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TRACE ELEMENT AND PROXIMATE ANALYSIS OF SELECTED MEDICINAL PLANTS OF KALABURAGI REGION, KARNATAKA INDIA.

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ABSTRACT: *Tridax procumbens*, *Gyanandropsis pentaphylla*, *Vitex nigundo*, *Datura stramonium*, *Balanites roxburghi* and *Psidium guajava* are plants of great medicinal value investigated for the presence of trace element and proximate analysis. The trace element analysis is carried out by using Atomic Absorption Spectrophotometer and proximate analysis is carried out using standard methods. The trace element analysis shows the presence of Fe^{2+}, Ca^{2+}, Mn^{2+}, K^{+}, Zn^{2+}, Cr, Ti, Mg^{2+} ,Cu^{2+} and Al. Whereas Molybdenum (Mo), Vanadium (V) and the heavy metals like Cadmium and Silicon (Si) were not detected in all the plants. The proximate analysis shows Moisture content, Dry mater content, Total ash value, Acid insoluble ash value and Water soluble ash value respectively. Further the *Psidium guajava* shows the presence of more concentration of elements followed by *Tridax procumbens*, *Gyanandropsis pentaphylla*, *Vitex nigundo*, *Datura stramonium* and *Balanites roxburghi* respectively. Present study reveals that these plants are rich in essential elements which play key role in nutrition and health care needs of livestock and human beings. Therefore, these elements can also serve as active constituents of herbal medicines and useful in the treatment of various diseases in future.

Key words: Trace elements, Proximate analysis, Heavy metals, Atomic Absorption Spectrophotometer Medicinal plants, *Tridax procumbens*, *Balanites roxburghi*.

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INTRODUCTION

Plants are the rich sources of all the elements essential for human beings. Like all living things, plants must obtain certain elements from their environment in order to sustain their biological functions necessary for survival. There is a relationship between the element content of the plant and its nutritional status. Some elements are essential for growth, for structure formation, reproduction or as components of biologically active molecules while others have some other beneficial effects. Metals and minerals present in biological system play a significant role in the metabolism of plants and humans (Shute KH, 1964). There is a great interest in macro and trace element composition of medicinal plants. It is believed that great majority of elements act as key components of essential enzymes for vital biochemical functions. The quantitative estimation of trace elements concentration is important for determining the effectiveness of medicinal plants in treating various diseases and also to understand the pharmacological action (Hari Om Saxena, 2014). The inorganic compounds are essential in trace amounts to play an important role in nutrition, enzyme reaction and also in the metabolic processes (Tamilarasi L, 2014). Active constituent of medicinal plants are metabolic products of plant cells and a number of trace elements play an important role in the metabolism. The screening of the actual bioactive elements of plant origin and assessment of elemental composition of the widely used medicinal plants is highly essential (Zafar et al,2010). Most of the medicinal plants are found to be rich in one or more elements.

The *Tridax procumbens* L it is best known as widespread weed and pest plant. It is native to the tropical America. The *Psidium guajava* L is an evergreen shrub or small tree native to the Caribbean, Central America and South America. The *Balanites roxburghi* Planch. is a spiny, evergreen tree. It is common in open sandy plains of the Indian peninsula. It s bark, fruit seed, leaves of the tree and the oil from seeds is of medicinal value. The *Vitex nigudo* L five-leaved chaste tree, is a large aromatic shrub with quadrangular, densely whitish, tomentose, branchlets. The *Datura Stramonium* L., known as Jimson weed or Devil's snare. It is believed to have originated in Mexico. The *Gynandropsis pentaphylla* Dc commonly known as Shona cabbage is used as a green vegetable. All these plants are great medicinal value used to treat various diseases in Indian medicinal systems. Like Ayurveda, Siddha, Unani and folklore medicine. Keeping this in view the present study aims to evaluate essential elements present and their concentration in selected medicinal plants, collected from Kalaburagi region (Table No 1) by using Atomic Absorption Spectrophotometer (AAS) and proximate analysis using standard methods.

Table No-1: Botanical names and uses of selected medicinal plants.

