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QUALITATIVE AND QUANTITATIVE DETERMINATION OF TRACE ELEMENTS IN *GLINUS OPPOSITIFOLIUS* (L) USING ATOMIC ABSORPTION SPECTROSCOPY

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ABSTRACT: *Glinus oppositifolius* (L) is a medicinal plant as well as edible leafy vegetables that has long been utilized for its therapeutic effects. The goal of this work is to use Atomic Absorption Spectroscopy to determine trace elements in *Glinus oppositifolius* (L). Acid digestion was used as a flexible method and all elements were determined using Atomic Absorption Spectroscopy. Calibration curves were created using standard solutions. The average concentration of the elements, expressed as mg/kg dry weight of the sample, were found to be 205.55mg/kg for Zn, 113.7mg/kg for Mn, 3.75mg/kg for Cr and 78.8mg/kg for Ca. Among the analysed elements, maximum amount of trace elements was Zn followed by Mn, Ca, and Cr. This study sheds light on that the *Glinus oppositifolius* (L) plants potential nutritional and health-related benefits through their high trace element content present. Trace element levels are being monitored and managed. Moreover, it showed that the AAS method is a simple, fast, and reliable for the determination of elements in plant materials. The obtained results of the current study provide justification for the usage of such leafy vegetables in daily diet for nutrition and for medicinal usage in the treatment of various diseases.

INTRODUCTION: The common problem of micronutrient deficiencies and imbalances around the world constitutes a substantial health risk, contributing to the emergence of a variety of serious diseases and impairing immune system performance. Addressing this urgent issue involves the investigation of environmentally friendly alternatives. According to the WHO, several human diseases, including cancer are linked to dietary deficiencies [1, 2].

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Nutrition experts revealed that microelements (iron, iodine, copper, selenium, manganese, zinc, chromium, and so on) can preserve cell genetic stability and reduce the processes of biological aging and the development of age-related disorders [3, 4]. The trace Elements selenium and zinc, among these micronutrients, carry out the most important functions in the human body.

Traditional medicine is primarily reliant on medicinal plants, which are frequently utilized as home remedies, and it plays an important part in healthcare. According to the World Health Organization (WHO), over 80% of the global population still relies on conventional medicine for their primary healthcare requirements. This highlights the important role of plant extracts or active substances in traditional medicinal methods

[5]. Use of herbal medicine has increased significantly in the last decade because of its low side effects, ease of access, and universal acceptability, particularly in third-world countries. The consumption of these plants helps people of all ages, including infants and the elderly, get enough essential and non-essential minerals [6]. Scientific studies have demonstrated that traditional medicinal herbs can effectively regulate a variety of metabolic abnormalities that cause human diseases. Trace elements found in these medicinal plants play an important role in their therapeutic potential. A thorough examination of these components in the context of traditional medicinal plants indicates their significant involvement in the treatment of a wide range of human disorders [7]. It is important to note, however, that trace components in therapeutic plants can cause toxicity when present in excessive concentrations. Given their potential impact on human health, extensive research into the pharmacological properties of these medicinal plants is essential.

Glinus oppositifolius (L) belongs to the Molluginaceae family and is a branching herb found throughout India [8]. Its leaves are utilized as green vegetables by locals. It has linear to obovate leaves that are opposite and greenish blooms. *Mollugo oppositifolius* (L) is another name for it. Healers use this *Glinus oppositifolius* (L) shak to cure joint discomfort, inflammation, diarrhea, intestinal parasites, fever blisters, and skin diseases [9]. Macro, micro, and trace elements are known to be essential in plant biological activities and human metabolic reactions. Furthermore, trace elements are vital in the production of bioactive chemical compounds in medicinal herb plants, and are hence responsible for their therapeutic and poisonous characteristics [10, 11].

For the determination of trace elements in medicinal herbal plants, a variety of techniques such as voltammetry, atomic absorption spectrometry (AAS) [12], inductively coupled plasma atomic optical emission spectrometry (ICP-OES), X-ray fluorescence (XRF) [13], differential pulse cathode stripping voltamperometry (DPCSV) [14], and instrumental neutron activation analysis (INAA) [15] are commonly used. AAS is the most generally suggested instrument for trace metal analysis in complicated biological materials because of its specificity, sensitivity, high precision, simplicity, rapid analysis, low cost, low detection limit, and wide linear range. Aim of the present work, different trace nutrient elements (Mn, Ca, Zn, Ca) in *Glinus oppositifolius* (L) growing in West Bengal were determined by AAS coupled with acid digested method.

MATERIALS AND METHODS:

Reagents and Solutions: For each metal element, we used standard stock solutions with an initial concentration of 1000 mg L-1. These concentrations were then adjusted as needed by diluting with a 2% (v/v) nitric acid solution. The diluted standard solutions that resulted were used to build the calibration curves. Sigma-Aldrich (St Louis, MO, USA) provided the metal element standards. Furthermore, we got concentrated nitric acid (70%) and perchloric acid from Sigma-Aldrich (St Louis, MO, USA). For all tests, glass/plastic containers were rigorously cleaned by soaking them in a 10% (v/v) HNO_3 solution for at least 24 hours before rinsing with distilled water. Furthermore, all additional compounds used were of analytical quality.

