrid, light, astringent, carminative, anthelmintic, stimulant, alternative5. Its reputation is due to the action of expelling tapeworms.6. The paste of seeds is applied locally against ringworm and seed powder is used as an erthine in cold and headache3. Decoction of seeds is beneficial in fever, skin diseases and chest complaints7. Fruits of Embelia ribes are used to cure dental, oral and throat trouble8. It is also used in the process of formulating Anti-AIDS Ayurvedic pharmaceutical compositions9. The antibacterial activity of embelin isolated from berries of Embelia ribes has been reported10. This species shows an antispermatogenic effect11. It also acts as a contraceptive11.

Fruits of Embelia basal have similar botanical characters, as that of Embelia ribes. Embelia basal is a well known folk medicine. This suggests the equal importance of Embelia basal fruits. Taking into consideration the perspective of the medicinal importance, screening of nutraceutically valued plant - Embelia basal is achieved.

MATERIAL AND METHODS

Plant material:
The fruits of Embelia basal (R & S) A. DC. Family Myrsinaceae obtained as a market sample. The taxonomic identification was accomplished with the help of flora of Bombay Presidency3 and Flora of Maharashtra4 for identification. The fruits were authenticated by Agharkar Research Institute, Pune, Maharashtra, India. Its voucher No. is AHMA F- 084.

Preparation of Ash for Nutritional Analysis:
The medicinally important plant Embelia basal was scanned qualitatively and quantitatively for the presence of metals. Carefully prepared ash from the plant material consisting of important minerals would represent the inorganic parts of the experimental material under study. By standard procedures12 ash was prepared using dried fruits of plant (1.0 g) in muffle furnace at 550°C till constant weight was obtained. The ash was 6.9%. The percentage of acid soluble and acid insoluble ash was determined (Table 1).

Table 1: Percentage of Acid Soluble and Acid Insoluble Ash

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid Soluble Ash</td>
<td>6.0</td>
</tr>
<tr>
<td>Acid Insoluble Ash</td>
<td>0.9</td>
</tr>
</tbody>
</table>

It was converted to chlorides and the solution was tested for metals by applying standard procedures13. Initially the total ash was dissolved in 10% HCl (10.0 ml) and evaporated to dryness on water bath. The material was digested with 25 % HCl (5.0 ml) on water bath for 30 minutes. The resulting solution was filtered through Whatmann paper (No. 40). The residue was made chloride free (tested with silver nitrate solution) and washed with hot distilled water. The filtrate was diluted to 100 ml and used to estimate metals quantitatively (Table 2).

Table 2: Nutritional content of Fruits of Embelia basal

<table>
<thead>
<tr>
<th>Metals</th>
<th>Amount (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>6800.0</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>5000.0</td>
</tr>
<tr>
<td>Potassium</td>
<td>26010.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>1900.0</td>
</tr>
<tr>
<td>Magnesium</td>
<td>980.0</td>
</tr>
<tr>
<td>Zinc</td>
<td>31.0</td>
</tr>
<tr>
<td>Copper</td>
<td>29.0</td>
</tr>
<tr>
<td>Iron</td>
<td>532.0</td>
</tr>
<tr>
<td>Aluminium</td>
<td>180.0</td>
</tr>
<tr>
<td>Cobalt</td>
<td>0.5</td>
</tr>
<tr>
<td>Manganese</td>
<td>21.19</td>
</tr>
<tr>
<td>Nickel</td>
<td>3.45</td>
</tr>
</tbody>
</table>

* Corresponding author.

Jyoti P. Salvekar
Dr. T. R. Ingle Research laboratory, Department of chemistry, S. P. College, Tilak Road, Pune 411 030, Maharashtra, India
Tel.: + 91-20-25435554
Telefax: +91-20-24332479
E-mail: jsalvekar@yahoo.co.in,kamblegayatri@gmail.com

The major constituents of ash were determined qualitatively by spot analysis method. The quantitative estimation of metals was carried out by various methods like Atomic Absorption Spectrophotometer and Flame Photometer (Chemico 201 mech).

RESULTS

Traditionally the fruits of Embelia basal being used, very often are in powder or paste forms which contain both the organic and inorganic constituents13.
Gayatri S. Kamble et al. /International Journal of Chemical and Analytical Science 2010, 1(9),208-210

Nutritional analysis of acid soluble ash of fruits of *Embelia basalis* showed the higher concentration of nutraceutically valued elements like phosphorus, nitrogen, potassium, calcium, magnesium, iron etc. which catalyze various metabolic activities in human body. Aluminium, zinc, copper and manganese are present in low concentration whereas metals like nickel and cobalt are present in trace amounts.

**DISCUSSION**

Minerals are necessary for the growth of life, on which the exchange of energy in the combustion of foods and the building of living tissues depend. The minerals; natural resources even at threshold levels, contribute significantly to normal growth and play a pivotal role in biochemical functions and essential enzyme systems. These all metals have their effect on our health, when they are too high or too low.

