Heavy metal screening of Coccinia grandis (L).voigt leaves using atomic absorption spectroscopy (AAS).

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Abstract **- Coccinia grandis (L) Voigt is a dioecious perennial climbing plant, commonly called ivy gourd distributed mainly in Asia, Africa and Arabia. The plant contains minerals, a good source of protein, vitamins, beta-carotene, amino acid and various phenolics. Coccinia grandis (L) Voigt have been used to treat Leprosy, fever, asthma, bronchitis etc. Various studies proved that it has analgesics, antipyretic, anti-inflammatory, antimicrobial, antiulcer, antidiabetic, antioxidant, hypoglycemic, hepatoprotective, antimalarial, antidyslipidemic and anticancer properties. The concentration of phytochemicals varied according to the environment, place of collection and variety of Coccinia grandis (L)Voigt. The spectroscopic study on Coccinia grandis (L) Voigt leaves shows that it is an ideal food for the balance of minerals in human body. The quantitative investigation using atomic absorption spectroscopic technique shows the presence of calcium, phosphorus, copper, iron, magnesium, manganese, lead and zinc elements in the plant. This study reveals that Coccinia grandis (L) Voigt leaves can play a significant role in improving the health and nutrition, particularly malnourished populations. This study also shows that the concentration of calcium, iron and magnesium is very high in leaves of Coccinia grandis (L) Voigt. It indicates the importance of adding Coccinia grandis (L) Voigt leaves in our daily diet, as it is cheaply available and easy to cultivate.**

keywords **- Coccinia grandis; Atomic Absorption Spectroscopy; heavy metal analysis.**

I. INTRODUCTION

Coccinia grandis (L) Viogt a member of Cucurbitaceae is a dioecious perennial climber with single tendrils and glabrous leaves. Commonly called ivy gourd, also known as scarlet gourd, tindora and kowai fruit, is a tropical vine. It grows primarily in tropical climates and is commonly found in the southern Indian states of Kerala. Its native range extends from Africa to Asia and also found growing the wild and cultivated in Indo- Malayan region[1]. The leaves, fruit and shoot tips are used for cooking purpose in Asia[2].Every part of this plant is valuable in medicine and various preparations has been mentioned in indigenous system of medicine and unani systems of medicine. In traditional medicine, fruits have been used to treat leprosy, fever, asthma, bronchitis etc. The roots are used to treat osteoarthritis and joint pain. A paste is made of leaves is applied to the skin to treat scabies. It also used as expectorant and astringent [3].

Leafy green vegetables are an important part of a healthy diet. They are packed with vitamins, minerals, and fibre but low in calories. Eating a diet rich in leafy greens can offer health benefits including reduce deficiency diseases, obesity, heart disease, high blood pressure and mental decline. The leaves are the essential and most nutritious part of the plant, being a significant source of vitamin B1, vitamin C, vitamin B3, potassium, pro vitamin A as beta carotene and protein. Most leafy vegetables are very rich in phytonutrients and a host of antioxidants which assure a normal progression of the metabolic process of the body. Nutrients participate a central task in rewarding human requirements for energy and life processes [4].

Atomic Absorption Spectroscopy has many uses in different areas such as clinical analysis of metals in biological fluids and tissues such as blood, plasma, urine, saliva etc. It is useful in determining the metallic substance in water in treatment units, used to determine heavy metal poisoning in foods and it provides much scope for the soil analysis for mineral concentration. Mineral elements particularly metals play important role in biological system including plants. Magnesium (Mg) is in chlorophylls, Iron (Fe) is in hemoglobin and Cadmium (Cd) and Aluminium (Al) are toxic to plant metabolism. Atomic Absorption Spectroscopy helps in quantification of these elements. For agricultural applications, Atomic Absorption Spectroscopy offers a highly sophisticated way of performing quality control of food products, investigating chemical purity levels within the soil, maximizing harvest supplies, analyzing fertilizer properties and much more. The quality of the soil being used in both farming and agricultural applications plays a major role in determining the overall rate of food production.

