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Micronutrient Analysis of Different Edible Flowers Available in West Bengal Using Atomic Absorption Spectroscopy

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Abstract

West Bengal is a rich source of edible flowers, commonly consumed by people due to their significant micronutrient content, which has a positive nutritional impact.Micronutrients are crucial for their role in the development and growth of an organism. Micronutrients comprisemacrominerals, vitamins, and trace elements. They are involved in various metabolic functions and immune systems. The objective of the research is to determine and compare the amount of micronutrients (Zn, Cr, Se, Mn) in ten different edible flowers found in West Bengal. The estimation of micronutrients in edible flowers was carried out using atomic absorption spectroscopy (AAS). The sample was prepared for the estimation of micronutrients by wet oxidation and dry ashing methods.Analysis showed that overall nutritional impact is highest for Sesbania bispinosa followed byCarica papaya and Clitoria ternatea. Also, the highest mineral content of the ten edible flowers has been established in the present study with respect to the AAS data of zinc, chromium, selenium, and manganese. The findings of this research can help in the future development of various herbal formulations that can be used to treat various diseases as well as for recommendations of proper nutrition in various conditions caused by micronutrient deficiency.

Keywords: Micronutrient,edible flowers, Trace elements, zinc, selenium, atomic absorption spectroscopy

Introduction

Nowadays, the usage of flowers in food has become more popular because of their distinct flavours, attractive colours, and health benefits. Flowers aregood source of antioxidants, vitamins, and minerals, making them an attractive ingredient for the food industry[1].Flowers contain different variety of biologically active compounds such as vitamins, carotenoids, essential oils, polyphenols, dietary fibre, minerals etc. which are very effective for the prevention of various chronic illness.Micronutrients are required in the body in minute quantities, they are mainly two types:minerals and vitamins. The minerals are again classified into two types macroelement and microelement or trace element which are very essential for humans to play various physiological functions including the synthesis of hormones, enzymes, and other substances, for proper development, growth, and functioning of the reproductive and immune system[2].For plants, Soil is the main source of microelements, except in these conditions where large atmospheric deposition or flooding by contaminated waters.

In West Bengal wide variety of edible flowers are consumed, and micronutrient profiling of these flowers could be helpful for the recommendation in the management of their dietary supplementation.However mineral content of some of the edible flowers has remained unexplored till date. Literature of such ten unexplored edible flowers have been studied along with their therapeutic importance.*Musa paradisiaca*L.(banana flower): reduces the risk of dysentery, ulcers, and bronchitis[3], *Carica papaya*L.(Papaya flower): use as an antioxidant and antibacterial activities [4], *Nyctanthes arbor-tristis*L.(shiuli flower): used as a stomachic, expectorant, carminative, hair tonic, skin diseases, and ophthalmic diseases[5], *Ocimum sanctum*L.(tulsi flower): use to treat fever, bronchitis, arthritis, convulsions etc[6], *Clitoria ternatea*L.(Aparajita flower): used as an anti-inflammatory, analgesic activity, anxiolytic, antidepressant activity[7], *Sesbania bispinosa*L.(dhainchaflower): used as a stabilizer and thickener in food products[8], *Nymphaea stellata*L.(shapla flower): cure diabetes mellitus and liver disorders[9], *Hibiscus rosa-sinensis*L.(jaba flower): used as analgesics, antipyretics, asthmatics, and anti-inflammatory agents [11], and *Tagetes erecta*L.(genda flower):used as afevers, carminative, stomachic, liver complaints, astringent, and eye disorders [12]are commonly consumed flowers in West Bengal are used in this research.

The aim of this study was to determine the micronutrient content in edible flowers available in West Bengal, since there is not so much information on the description of edible flowers in the available literature.

