Atomic Absorption Spectrophotometer (AAS) analysis for evaluation of variation in mineral content in different varieties of *Trigonella foenum-graecum* L.

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**ABSTRACT**

Fenugreek or Methi is a well known leguminous crop. It is a plant of immense importance due to various medicinal properties. It comprises many bioactive compounds which are used in pharmaceuticals and nutraceutical industries. It included in diet as a vegetable with its leaves and as a spice with seeds. Present study aims at the estimation of micronutrients such as, copper, iron, magnesium and zinc in seeds of different varieties of fenugreek by using atomic absorption spectrophotometer. The results of present study revealed that there are significant variations in micronutrient content among the varieties. Iron and magnesium content was comparatively higher in GM-2 (2.97±0.14 mg/g and 17.68 ±0.15 mg/g, respectively) than the others, copper was highest in RMT-351 10.13± 0.18 and zinc 2.85±0.16 in RMT -303.

**Key words:** AAS, Fenugreek, Medicinal properties, Micronutrients.

**INTRODUCTION**

*Trigonella foenum-graecum* L. commonly known as fenugreek is an annual, herbaceous, aromatic plant belongs to the subfamily Papilionoideae of Leguminosae which is third largest family of flowering plants. Fenugreek seeds are bitter possess carminative properties, contains lysine and L-Tryptophan rich protein, mucilaginous fiber and other rare chemical constituents such as saponins, coumarin, fenugreekine, nicotinic acid, sapogenins, phytic acid, scopoletin and trigonelline, thought to account for many of its presumed therapeutic effect. It inhibits cholesterol absorption and help lowering blood sugar levels (Sauvaire et al., 1991 and Ribes et al 1986). Therefore, fenugreek seeds are used as a traditional remedy for the treatment of diabetes and hypercholesterolemia in Indian and Chinese medicines (Miraldi, 2001). It is reported to have restorative and nutritive properties and to stimulate digestive processes, useful in healing of ulcers in digestive tract (Khosla, 1995). Fenugreek has also been reported to exhibit pharmacological properties such as antitumor, antiviral, antimicrobial, anti-inflammatory, hypotensive and antioxidant activity (Cowan, 1999). Fenugreek seeds contain 50 per cent fiber (30 per cent soluble fiber and 20 per cent insoluble fiber) that can slow the rate of postprandial glucose absorption (Ethane et al., 2003). Fenugreek seeds contain oils, alkaloids, amino acids (lysine, arginine, tryptophan, threonin, valin and methionin) and mucilage that in this plant is most famous galactomannan, it also contains vitamin A, C, D, B1 and, minerals such as calcium, iron and zinc (Elnaz et al., 2010). In this study, several nutritionally important minerals (Cu, Fe, Mg and Zn) were measured by AAS in different varieties of *Trigonella foenum-graecum* which are cultivated in different regions of India.

**MATERIALS AND METHODS**

Mature seeds of different varieties of fenugreek were procured from Vegetable Research Centre, Pantnagar (Uttarakhand) and S.K.N.College of Horticulture, Jobner (Rajasthan). Out of the 10 varieties, Pusa early bunching (PEB), Hisar sonali (HS), Gujar methi (GM-2), Rajasthan Methi (RMT-1 and RMT-361) were collected from Pantnagar, and Rajasthan methi (RMT-303, RMT-305, RMT-143, RMT-351, and RMT-365) are from Jobner Rajasthan. All the chemicals used in the present study were obtained from Merck. Nitric acid and hypochloric acid were of analytical grade. All the glassware’s used in this study are washed with reverse osmosis (RO) water, soaked in 10 % HNO3 overnight and finally washed using ultra pure water. For analysis of micronutrients, one gram of powdered seed was weighed accurately followed by addition of HNO3 and HClO mixture in (3:1) which is kept overnight for pre digestion and finally digested on a hot plate for 1-2 hours. The digested samples were diluted to 50 mL using 0.1 % HNO3 in volumetric flask. The diluted samples were filtered and then stored for further analysis. The Quantitative estimation of micronutrients was performed using atomic absorption spectrophotometer of (SensAA Dual GBC...
RESULTS AND DISCUSSION

