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Elemental analysis of *Alternanthera sessilis* (L.) dc. Leaf by ICP-AES technique

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Abstract
The leaf of *Alternanthera sessilis* was screened for quantification of elements. This plant having relevant medicinal properties and are used as wild edible plant in Maharashtra and rest of India. Phyto-chemicals are responsible for medicinal activity of plant species whereas mineral elements play significant role in human metabolism and regulation mechanism. About twenty five essential as well as trace elements from leaf extract have measured by Inductive coupled plasma atomic emission spectrometry, ICP-AES technique. Na, Mg, K, Ca, Cr, Mn, Fe, Ni, Cu, Zn, Cd, Se, Al, Pb, Ba, Hg, As, B, Sr, Li, Mo, Te, V, In, Th were screened. Investigations confirmed the presence of varied concentrations of Ca, Mg, K, Fe, Sr, Na, Zn etc. elements in the leaf of *Alternanthera sessilis*.

Keywords: *Alternanthera sessilis*, elemental contents, ICP-AES, wild edible plants

Introduction
Alternanthera sessilis (L.) DC. Commonly called as Kateri or Kanchari in Maharashtra. It belongs to family Amaranthaceae. It is an annual or perennial prostate herb [2]. About sixteen species distributed in tropics and subtropical areas throughout the hotter regions of India. Plant is propagated though seeds. The plant is bitter astringent, acrid, cooling, constipating, and febrifuge. It is useful in vitiated conditions of *kapha* and *pitta*, burning sensation, diarrhoea, skin disease and fever [1]. It is useful pharmaceutical material to treat inflammation and arthritis [19]. Aerial parts exhibited significant hypoglycaemic activity, antibacterial activity [6, 10]. Young shoots and leaves are eaten as vegetable in Southeast Asia [18]. Leaves possess high antioxidant properties in general and hence it can be recommended to be included in our daily diet, as it will protect us from commonly occurring chronic diseases [15]. It is an edible leafy vegetable of South Odisa and contains appreciable amount of nutrients which are readily available [13]. Its regular consumption can provide a solution to myriad of health problems, including malnutrition to a great extent and even in curing deadly diseases like cancer [8].
Human beings require mineral elements within certain concentrations for growth and good health. Many trace elements play a significant role in the formation of active constituents in plants which are responsible for their curative properties [5]. Analyzing the elemental composition in vegetables, fruits and their product is therefore very important for understanding their nutraceutical value. Quantitative estimation of elements can be done with various advanced techniques like inductively coupled plasma atomic emission spectrometry (ICP-AES), Inductively coupled plasma mass spectrometry (ICP-MS), Inductively coupled plasma optical emission spectrometry (ICP-OES), Neutron activation analysis (NAA), X-ray fluorescence (XRF), Anodic striping voltametry (AVS) and Flame atomic absorption spectrometry (FAAS). It was found that Atomic absorption and Emission spectroscopy (AAS/AES) techniques could provide not only analysis of wide range of heavy metals but also ensure immense reliability by exhibiting well precision and accuracy at trace level [9]. These techniques are rapid, accurate and producible as compared to regular analytical techniques. ICP-AES method provides accurate elemental food composition data [12].
Therefore, present study deals with determination of 25 essential and trace elements Na, Mg, K, Ca, Cr, Mn, Fe, Ni, Cu, Zn, Co, Cd, Se, Al, Pb, Ba, Hg, As, B, Si, Br, Li, Mo, Te, V, Th in *A. sessiles* leaf by using nitric acid digestion procedure with ICP-AES technique [11]. The data obtained will provide significant information on whether this plant contains essential mineral nutrients and heavy elements in the amounts which can be healthier or toxic at the normal doses if consumed as vegetable.

3. Materials and methods

3.1. Collection of Sample

The aerial parts of *Alternanthera sessilis* L. were collected from different areas of Nanded district and then leaves were properly shade dried in an airy place, crushed, powdered and stored in dry sealed glass container. Plant material was identified and authenticated at PG department of Botany NES Science College, Nanded using standard floras [16].

3.2. Quantitative elemental analysis

Plant sample was hydrolysed by strong acid and analysed with ICP-AES. All spectrometric measurements were performed with ICP spectrometer (Arcos from M/S Spectro Germany). The software used was smart analyser vision 5.01.0921. The detector is Charge Couple Device (CCD). All the samples were analysed in triplicate and mean value of concentrations for each elements are given along with standard deviation. The instrumental parameters and operating conditions for ICP-AES are given in table 1.

Table 1: Instrumental parameters and operating conditions for ICP-AES

ICP-AES Parameter	Value
R.F Generator	1.6 KW, 27.12 MHz
Plasma Power	1400 W
Pump Speed	30 rpm
Coolant Flow	12.00 l/min
Auxiliary Flow	1.00 l/min
Nebulizer Flow	0.80 l/ml

3.3 Statistical analysis

The data was analyzed by MS-EXCEL and results expressed as means and standard deviation (Mean±SD).