Materials and Methods

Flowersamples:

Ten commonly consumed flowers of West Bengal are *Musa paradisiaca* [Musaceae], *Carica papaya* [Caricaceae], *Nyctanthes arbor-tristis* [Oleaceae], *Ocimum sanctum* [Labiatae], *Clitoria ternatea* [Fabaceae], *Sesbania bispinosa* [Leguminosae], *Nymphaea stellata* [Nymphaeaceae], *Azadirachta indica*[Meliaceae], *Hibiscus rosa-sinensis*[Malvaceae],*Tagetes erecta* [Asteraceae], were collected from Maheshtala, West Bengal. The samples used in this research are fully opened flowers.

Chemicals and instruments:

All the chemicals used in this experiment are analytical grade reagents: hydrochloric acid (Changshu Hongsheng FineChemical Co. Ltd.), nitric acid (Emplura), Perchloric acid (Merck specialities Pvt. Ltd). Zinc, selenium, chromium, and manganese stock solution are from Perkin Elmer manufacturer, and double distilled water was used for the preparation of the sample. An Atomic Absorption Spectrophotometer (Perkin Elmer Model: PinAAcle 500) was used for the analysis of the flower sample.

Preparation of sample:

In the laboratory, the flowers were cleaned by using distilled water and only the edible portion of the flowers was shade-dried for a few days and then crushed to fine powder. The flowers were then kept in an airtight container at room temperature before analysis.

Estimation of micronutrients:

Preparation of Standard Calibration Curve

Using Atomic Absorption Spectroscopy calibration curves for zinc, selenium, chromium, and manganese were prepared by using their stock solutions. A 2% (v/v)nitric acid solution was used as a blank for the analysis of these micronutrients.

Samples preparation:

For the determination of micronutrients, it is necessary to decompose the organic matter present in the powdered flower sample. The “wet oxidation” and “dry ashing” method are generally used for the decomposition of organic matter.

Wet Oxidation method:

0.5 g of powdered flower sample was taken in a beaker and 10 ml conc. nitric acid was added to it. The sample was digested in a hot plate at 55-70°C for 30 minutes. The sample was cooled at room temperature and 5 ml of 70% perchloric acid was added to it and again digested the sample until it became colourless. Cooled the sample at room temperature and mixed with double distilled water. Filtered the sample in a 100 ml volumetric flask and added double distilled water to make the volume up to the mark[13].

Dry ashing method

5 g of powdered flower sample was weighed and taken in a crucible in a muffle furnace at 500°C for 1 hour. The ash of the flower sample was digested with a mixture of hydrochloric acid and nitric acid (1:3). The digested sample was mixed with double-distilled water and then filtered. Then the filtrate was taken in a 50 ml volumetric flask and double distilled water was added to make the volume up to the mark[14].

Analysis of sample:

The prepared sample was analysed to determine the levels of zinc, selenium, chromium, and manganese using an Atomic Absorption Spectrophotometer. The value was obtained in mg/100g unit of dry weight of the powderedinflower sample. the mean of three readings was considered and presented as (n=3).

Results:

In this research,we analysed the estimation of micronutrients from ten different edible flowers in West Bengal. Using wet oxidation and dry ashing methods the powdered flower samples were digested and micronutrients were quantified using Atomic Absorption Spectroscopy.Results obtained from the AAS analysis are presented in Table 1.

Table 1: Micronutrient content in edible flowers in mg/100g, determined by wet oxidation and dry ashing methods. (n=3, mean± SEM).