S.No	Scientific name	English name	Family	Part used	Place of collection	Medicinal uses
1.	*Tridax procumbens* L	Coat battons	Asteraceae	Leaves	Kalaburagi	Wound healing activity antiviral, antibiotic, anti-oxidant etc.
2.	*Psidium guajava* L.	yellow guava	Myrtaceae	Bark	Gulbarga University Kalaburagi	Stomachache and diarrhoea
3.	*Balanites roxburghi* Planch.	Desert Date	Zygophyllaceae	Fruit	Aland	Febrifuge, asthma, antidiabetic, jaundice etc.
4.	*Datura Stramonium* L.	Thorn Apple	Solanaceae .	Seed	Kalaburagi	Asthma,bonesetting antispasmodic, hypotonic nacrotic etc.
5.	*Gyanandropsis pentaphylla* DC.	Shona cabbage, African cabbage.	Capparaceae	Leaves	Afzalpur	Respiratory diseases ,anti-inflammatory, analgesic,& gastrointestinal etc.
6.	*Vitex nigundo* L.	Five leaved chaste tree	Verbinaceae	Leaves	Aland	Cough, skin diseases liver disorders, rheumatic pain etc.

MATERIALS AND METHODS

Collection and Identification of the Plants

The medicinal plants were collected from the various places of Kalaburagi district. The plants are identified referring various floras available in the Department of P. G. Studies and Research in Botany Gulbarga University, Kalaburagi.

Preparation of plant material

The fresh leaves, fruits, bark and seeds were shade dried for about 15-20 days and they were powdered with electronic blending machine. The powdered materials were stored in air tight containers for future use.

Ashing of plant materials

10 gm of plant material is taken in a crucible and heated for 2 hours at 450^0 C on muffle furnace. And the collected ash used for the analysis.

Acid digestion of plant materials

1 gm of ash (sample) by weight was taken in a beaker and 3:3 ml of conc. Sulphuric acid and Perchloric acid are added. The samples are heated to get clear solutions, subsequently it was cooled by adding distilled water and the samples were filtered with whatman filter paper no 42. Then final volume made to 1000 ml with the help of distilled water. Blank samples were also processed and analyzed simultaneously.

Elemental analysis of plant materials

The samples of selected plants were subjected to the elemental analysis using Atomic Absorption Spectrophotometer equipped with Acetylene (C_2H_2) flame and air, nitrous oxide (N_2O_2) as oxidising agent.

Proximate Analysis (Arefin *et.al* 2015, S. R. Thimmiah 2006).

Proximate analysis of a substance constitutes different classes of nutrients present in samples such as moisture content, dry matter, Ash value, acid insoluble value, water soluble ash value etc**.**

Determination of total Moisture content

10g of fresh sample heated on hot air oven at 250^{0}C temperature until it free from water moisture content and cooled. The weight of the dry sample was taken and the percentage of it was calculated with reference to the fresh sample.

Determination of Dry matter content

10g of fresh sample heated on hot air oven at 250^{0}C temperature until it free from moisture content and then cooled .The weight of dry sample was taken and the percentage of it was calculated with reference to the fresh sample.

Determination of Total ash value

10g of dry powder was taken in silica crucible and heated on a muffle furnace at 450^{0}C temperature until it free from carbon and then cooled .The weight of ash was taken and the percentage of it were calculated with reference to the air-dried sample.

Determination of Acid insoluble ash value

The total ash obtained was boiled for 5 minutes with 25 ml of 2 N HCL, filtered and the insoluble matter was collected on ash less filter paper. Then it was washed with hot water, ignited in silica crucible for 15 minutes at temperature 380^{0}C not exceeding more than 450^{0}C, cooled and weighed the obtained residue. The percentage of acid insoluble ash was calculated with reference to the air-dried sample

Determination of Water soluble ash value

The total ash obtained was boiled for 5 minutes with 25 ml of water for few minutes, filtered and the insoluble matter was collected on ash less filter paper. Then it was washed with hot water, ignited in silica crucible for 15 minutes at temperature not exceeding 450^{0}C, cooled and weighed the obtained residue. The difference in weight represents the water soluble ash. The percentage of water soluble ash was calculated with reference to the air-dried sample. Finally, the percentage of water soluble ash was calculated with reference to the air-dried sample.

Statistical analysis

The elemental analysis was performed in triplicates for each element. The results were expressed as mean ± Standard error mean and Significant value P <0.001. Using one way ANOVA.(Graph Pad Instat 3.)

RESULTS

In the present study selected plants were analysed for the presence of trace element content and proximate analysis. The results of element content are tabulated in Table No 2 and Proximate analysis such as moisture content, dry matter, total ash value etc are tabulated in Table No 3.

In our study the concentration of Al found high followed by Fe^{2+}, Ca^{2+}, Mn^{2+}, K^{+}, Zn^{2+} , Cr, Ti, Mg^{2+} and Cu^{2+}respectively. Whereas Molybdenum (Mo), Vanadium (V) and the heavy metals like Cadmium and Silicon (Si) were not detected in all the plants. Among selected plants The *Psidium guajava* shows presence of more concentration of elements followed by *Tridax procumbens*, *Gyanandropsis pentaphylla*, *Vitex nigundo*, *Datura stramonium* and *Balanites roxburghi* respectively. Proximate analysis shows the Moisture content, Dry matter, Total ash, Water soluble ash and Acid insoluble ash values respectively in all the plants.