Sample Preparations: Plant samples collected from Deulbari were rinsed with deionized water after being washed with flowing tap water to eliminate absorbed soil particles. Sade drying was used to dry the samples. To prepare fine powder for digestion, the dried samples were powdered using an electronic blender and sieved through a 2 mm sieve.

Acid Digestion Procedure: For plant digestion, 1 g of powdered roots and leaves of the plants under study were weighed inside Teflon PFA containers and digested for 3 hours at 85°C with a 10 mL of conc. HNO_3. Then, 2 mL of concentrated $HClO_4$ was added in order to improve the oxidation process in the digestion. The resultant solutions were filtered and diluted with distilled water to 50.0 mL. Working standard solutions of all metals were prepared from stock standard solution (1000 ppm).

Instrumentation: Mn, Ca, Zn, and Cr, were determined using an AAS instrument (Perkin Elmer Analyst 700 model AAS). The entire test was performed in an air/acetylene flame. The operating settings for functioning elements were set in accordance with the manufacturer's guidelines.

Statistical Analysis: Data entry and early summaries were completed on a Microsoft Office Excel spreadsheet. The acquired data's means and standard deviations were calculated. All analyses were performed in triplicate, and the findings were given as means standard deviations. To evaluate statistically significant variations in the mean concentrations of metals among groups of different portions of plant samples, a one-way analysis of variance (ANOVA) at p 0.05 was performed.

RESULTS AND DISCUSSION: Some trace elements recognized to be necessary to human bodies are Mn, Zn, Cr and Ca. As a result, different trace elements in various medicinal plants will play a distinct role in how our bodies work. In our preliminary trials, we assessed the accuracy of the current work by evaluating samples at three levels of concentration (low, medium, and high), which were collected from stock solutions of each metal in a 100 mL Erlenmeyer flask containing 1gm sample. The metal recoveries in the spiked samples ranged from 0.12 to 27.77%. **Table 1** shows the average elemental analysis values obtained by the AAS technique for the examination of *Glinus oppositifolius* (L) plants in mg/kg dry weight of the sample. It should be emphasized that each result is an average of three independent triplicate measurements taken in duplicate. Trace elements concentration of Zn, and Ca were determined to be 205.55±0.034 and 3.44±0.702mg/kg dry weight of the sample. Other elements detected in 113.7±0.003 and 3.75±0.021mg/kg dry weight of the sample included Mn, and Cr. The observed elements' roles are shown below.

TABLE 1: THE CONTENT OF TRACE ELEMENTS OF *GLINUS OPPOSITIFOLIUS* (L) PLANTS USING ATOMIC ABSORPTION SPECTROSCOPY

Sl. no.	Trace elements	Concentration (mg/kg Dry Weight)	% RSD
1	Zn	205.55±0.034	0.83
2	Mn	113.70±0.003	0.12
3	Cr	3.75±0.021	27.77
4	Ca	3.44±0.702	20.51

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Manganese (Mn): As previously stated, pyruvate carboxylase and superoxide dismutase are enzymes that contain manganese [16]. The manganese concentration of the *Glinus oppositifolius* (L) was 113.7±0.034 mg/kg dry weight of the sample.

Ca (Calcium): Calcium (Ca) is essential for vitamin B absorption, as well as the activation of enzymes such as pancreatic lypase and the creation of the neurotransmitter acetylcholine. Therefore, in order to obtain a Ca level of practically one percent of the overall diet would be tough [17]. The Ca concentration in *Glinus oppositifolius* (L) was 3.44 ± 0.702 mg/kg dry weight of the sample.

Zinc (Zn): Zinc is a key component of about 200 enzymes that play both catalytic and structural roles, including alcohol dehydrogenase, ribonucleic polymerases, alkaline phosphatase, and carbonic anhydrase. Animal studies have revealed that zinc shortage during pregnancy might result in developmental abnormalities in the progeny [18]. Zinc deficiency may lead to coronary artery disease. The zinc concentration in *Glinus oppositifolius* (L) was 205.55±0.034 mg/kg dry weight of the sample.

Chromium (Cr): Chromium is a mineral that is required for the metabolism of glucose, insulin, and blood lipids. Several investigations have suggested that it plays a role in enhancing insulin signaling cascades. Chromium stimulates insulin signal transduction by influencing effector molecules downstream of the insulin receptor (IR). The chromium concentration in *Glinus oppositifolius* (L) was 3.75±0.021 mg/kg dry weight of the sample.

CONCLUSION: The varying element concentrations found in *Glinus oppositifolius* (L) lead to the conclusion that these plans will play distinct roles in the treatment of various ailments.

The current study's findings provide critical data on the availability of several necessary elements, which can be used to provide nutritional information for designing value-added foods and for food biofortification. This study investigates the contents of four trace elements in a *Glinus oppositifolius* (L) sample grown in West Bengal. The acid digestion method, in combination with atomic absorption spectrometry, was used to determine trace elements in Glinus oppositifolius (L). The results showed that *Glinus oppositifolius* were high in, Zn, Mn, Cr an Ca. This technique is regarded as reliable for regular element determination in a variety of botanicals and nutritional supplements.

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