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Research Article

PROFILING OF SELECTED MICRONUTRIENTS AND HEAVY METAL ELEMENTS IN *OCIMUM SANCTUM* BY ATOMIC ABSORPTION SPECTROSCOPY

Himakar Reddy K [1]*, Jhansi U[1], Subramanyam G [2]
[1]Dept. Of Advanced Research Centre, Narayana Medical Hospital & Nellore, Nellore, AP, India
[2]Director, Narayana Medical Institutions, Nellore, Andhra Pradesh, India
*Corresponding Author Email: himakarreddybiochem@gmail.com

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ABSTRACT

Background: *Ocimum sanctum* commonly called as Tulsi, sacred to Hindus and possess various biological activities. Medicinal plant raw materials will be checked for the presence of heavy metals and trace elements concentration. Beyond permissible level is mater of great concern to public safety all over the world. Usually accumulation of essential elements may also lead to toxic at high levels. Aim: The present study emphasises on the levels of some selected essential micro nutrients and heavy metal concentrations in *Ocimum sanctum.* Method: Profiling of trace elements was done by Atomic Absorption Spectroscopy. Zinc, Copper, Manganese, Chromium, iron, lead and cadmium element levels were estimated. Results: All the selected elements were within the permissible levels of World Health Organization. Lead and cadmium were not found in both varieties Conclusion: From the results it is concluded that intake of Ocimum sanctum as in the raw form will be safe as there is no accumulation of micronutrients and toxic elements

Keywords: *Ocimum sanctum*, Atomic Absorption Spectroscopy. Essential micro nutrients, heavy metals

INTRODUCTION

Ocimum sanctum known as Holy Basil/Tulsi has a rich and fanciful history in the Ayurveda for its immense curative and multipurpose utility.[1] It belongs to Lamiaceae family which has aromatic and bitter in taste, native to Indian sub continent and wide spread throughout the South East Asian countries.[2]. Two varieties of Tulsi namely Vishnu and Krishna are sacred to Hindus. The essential oils produced by this plant are widely used in the treatment of various ailments globally.[3] It possesses biological effectiveness against diabetes mellitus, hypertension, and cancer, anti-microbial, antioxidant, anti-atherogenic, immune-modulator, hepatoprotective, anti-inflammatory and various other biological properties. [4-11] It also plays an important role in relieving stress, restore and improve body immunity and digestion[12]. The main phytochemical constituents are (-)-linalool, eugenol, methyl chavicol, gamma-caryophyllene are major constituents and minor are (+)-delta cadinene, 3-caune, citral and also high percentage of α-linolic acid content was reported.[13]

In spite of advance in medical technology, 80% of people are relying on the traditional medicine treatment for various ailments because of its cost effective and less toxic side effects. The world health organization (WHO) recommended that raw medicinal plant materials will be checked for the presence of heavy metals and trace elements concentrations.[14] Trace elements represent minor quantities but play a vital role in various biological reactions. Accumulation of these toxic elements beyond the permissible levels may lead to adverse reactions in the body.[15] In the present study two varieties of Tulsi such as Krishna and Vishnu were selected and further carried out for trace elements profiling. Copper, Zinc, Chromium, Manganese, iron, trace elements are some of the selected essential trace elements and lead, cadmium of heavy metal trace elements were assessed by using Atomic Absorption Spectroscopy (AAS).

MATERIALS AND METHODS

Sample collection

Tulsi varieties of Vishnu and Krishna were collected from a local nursery in Nellore district of Andhra Pradesh, India. These plants were authenticated from the Department of Botany, Sri Venkateswara University, Tirupati. Plant materials were allocated voucher specimen number in our department with OS02/2018 (Vishnu Tulsi) and OS03/2018 (Krishna Tulsi). Plant materials were washed using distilled water, dried in shade and then heated in a heating block in a muffle furnace for complete dryness. They were finely powdered using an electric blender and carried out for trace elements profiling.

Chemicals and reagents

All chemicals used in the study were of Analytical grade. Ultrapure-deionised water was used throughout the study. The glass ware soaked in 3M HNO_3 for the whole night and washed and rinsed with deionised water to minimize the chances of interference.

Instrument and standards calibration

Schimadzu Atomic Absorption Auto Sampler (AAS-700) model was used to assess the profiling of trace elements in the Ocimum sanctum. Different multi element grade standards from SD fine Chemicals were used as standards. Calibration curve was plotted using different concentrations giving regression coefficient (r2) values ranging from 0.9957 to 0.9996. The operational condition parameters followed for each element analysis was tabulated in the Table 1.

Sample digestion

0.5 g of sample were weighed and digested 3 hours with conc. HNO_3 and Con. Hcl in the ratio of (3:1). Then 1 ml of Perchloric acid was added to enhance the oxidation process. The resulting solution is diluted to 50 mL with distilled water and further analysis was carried out.

After sampling digestion, aliquots of the sample mixture were used to estimate the essential trace elements (Cu, Zn, Mn, Fe, V, and Cr) and heavy metal concentration (Pb and Cd). Each sample was analyzed thrice and the data were reported as mean ± SD in µg/g.