II. MATERIALS AND METHODS

MATERIALS

For the present investigation, samples of *Coccinia grandis* (L) Viogt were collected and cultivated at normal climatic conditions. The plant was identified using the "Flora of Presidency of Madras Volume 1" by James Sykes Gamble [5]. Heavy metal content present in the plant was identified through Atomic Absorption Spectroscopy. Samples are stored in tight sealed pack and analyzed within a day if any delay occurred samples are sorted without contamination and leakage

Methods

Experimental Design Preparation of sample in laboratory.

The whole sample is mixed well and a portion is blended to fine powder. Calibration is done by aspirating standard metal solutions and noted the absorbance.

Preparation of sample and extraction

1 to 3 g of well ground mixed sample is weighed into a pre weighed crucible and heated for overnight at 500 degree centigrade and let cool. Wet ash with 10 drops water and 1-2ml nitric acid is carefully added. Evaporated excess nitric acid on a hot plate set at approximately 100 degree centigrade. Returned crucible to furnace and heated for 1 hour at 500 degree centigrade. Ash is dissolved in 10ml HCl, filter to volumetric flask and made up to 10ml with distilled water. Read the concentration by aspirating sample and reference standard solution in Atomic Absorption Spectroscopy.

III. RESULTS AND DISCUSSIONS

Coccinia grandis L. Voigt, a member of family Cucurbitaceae, is one of the most important vegetable and medicinal plants, distributed in Asian and African continent. Generally green leafy vegetables are good source of vitamins and minerals. They are excellent in carotenes, which are converted to vitamin A. The leaves in consequence are low in carbohydrate and energy but they are good source of beta-carotene, calcium, riboflavin, folic acid, ascorbic acid, Iron and vitamin K. Beta carotenes are also good antioxidants. From ancient times *Coccinia grandis* L. Voigt is used as anti-inflammatory, anticonvulsant, wound healing, bronchial inflammation, antiulcer, coughs, purgative, respiratory mucosae, antiemetic, astringent, treatment of diabetes mellitus etc. Nutrients are needed in sufficient value to survive a healthy life and to obtain best productivity. The daily mineral requirements of an adult man (a 70 kg person) are as follows 15 mg Iron, 2.8 mg Manganese, 15 mg Zinc, 2.5 mg Copper, 0.025 mg Nickel, 0.05- 0.2 mg Chromium, 0.415 mg Lead and 0.057 mg Cadmium [6]. A number of these elements have been reported with high biochemical essence and are involved in up regulating the formation of secondary metabolites which are responsible for pharmacological actions of vegetal species [7].The present study indicates that the amount of calcium is higher than that of other metals which is 2831 mg/kg. The concentration of Iron in *Coccinia grandis* L. Voigt was 97mg/kg. Iron is an essential element for the optimal bodily functions. The WHO recommended daily dietary limit of iron for human consumption is 10 to 60 mg/day (ATSDR 1994b). Furthermore Iron is actively involved in preventing disorders like anemia and cough associated with angiotensin-converting enzyme (ACE) inhibitors, pallid physique [8] while hyper accumulation of iron can lead to hepatic megaly, cardiac infraction, and nephric malfunction [9]. In addition, Manganese and Iron play vital roles in biochemical processes, improvement of impaired glucose tolerance and have indirect role in the management of diabetes mellitus [10]. Also vegetal species from Cucurbitaceae are reported as good absorbers of iron from soil [11]. The rich iron and calcium content help to build a healthy body and help to avoid the anemia like diseases.

The concentration of Magnesium is 496 mg/kg in *Coccinia grandis* L. Voigt. Magnesium (Mg) improves insulin sensitivity, protect against diabetes and its complications and reduce blood pressure. Magnesium is the major part of chlorophyll. Magnesium play important role in the human body that maintain the cholesterol in human body and control heart diseases, maintains heart rhythm. Magnesium converts blood sugar into energy and also prevents headache and attention deficit hypersensitivity disorder [12]. The amount of Zinc present in *Coccinia grandis* L. Voigt is 44.1 mg/kg. Zinc deficiency is the most wide spread micronutrient deficiency problem. Zinc is also essential for many enzymes which are needed for nitrogen metabolism, energy transfer and protein synthesis. Zinc is the key mineral in human diet that used to metabolise nutrients, immune function, DNA and protein production and cell division. It also enhances the production of testosterone. The amount of Phosphorus in *Coccinia grandis* L. Voigt was 0.094/g/100mg.The recommended dietary allowance for phosphorus ranges from 500mg to 1500mg for various age groups. Phosphorous plays an important role in the formation of bones and teeth.