The results show that the fruits of *Embelia basalis* are a good resource of crucial nutrients. Phosphorus, nitrogen, potassium, calcium, magnesium and iron are found as major constituents where as aluminium, zinc, and copper manganese are minor constituents. Metals like nickel and cobalt are present in trace amounts. The fruits of *Embelia basalis* are consumed in Ayurvedic systems; its nutritional analysis plays a significant role.

Potassium has many functions, and is essential for protein synthesis, conversion of blood sugar into glycogen, stimulation of the movement of the intestinal tract, and activation of many enzymes. Severe potassium deficiency can present symptoms of fatigue, vomiting, acute muscular weakness and paralysis, loss of appetite, low blood pressure, intense thirst, drowsiness, confusion and eventually coma. The sudden death that can occur in fasting, anorexia nervosa or starvation is often a result of heart failure caused by inadequate intake of potassium. Potassium supplementation has been shown to be of benefit in menopause to control mood swings and fatigue. Fruits of *Embelia basalis* are a good source of potassium.

Phosphorous is required in the human body to carry out many complex reactions while Calcium plays an important role in building of bones and teeth. Phosphorus is tied to calcium in bone structure and plays a significant role in CNS function. It is a part of the ATP (adenosine triphosphate) molecules, which is the body’s energy carrier. Many enzymes contain as a base phosphoproteins. Phospholipids are also involved in nerve conduction. Calcium and phosphorus act together, balancing each other in many body functions. Phosphate is the primary ion in extra- and intra-cellular fluid. It aids absorption of dietary constituents, helps to maintain the blood at a slightly alkaline level, regulates enzyme activity and is involved in the transmission of nerve impulses. Symptoms of phosphate deficiency include loss of appetite, anxiety, bone pain, bone fragility, stiffness in the joints, fatigue, irregular breathing, irritability, numbness and many more. In order to overcome the phosphorous deficiency, phosphorous compounds need to be included in the diet taken as dietary supplements. Besides it, calcium is also important for nerves and muscles. Calcium activates some enzymes such as protein kinases, which generate neurotransmitters. A long term deficiency of calcium may result in weak and fractured bones, cramp pains in legs, poor sleep disorder, extremely irritable nerves etc. Fruits of *Embelia basalis* are having a high accumulation of Calcium and Phosphorous.

Magnesium is known to be antagonistic to calcium. The balance between calcium and magnesium controls the release of many of the hormones. All enzymatic reactions utilizing the energy storage molecule, ATP require magnesium. It is also required for DNA manufacture, protein synthesis and fatty acid synthesis. Magnesium is necessary for the action of a compound which plays a vital role in transmitting messages from hormones and other stimuli which cause chemical reactions inside cells. A magnesium deficiency affects body tissues and also contributes to anxiety, sleeping problems, and (CFS) neuropsychiatric conditions.

Manganese, an essential trace element for humans, plays an active role in CNS function. Manganese appears to be involved in many enzyme systems. It acts as a co-factor for enzymes necessary for energy production and is involved in glucose metabolism, the stimulation of glycogen storage in the liver, protein digestion and cholesterol and fatty acid synthesis. It is also necessary for the synthesis of DNA and RNA. Manganese is necessary for growth and maintenance of the nervous system. It also plays a role in formation of blood clotting factors, female sex hormone function and thyroid hormone function. The deficiency of manganese can result in bone malformation, infertility, weakness, seizures, convulsions, eye problem, hearing problem and many more.

Metals like Nickel and Cobalt are advantageous when they are present in trace amount. Nickel has an influence on carbohydrate metabolism, is associated with some enzyme activity and it helps to stabilize the protein structure of the enzymes like Factor F-430. The well-recognized activity of cobalt is almost totally confined to functions of Vitamin B12. Symptoms of a deficiency of cobalt are anemia demyelination, parasthesia of extremities, sore tongue. It is known to reduce thyroid activity and beneficial in hyperthyroid condition. Cobalt therapy is useful in treatment of Parkinson’s multiple sclerosis and neuropsychiatric conditions.

**CONCLUSION**

The above results indicate that the fruits of *Embelia basalis* are a good source of essential nutrients required for the well being of human body. The presence of potassium, phosphorus, iron, calcium, magnesium, and copper etc in high concentration in the fruits of *Embelia basalis* suggests its use in therapeutic purposes. Thus the presence of the nutraceutically valued minerals in the plant points toward the possibility of their use to restore the different imbalances caused in the body.

**ACKNOWLEDGEMENT**

Authors are thankful to the Principal S. P. College Pune and the Head, Department of Chemistry, S. P. College, Pune, Maharashtra, India for providing the necessary laboratory facilities for the work.

**REFERENCES**

5. C. C. Divi and E. Sukumar, Fisetin (2003), 74(4), 401-403

Source of support: Nil, Conflict of interest: None Declared