Table No-2: The concentration of elements represented in mg/L of dry sample.

S.No	Concentration in mg/L.	*Psidium guajava*	*Gyanandropsis pentaphylla*	*Datura stramonium*	*Vitex nigundo*	*Tridax procumbens*	*Balanities roxburghi.*
1	K	1.27±3.33	0.44±8.81	0.20±0.00	0.36±8.81	1.02±8.81	0.24±5.77
2	Mg	1.00±5.77	0.19±6.66	0.14±5.77	0.51±0.00	0.45±0.00	0.29±0.00
3	Ca	2.11±0.00	1.03±0.00	0.11±0.00	1.06±0.00	1.99±0.00	0.27±0.00
4	Fe	3.26±5.77	0.89±0.00	1.57±0.00	2.03±8.81	1.33±8.81	0.75±8.81
5	Zn	0.20±0.00	0.66±0.00	0.68±0.00	0.21±8.81	1.27±8.81	0.21±0.00
6	Cu	0.85±0.00	0.13±0.00	0.43±0.00	0.11±0.00	0.91±0.00	0.17±0.00
7	Mn	1.30±0.00	0.68±0.00	0.24±8.81	0.23±0.00	1.24±0.00	0.13±0.00
8	Al	7.08±3.33	6.06±5.77	1.68±5.77	2.05±0.00	7.41±0.22	1.14±3.33
9	Cr	0.27±3.33	0.65±3.33	0.45±3.33	0.46±3.33	0.65±0.00	0.60±3.33
10	Ti	0.95±6.66	0.99±8.81	ND	ND	0.99±3.33	ND
11	V	ND	ND	ND	ND	ND	ND
12	Mo	ND	ND	ND	ND	ND	ND
13	Cd	ND	ND	ND	ND	ND	ND
14	Si	ND	ND	ND	ND	ND	ND

Mean ± Standard error mean, ND –Not detected.

Table No-3: Proximate analysis of selected plants in (%) w/w.

Plant names	*Tridax procumbens*	*Gyanandropsis pentaphylla*	*Datura stramonium*	*Vitex nigundo*	*Psidium guajava*	*Balanities roxburghi.*
Moisture Content (%)	94.13	83.91	69.47	69.36	55.58	10.98
Dry matter Content (%)	5.87	16.05	30.53	30.64	44.42	89.02
Total ash Value (%)	20.3	22	22.6	12.42	18.59	27.3
Acid insoluble ash value (%)	2.44	1.80	3.12	2.94	2.58	13.26
Water soluble ash Value (%)	15.48	19.48	17.44	7.88	13.47	14.62

DISCUSSIONS

The results of the present study shows the variations among the concentration of element content in the selected plants. These variations may be due to the different climatic conditions like soil, water and temperatures. The trace element and proximate analysis plays an important role in exploring new potential drugs from medicinal plants as it provides nutritional and phyto constituent values.

Potassium K^{2+} act as Cofactor that functions in protein synthesis, activation of enzymes, major solute functioning in water balance and thus affecting osmosis, operation of stomata in plants. Potassium required for glycogensis, cellular enzymatic reactions, and cell membrane function in humans (Soetan et.al, 2010). The highest concentration of Potassium is present in *Psidium guajava* i.e. 1.27±8.81mg/L and the lowest 0.20± 0.00mg/L in *Datura Stramonium***.**

Magnesium Mg^{2+} is an important component of chlorophyll in plants. It activates many enzymes involved in photosynthesis, respiration and are involved in the synthesis of DNA and RNA of plants. Magnesium is absorbed in the intestine and then transported through the blood to cells and tissues of humans. It is also a constituent of bones, teeth, enzyme cofactor kinesis' etc [Soetan et.al]. The highest concentration of Magnesium is present in *Psidium guajava* i.e. 1.00±5.77mg/L and the lowest concentration 0.14±5.77mg/L in *Datura stramonium*.

Calcium Ca^{2+} is highly implicated in the maintenance of firmness of fruits and its requirements in fruits are related to cell wall stability and membrane integrity in plants. It is also required for membrane permeability, involved in muscle contraction, normal transmission of nerve impulses and in neuromuscular excitability in humans (Soetan et.al, 2010). The highest concentration Calcium is present in *Psidium guajava* i.e. 2.11±0.00mg/L and the lowest concentration 0.11±0.00mg/L in *Datura stramonium*.