4. Result and discussion

A. sessilis shows presence of various bioactive compounds which has important role in nutritive value of plant and proves its edible nature [20]. Various essential as well as trace elements of biological importance in human metabolism were found to be present in different concentrations. Elemental analysis has shown higher concentration of Calcium, potassium and magnesium. Concentration of analysed elements were in order of Ca>K>Mg>Fe>Al>Na>Sr>Mn>Pb>B>Ba>Zn>Cu. Elements such as Cd, Cr, In, Li, Ni, As, Hg, Se, Mo, Te, V, Th are not detected or their concentration is less than 0.001 ppm (Table 2). The variation in the concentration of these elements is due to the factors such as preferential absorption of a particular plant for the corresponding elements, age of the plant, The mineral composition of the soil and the climatic conditions [17].

Most of essential elements which have active role in metabolic reaction in human body are present in good concentration. Calcium is an important mineral element for cell signalling, strong bones, teeth, maintains proper blood pressure and also for blood clotting. Its deficiency can lead to very serious problems like arthritis in old aged peoples. It plays important function in synaptic nerve transmission and metabolism of vitamin D. calcium concentration in *A. sessilis* is higher 49182.75ppm. Magnesium is the most abundant element in the human body and is essential macronutrient. It is one of main component of chlorophyll. It helps in absorbing calcium and phosphorus. It is involved with energy production of glucose, protein and nucleic acid synthesis, the formation of urea. It plays an important role in enzyme activity. Its deficiency interferes with the transmission of nerve and muscle impulses, causing irritability and nervousness [21]. Magnesium concentration is 12856.14ppm; other essential elements Fe, K, Mn, Na, Zn, and Cu were recorded in ppm concentration as 718.95, 38695.93, 121.62, 680.85, 20.32 and 7.621 respectively. Trace elements from plant leaf were evaluated as Aluminium (692.12ppm) is now thought to be involved in action of a small number of enzymes. We take in about 2 mg (2000ppm) each day from our food about 60 gm in a lifetime. Some boron compounds show promise in treating arthritis, it is estimated and found 36.201ppm. The best known use of barium is in the form of barium sulfate, which can be drunk as a medical cocktail to outline the stomach and intestines for medical examination. Barium and all its compounds that are water or acid soluble are toxic [7], its concentration in plant is 22.070ppm, Sr (133.69ppm) Strontium has no known biological role and it is non-toxic. Lead is known to cause neurological disorders, anemia, kidney damage, miscarriage, lower sperm count and hepatotoxicity in higher concentration [4, 14] but mean daily intake of 3–4 µg/kg of body weight was not associated with an increase in blood lead levels or in the body burden of lead, this provisional tolerable weekly intake (PTWI) was reconfirmed by JECFA in 1993 and extended to all age groups [3]. Result showed that the heavy metals like Hg, As, Te, Cr, Cd, Th, etc are not detected.

Table 2: Quantitative elemental analysis

S. No.	Elements	Wavelength (nm)	Concentration in ppm (Mean±SD).
1	Al	176.641	692.12 ±0.114
2	B	249.773	36.201 ±0.002
3	Ba	455.404	22.070 ±0.001
4	Ca	422.673	49182.75 ±2.85
5	Cd	214.438	ND
6	Cr	267.716	ND
7	Cu	324.754	7.621 ±0.001
8	Fe	259.941	718.95 ±0.049
9	In	325.609	ND
10	K	766.491	38695.93 ±2.54
11	Li	670.780	ND
12	Mg	279.079	12856.14 ±0.972
13	Mn	257.611	121.62 ±0.010
14	Na	589.592	680.85 ±0.077
15	Ni	231.604	ND
16	Pb	220.353	47.316 ±0.002
17	Sr	407.771	133.69 ±0.009
18	Zn	213.856	20.32 ±0.001
19	As	189.042	ND
20	Hg	184.95	ND
21	Se	196.09	ND
22	Mo	202.095	ND
23	Te	170	ND
24	V	292.464	ND
25	Th	401.913	ND

(ND= Not Detected or less than 0.001ppm)

5. Conclusion

Review of the literature on *Alternanthera sessilis* showed that there was no fine data available on the elemental composition of this plant. The studied plant contains essential as well as trace elements which can play an important role in the various biochemical and physiological processes in humans and hence can be considered as a potential source for providing trace

elements other than diet. ICP-AES technique was employed for the determination of the elemental compositions of 25 elements and their concentrations were estimated. 13 elements were found to be present in the above leaf in different concentrations. The data obtained in this work could serve as an important resource for further studies on Nutraceutical prospectus of this plant.

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7. Conflict of Interest
Authors have no conflict of interest

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