The micronutrient content in fenugreek varieties was estimated for iron, zinc, copper and magnesium. Significant variations were observed in the content of iron, zinc copper and magnesium. The magnesium content ranged from 17.68±0.15 µg/gm to 10.14±0.14µg/gm Table 1. with highest in GM-2 and lowest in PEB both the varieties were collected from Pantnagar. The dietary allowance for magnesium is 400 mg, it is important for energy production and transport in the body as it is involved in glycolysis, and oxidative phosphorylation. It has also been reported for maintaining normal heart rhythm (Soetan et al., 2010). It is also involved in muscular activity and required by more than 300 enzymes in the body that catalyze various important functions such as protein synthesis, muscle and nerve function, blood glucose control and blood pressure regulation (Rude, 2012).

Iron content ranged from 2.97±0.14µg/gm to 0.03 ±0.05µg/gm. Iron deficiency is a major cause of anemia, increase of infection, decrease of myoglobin content and electron transport capacity in skeletal muscle (Davies et al., 1982). Iron is an important mineral as it performs several important functions such as being a component of enzymes it involved in energy production, proteins metabolism, and nucleotides as well as in synthesis of proteins and neurotransmitters. It is a component of hemoglobin and myoglobin hence involved in oxygen transport in the body (Soetan et al., 2010). The lowest content of iron was found in RMT-365 while highest content was found in GM-2. The varieties grown at Pantnagar showed high iron content as compared to the varieties from Rajasthan. A reason for this difference in the iron content may be the soil type of Rajasthan which is alkaline and highly permeable with loose textured that results in decreased mobilization of iron. The recommended dietary allowance of iron is 18 mg and this is estimated for iron, zinc, copper and magnesium. Significant variations were observed in the content of iron, zinc copper and magnesium. The magnesium content ranged from 17.68±0.15 µg/gm to 10.14±0.14µg/gm Table 1. with highest in GM-2 and lowest in PEB both the varieties were collected from Pantnagar. The dietary allowance for magnesium is 400 mg, it is important for energy production and transport in the body as it is involved in glycolysis, and oxidative phosphorylation. It has also been reported for maintaining normal heart rhythm (Soetan et al., 2010). It is also involved in muscular activity and required by more than 300 enzymes in the body that catalyze various important functions such as protein synthesis, muscle and nerve function, blood glucose control and blood pressure regulation (Rude, 2012).

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Zinc plays crucial role in carbohydrate and lipid metabolism, control of gene transcription and several other biological processes (Dhawan and Chadha, 2010). The recommended dietary allowance for zinc is 15 mg per day respectively. The highest zinc content was observed in Jobner Rajasthan cultivated RMT-303 2.85±0.16µg/gm while the minimum zinc content was found in RMT-143 0.30±0.16 µg/gm. Zinc deficiency is characterized by skin disorders, short stature, impaired immune function, hypogonadism, cognitive dysfunction and anorexia (Prasad, 1991). Zinc is involved with the sense of taste, smell and appetite as the areas of brain that are involved in these perceptions are activated by zinc. Zinc is also important for growth, so it becomes vital during pregnancy because of the rapidly dividing cells of the fetus. Zinc also prevents night blindness and prevents development of cataract (Soetan et al., 2010). Copper is required for the development of fetal brain and maintenance of brain throughout the life. The recommended dietary allowance for copper is 2 mg per day respectively. It is also involved in the formation of the cells of the immune system and it also maintains proper structure and function of circulating blood vessels (Soetan et al., 2010). The copper content ranged from 10.13±0.18µg/gm to 1.63±0.24µg/gm. The highest copper content was found in Rmt-351 and lowest in Rmt-1 from Jobner, Rajasthan

Similar findings regarding the variation in content of micronutrients was also reported by Pathak and Agrawal (2014) in 13 different genotypes of fenugreek. Where they reported the content of magnesium ranged from 212.36 ± .07 µg/gm to 289.64 ± .29 07 µg/gm., the iron content ranged from 5.89 ± .01 µg/gm to 89.04 ± 0.07 µg/gm. while the zinc and copper content ranged from 25.4 ± .02 µg/gm to 68.05 ± .02 µg/gm and from 2.49 ± 1.42 µg/gm to 6.13±0.09 µg/gm.