Iron Fe^{2+} is a important component of cytochromes, electron transport, activates some enzymes, plays a role in chlorophyll synthesis (Soetan et.al, 2010). Fe is required for making Hb. It is a pro oxidant which is also needed by microorganisms for proliferation [Galan et.al]. Biologically important compounds of iron are hemoglobin, myoglobin, cytochromes, catalases and peroxidase (Soetan et.al, 2010), (Mathad et.al, 1998). The highest concentration of Iron is present in *Psidium guajava* i.e. 3.26±5.77mg/L and the lowest concentration 0.75±8.81 mg/L in *Balanites roxburghi*.

Zinc Zn^{2+} activates formation of chlorophyll, activates some enzymes, plays a role in formation of auxin, chloroplasts and starch (Soetan et.al, 2010). Carbonic anhydrase is present in erythrocytes, kidney tubules, gastrointestinal mucosa and glandular epithelium of humans are Zn dependent enzymes (Malhotra V.K, 1998). The highest concentration of Zinc is present in *Tridax procumbens* i.e. 1.27±8.81mg/L and the lowest concentration 0.20±0.00 mg/L in *Psidium guajava*.

Copper Cu^{2+} is component of many redox and lignin-biosynthetic enzymes in plants. Cu is an essential micro-nutrient necessary for the hematologic and neurologic systems (Soetan et al, 2010). It is necessary for the growth and formation of bone, formation of myelin sheaths in the nervous systems (Tan JC, Burns DL, Jones HR, 2006). The highest concentration of Copper is present in *Tridax procumbens* i.e. 0.91±0.00mg/L in and the lowest concentration 0.11±0.00mg/L in *Vitex nigundo*.

Manganese Mn^{2+} helps in formation of amino acids, activates some enzymes, coenzyme activity, required for water-splitting step of photosynthesis, chlorophyll synthesis, Mn is a part of enzymes involved in urea formation, pyruvate metabolism and the galactotransferase of connective tissue biosynthesis in humans (Soetan et.al, 2010). The highest concentration of Manganese is present in *Psidium guajava* i.e. 1.30±0.00 mg/L and the lowest concentration 0.13±0.00mg/L in *Balanites roxburghi*.

Aluminium Al is present in large amount compare to other microelements. It is neither essential nor beneficial to plants or animals and but in access harmful to humans (R jyothi kumara et.al, 2014). The highest concentration of Aluminium is present in *Tridax procumbens* i.e. 7.41±0.22mg/L and the lowest concentration 1.14±3.33mg/L in *Balanites roxburghi*.

Titanium Ti The highest concentration of Titanium is present in *Gyanandropsis pentaphylla* and *Tridax procumbens* i.e. 0.99±8.81 & 0.99±3.33mg/L respectively and the lowest concentration 0.95±6.66mg/L in *Psidium guajava*.

Chromium Cr^{2+} The highest concentration of Chromium present in *Gyanandropsis pentaphylla* and *Tridax procumbens* i.e. 0.65±0.00 and 0.65±3.33mg/L respectively and the lowest concentration 0.27±3.33mg/L in *Psidium guajava*. If the Chromium is present in large amount it is highly toxic to plants.

To ensure the safety and efficacy of herbal medicines used, standardization and the development of the processing aspects of phyto-medicines are very important (R Jyothi kumari et al.2014). The importance of mineral elements in maintaining good health is well known. Some elements help to combat infection, but they are also associated with many chronic, epidemic, endemic, and even malignant diseases. Numerous epidemiological investigations have pointed out that a lack of essential mineral elements can precipitate an increase in sensitivity to illness, leading to suboptimal health or an enhancement of disease occurrence and development (Heghedűş 2014) The proximate analysis of plant parts, foods, feeding stuffs and other compounds reveals the presence of protein, carbohydrate, fat, crude fibre and moisture in them (Danlami et al 2012). The different concentration of elements in different plants lead to the conclusion that the plants will have specific roles in the treatment of different diseases (Singh et al 2010).

CONCLUSION

The present study was an effort to know the biological properties of medicinal plants by trace element and proximate analysis. From the study it can be concluded that these plants contains important trace elements and the percentage of all the trace elements within permissible level which directly influence the quality of secondary metabolites. The proximate analysis such as moisture content, dry matter, total ash, acid insoluble ash and water soluble ash value shows the quality of plants. The data obtained from this study can be used to discover novel herbal drugs to treat various diseases of animals as well as human beings. Further studies are needed in this direction to explore more pharmacological actions of these plants.

Conflict of interest statement

We declare that we have no conflict of interest.

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