RESULTS

After sample digestions the plant sample was subjected to AAS for determination of different essential and heavy metal trace elements. Results were tabulated in Table 2. In Vishnu Tulsi, the levels of selected micro nutrients were as follows in µg/g; zinc (182.3±0.4), copper (110.6±0.4), manganese (85.6±0.5), chromium (22.6±0.4), iron (452.6±0.2) where as in Krishna Tulsi zinc (201.5±0.5), copper (126.7±0.1), manganese (81.9±0.3), chromium (24.7±0.6), and iron (664.1±0.1). Lead and cadmium was not found in both varieties.

DISCUSSION

Herbal medicines play a vital role in the management of diseases it possesses many therapeutic bioactive compounds and also essential trace elements.[16-17] Trace elements are important for the proper functioning of vital organs in the body. Phytochemical and bioactivity studies of Ocimum have been reported so far but not much has been reported on the presence of trace elements. In this present context essential trace elements such as Cu, Zn, Fe, Mn, Cr and heavy metals such as lead and cadmium are estimated by AAS.

Zinc

It is an important essential trace element and plays a pivotal role in cell growth, bone development, behaviroal response, bone formation and wound healing. The amount of zinc present in the Vishnu and Krishna Tulsi are 182.3 and 201.5. According to WHO, the amount of zinc in edible plants was 27.4 ppm but not specific range was mentioned to the medicinal plants. But our results are in concurrent with previous reports. Deficiency and toxicity leads to retardation of growth, high blood cholesterol.

Copper

Permissible limit of Copper is 3 ppm in edible plants according to WHO. The permissible limits of copper in medicinal plants set by China and Singapore were 20 ppm and 150 ppm range. From the results it is evident that the amount of copper present in Ocimum is also present in permissible limit. High levels f copper leads to dermatitis, irritation of upper respiratory tract [18] where as deficiency leads to anaemia and congenital inability.[19]

Manganese

It is also an essential trace element which plays a vital role in normal reproduction and normal functioning of the nervous system. The permissible limit of Mn in edible plants and medicinal plants was not set by[14] WHO, 2005 In 2010 Jaben et al., [18]showed that Mn permissible ranges from 44.6 to 339 ppm. From our results also it has proved that Mn levels are in the permissible range. Deficiency leads to myocardial infarction, cardiovascular disease, and disorder of bone cartilage, growth and rheumatoid arthritis. [20]

Iron

It is an essential element in the haemoglobin which facilitates the oxidation of carbohydrates, proteins, fat and also plays an important role in oxygen and electron transfer. [19] Deficiency leads to myocardial infarction, gastrointestinal infection and nose bleeding. Jabeen et al., [18] reported that the amount of iron present in the medicinal herbs ranges from 231-1239 ppm. So from the results it is evident that the amount of iron present in the *Ocimum* is within the range.

Chromium

Chromium plays an important role in human metabolic process and its accumulation leads to carcinogenic in nature, irritant contact dermatitis, and nasal mucosa injury where as deficiency of chromium can lead to disturbances in glucose, lipid and protein metabolism. The amount of chromium present in the Ocimum is within the permissible limits.

Lead

It is not an essential trace element. Accumulation leads to and causes lead poising colic, anaemia, headache, convulsions and chronic nephritis of the kidneys, brain and damage. [20] The permissible limit set by WHO for lead in medicinal plants is 10ppm,. In our study there is no detectable amount of lead in Ocimum.

Cadmium

Cadmium causes acute poising and show adverse effects on kidney, liver, vascular and immune systems. Permissible limit for cadmium in medicinal plants was 3ppm. Results obtained show that Cd concentration is not found in Vishnu and in Krishna tulsi it is found to be 3 ppm.

Table 1: Atomic Absorption Spectroscopy operating conditions for profiling of elements in *Ocimum Sanctum*

Parameter	Copper	Zinc	Manganese	Chromium	Iron	Lead	Cadmium
Wavelength	324.7	213.9	279.5	357.9	372.0	283.3	228.8
Slit width (nm)	0.5 nm	0.5	0.2	0.5	0.5	0.5	0.5
Flame type	Air-C_2H_2	Air-C_2H_2	Air-C_2H_2	Air-C_2H_2	Air-C_2H_2	Air-C_2H_2	Air-C_2H_2
Fuel gas flow(l/min)	1.8	2.0	2.0	2.8	3.7	2.0	1.8

Table 2: Profiling of essential micronutrients and heavy metal concentrations in Tusli Varieties by AAS

Element	Vishnu Tulsi	Krishna Tulsi
Zinc	182.3±0.4	201.5±0.5
Copper	110.6±0.4	126.7±0.1
Manganese	85.6±0.5	81.9±0.3
Chromium	22.6±0.4	24.7±0.6
Iron	452.6±0.2	664.1±0.1
Lead	nd	nd
Cadmium	nd	nd

All values are expressed in mean ± SD in µg/g

CONCLUSION

From the results it is evident that the selected essential micro and macro nutrients such as zinc, copper, manganese, chromium, iron and heavy metals such as lead and cadmium were estimated in Ocimum and these levels are in permissible limits.

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