Table 1: Estimation of micronutrien in seeds of different varieties of fenugreek (Trigonellean foenum-graecum)

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Cu</th>
<th>Mg</th>
<th>Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM2</td>
<td>2.71±0.31</td>
<td>2.97±0.14</td>
<td>17.68±0.15</td>
</tr>
<tr>
<td>HS</td>
<td>3.00±0.25</td>
<td>0.14±0.09</td>
<td>12.37±0.16</td>
</tr>
<tr>
<td>PEB</td>
<td>1.71±0.30</td>
<td>0.73±0.12</td>
<td>10.14±0.14</td>
</tr>
<tr>
<td>RMT1</td>
<td>1.63±0.24</td>
<td>1.54±0.13</td>
<td>13.19±0.16</td>
</tr>
<tr>
<td>RMT303</td>
<td>7.25±0.37</td>
<td>2.00±0.10</td>
<td>15.69±0.11</td>
</tr>
<tr>
<td>RMT305</td>
<td>4.20±0.19</td>
<td>1.66±0.14</td>
<td>14.00±0.10</td>
</tr>
<tr>
<td>RMT143</td>
<td>1.66±0.14</td>
<td>0.19±0.09</td>
<td>11.75±0.08</td>
</tr>
<tr>
<td>RMT351</td>
<td>10.13±0.18</td>
<td>0.11±0.02</td>
<td>11.04±0.12</td>
</tr>
<tr>
<td>RMT361</td>
<td>6.13±0.25</td>
<td>1.89±0.14</td>
<td>12.72±0.11</td>
</tr>
<tr>
<td>RMT365</td>
<td>7.08±0.26</td>
<td>0.03±0.05</td>
<td>11.95±0.13</td>
</tr>
</tbody>
</table>

Column values with the lower case same letter are not significantly different as determined by Duncan’s multiple range test (P<0.05).
to 12.51 ± 82 µg/gm. Singh et al., (2013) also reported the variation in Minerals content in different genotypes of fenugreek, where they found the content of Zinc ranged from 1.28 to 2.78 mg/100g, iron content in seeds varied from 7.77 mg/100g to 11.2 mg/100g, Manganese content ranged from 1.79mg/100g to 1.35 mg/100g and the content of magnesium in seed varied from 143 mg/100g to 197 mg/100g.

Duncan multiple range test (DMRT) showed that there is no significant difference between the variety RMT-365 and Rmt-143 in terms of Mg content, while other varieties shows significant difference. The Copper content of HS and GM-2, PEB, RMT-143, RMT-1 was not significantly different. Fe content in RMT-361, RMT-305, GM-2, PEB, and RMT-143 are almost equal. Zn content of RMT-361, RMT-351 RMT-305, and RMT-1, HS, RMT-143 was not significantly different.

The environmental variables, such as soil pH, temperature, solar radiation, precipitation, organic matter, and soil texture, have the potential to influence nutrient concentration and must be taken into consideration while explaining the variation for plant micronutrient in germplasm.

**REFERENCES**


CONCLUSION

In the present study the results indicate that fenugreek varieties collected from different locations exhibited variations in the content of mineral elements. The incorporation of fenugreek in diet will provide a small part of the mineral requirement besides safeguarding the body from oxidative damage as a result of its antioxidant properties (Kaviarasan et al., 2007). The incorporation of natural sources like fenugreek for supplementing the dietary requirements is the best possible measure to fulfill the desired nutrient requirement of the body. These natural sources also provide some health promoting phytochemicals to the body. Therefore fenugreek can be considered as longevity promoter that will increase the overall health status of the body consumption.

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