The amount of Manganese present in *Coccinia grandis* L. Voigt is 23.7mg/kg. Manganese (Mn) is known to assist the body in metabolising protein, carbohydrates and used in treating diabetes. The necessary daily intake is 350 mg/day for men and 300 mg/day for women, while the permissible concentration of Manganese in vegetal and medicinal plants has not yet been established the WHO (2005) limits [9].Copper was found in trace amount in the plant *Coccinia grandis* L. Voigt and the amount is 4.4mg/kg. Copper is employed to treat several different types of cancer in humans and anemia but the intake of high amount can cause heart diseases. There were no traces of Cadmium in the sample. Cadmium seems to be the most toxic heavy metal to plants and it affects the remaining metals that were present in the plant. Its excessive consumption may cause intake of toxic heavy metals, which may result in serious complications like accumulative poisoning, nervous disorder, cancer and leads to mortality [13]. Cadmium disturbs other metals and finally the growth of the plant. Cadmium is absorbed by the roots of many plants, cannot be removed by washing and is concentrated particularly in the kidneys, liver, blood forming organs and the lungs[14].Lead and Copper are found in trace amount so it does not affect the growth of the plant.. The presence of heavy metals was detected through Atomic absorption spectroscopy. The sample *Coccinia grandis* L. Voigt is highly nutritional and there has no heavy metal contamination. The high concentration of certain metals, Magnesium, Potassium, Calcium and Iron in the plants are essential for proper growth and normal functioning of the plant [15].They are rich in fiber which helps in the digestion of food. Each and every part of *Coccinia grandis* L. Voigt is effective in the health metabolism. The leaves, fruit, stem and root are used to make medicines. Heavy metals are natural constituent of the soil. Excess of heavy metals decreases the growth, causes oxidative stress, chlorosis and blackening of the root system and upsets mineral nutrition and water balance [16]. Iron also present in moderate amount and it is helpful to prevent anemia and highly beneficial in pregnant ladies.The whole plant of *Coccinia grandis* L. Voigt play a great role in maintaining human health and improving the quality of human life.

Table 3.1 Chemical analysis of *Coccinia grandis* L. Voigt by atomic absorption spectroscopy

SL NO	PARAMETERS	RESULTS	UNIT	TEST METHOD
1	Phosphorous (as P)	0.094	g/100g	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
2	Copper (as Cu)	4.4	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
3	Iron (as Fe)	97.0	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
4	Calcium(as Ca)	2831	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
5	Lead (as Pb)	4.3	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
6	Cadmium (as Cd)	Not detected(Det.limit:0.5)	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
7	Manganese (as Mn)	23.7	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
8	Magnesium (as Mg)	496	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)
9	Zinc (as Zn)	44.1	mg/kg	A.O.A.C.lnternational 20th Edition 2016 (3.2.05)

IV. CONCLUSION

Leafy green vegetables are an important part of a healthy diet. They are packed with vitamins, minerals, and fibre in low calories. Eating a diet rich in leafy greens can offer health benefits including reduce deficiency diseases, obesity, heart disease, high blood pressure etc. The leaves are the most nutritious part of the plant, being a significant source of vitamin B1, vitamin C, vitamin B3, potassium, pro vitamin A as beta carotene and protein. *Coccinia grandis* L. Voigt leaves are more effective for adult people as well as pregnant women. The higher amount of calcium helps to maintain strong bones and teeth. Iron is a great dietary supplement for anemic patient. High amount minerals and vitamin content gives healthy life. The plant is easily available, cheap and can play an important role in human health. *Coccinia grandis* L. Voigt is an important source of many pharmacological and medicinally important chemicals. Further studies are necessary to elucidate in detail the mechanism of action of this medicinal plant at various levels.

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