Sl. no	Selected plants	Zinc		Selenium		Chromium		Manganese	
		Wet oxidation	Dry ashing	Wet oxidation	Dry ashing	Wet oxidation	Dry ashing	Wet oxidation	Dry ashing
1	Musa *paradisiaca*	3.06±0.01	1.00± 0.05	12.78± 1.63	4.17± 0.96	1.80±0.25	0.64± 0.08	6.20±0.05	3.73± 0.01
2	Carica papaya	16.34± 1.63	0.49± 0.42	33.84± 3.05	5.05± 1.55	7.60±0.30	1.39± 0.01	14.38± 0.08	2.98± 0.01
3	Nyctanthes arbor-tristis	2.38±0.04	5.99± 0.01	76.22± 1.99	7.50± 0.20	7.90±2.13	1.11± 0.02	3.52±0.02	2.61± 0.01
4	Ocimum sanctum	4.66±0.02	8.47± 0.01	47.48± 1.62	4.31± 0.56	2.70±0.90	0.59± 0.09	4.60±0.05	2.63± 0.03
5	Clitoria ternatea	20.42± 0.03	1.16± 0.06	132.76 ±6.05	3.16± 0.40	2.80±0.82	1.86± 0.05	7.50±0.04	34.45 ±13.87
6	Sesbania bispinosa	7.24±0.04	7.72± 0.07	96.60± 5.30	15.12 ±0.30	12.54± 0.56	0.63± 0.03	5.94±0.04	3.83± 0.07
7	Nymphaea stellata	0.64±0.08	5.82± 0.02	102.46 ±3.06	11.92 ±0.60	7.62±0.24	0.82± 0.03	32.42± 0.07	1.26± 0.01
8	Azadirachta indica	1.02±0.01	0.97± 0.01	56.38± 6.28	0.90± 0.26	6.90±0.14	0.05± 0.02	1.70±0.04	2.26± 0.05
9	Hibiscus rosa-sinensis	2.40±0.08	1.25± 0.03	107.78 ±7.43	1.07± 0.13	2.04±0.28	1.29± 0.03	4.68±0.02	4.33± 0.01

10	Tagetes erecta	3.10±0.02	7.02±0.01	60.42±8.07	18.73±0.26	2.26±0.18	0.46±0.01	2.92±0.02	2.05±0.01

Table 1: Micronutrient content in ten edible flowers

Discussion:

Micronutrients play an important role in the proper growth and development of the human body and their deficiency affects health contributing to low productivity and the vicious cycle of malnutrition, underdevelopment as well as poverty. Micronutrient deficiency is a public health problem affecting more than one-fourth of the global population[15].

The concentration of zinc, selenium, chromium, and manganese in ten edible flowers is analyzed by wet oxidation and dry ashing methods. Table 1 explored the micronutrient content in ten different edible flowers obtained from wet oxidation and dry ashing methods.Most of the data of wet oxidation method were found to be matched (and reconfirmed) with result of dry ashing methods, however in few cases, data of wet oxidation was found to be different from that of dry ashing. In such cases, priority was given to the results obtained from wet oxidation methods, since, literature shows that data from Wet oxidation method is more reliable because wet ashing technique involves lower temperatures and thus prevents the loss of volatile materials, such as selenium, potassium, phosphorous, and sulfur from the crude drug[16].Therefore,considering both wet and dry methods, overall the data was analysed and was found thatthe highest amount of zinc present in the flower of *Sesbania bispinosa*, followed by *Ocimum sanctum*, and T*agetes erecta*. The highest amount of chromium was present in the flower of *Nyctanthes arbor-tristis*, followed by *Carica papaya*, and *Nymphaea stellata*. The highest amount of selenium was present in the flower of *Nymphaea stellata*, followed by *Sesbania bispinosa*, and *Nyctanthes arbor-tristis*. The highest amount of manganese was present in the flower of *Carica papaya*, followed by *Clitoria ternatea*, and *Musa paradisiaca*.Overall, considering the analysis of all the four nutrients in the edible flowers, present study indicates that incorporation of the flowers in order: *Sesbania bispinosa>Carica papaya>Clitoria ternatea*in the daily diet may be useful to meet the requirement of these micronutrients. However, further studies can be extended for a better understanding of the absorption, bioavailability, and bioactivity of micronutrients.

Conclusion:

For regular consumers, edible flowers can become important sources of micronutrients in their diets.Edible flowers are aesthetically attractive and have a high nutritional content and antioxidant capacity.The primary goal of the research is public education and the promotion of edible flower consumption.The obtained results should contribute to the popularization of edible flowers as a new and prospective source for the food industry, gastronomy as well as a promising object of human nutrition.Therefore, in the future days, these edible flowers can become a powerful nutritional supplement for the well-being of humanity.

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