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Full Length Research Paper

Element content analysis of plants of genus *Ficus* using atomic absorption spectrometer

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Ficus **species have wide distribution and uses worldwide traditionally as medicine, vegetable, food, fodder and fuel wood etc. The flame atomic absorption spectrophotometer was employed for the estimation, conducted on four plant parts (leaves, bark, aerial roots and fruits) of 12 samples of eight medicinally important species of *Ficus* and nine samples of wild edible fruits of genus *Ficus,* collected from different locations within Pakistan. The results of the present study provide justification for the usage of these fruits in daily diet for nutrition as well as for medicinal usage and medicinal plants in the treatment of different diseases. The metal contents in the samples were found at different levels which play a vital role in cure of diseases. Toxic elements Cd and Pb were also found but at very low concentration. These results can give the importance about the wild edible fruits and used to set new standards for prescribing the dosage of the herbal drugs prepared from these plant materials in herbal remedies and in pharmaceutical companies.**

Key words: Atomic absorption spectrometer (AAS), drugs, elements, *Ficus,* fruits, medicinal.

INTRODUCTION

The drugs are derived either from the whole plant or from their different organs, like leaves, stem, bark, root, flower, seed, prop roots etc. Some drugs are prepared from their secondary product such as gum, resins and latex. Even the modern system of medicine has adopted a number of plant-derived drugs which have been used in traditional system of medicines. Medicinal plants play an important role in traditional medicine and are widely consumed as home remedies. The past decade has seen a significant increase in the use of herbal medicine due to their minimal side effects, availability and acceptability to the majority of the population of under developing countries and wild fruits to overcome the malnutrition.

Since times immemorial, plant based drugs have been in use in the amelioration of various ailments ranging from common cold to cancer (Rajua et al., 2006). Relatively high levels of essential elements, such as Fe, Mn, Zn, and Ca, have been demonstrated to influence the retention of toxic elements in animals and human beings (Calabrese, 1981; Wang at al., 1996). Only scanty reports are available on the role of micronutrients, (Bonnefont_Rousselot, 2004; Rajurkar and Paradeshi, 1997) which play an important role in the formation of active constituents responsible for their curative properties (O'Dell and Sunde, 1997; Steiner, 1986). In recognition of the important role that major and trace elements play in health and disease of human body, in the building up and restoration phenomenon, it was observed that during the last few years remarkable progress has occurred in this area of health sciences. Elements research has definitely been part of this explosion of scientific knowledge (Said et al., 1996). Direct correlation between elemental content of medicinal plants and their curative ability is not yet understood in terms of modern pharmacological concepts. So, the quantitative estimation of various trace element concentrations is important for determining the effectiveness of the medicinal plants in treating various diseases and also to understand their pharmacological action (Rajua et al., 2006). The imbalance in human health has been linked with the excess or deficiency of trace elements in soils, water, plants and animals. The

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Table 1. Botanical names and their ethno-medicinal uses of some medicinal plants of genus *Ficus.*

Botanical name	Habit	Part used	Uses
F. microcarpa L.f.	Tree	Leaf	Diabetes, burning sensation etc.
		Bark	Ulcer, diarrhea, diabetes and hyperdipsia etc.
		Fruit	Diabetes, Bone fracture.
F. lacor Ham.	Tree	Bark	Ulcer and gastric.
F. palmata Forrsk.	Tree	Fruit	Ringworm and skin diseases.
F. religiosa L.	Tree	Leaf	Sexual disorder, cough, diarhhoea, gastric problems, toothache and migraine.
		Bark	Veneral diseases, diabetes, scabies and paralysis.
		Fruit	Asthma
F. nerrifolia J.E. Sm. in Ress	Tree	Bark	Conjunctivities and boils
F.auriculata Wall.	Tree	Leaves	Diarrhea, dysentery, healing wounds.
		Bark	Healing wounds and cuts
		Fruit	Diarrhea and dysentary
F. benjamina	Small tree	Leaves	bugs repellant, Ulcer
		Twigs	Insect repellant
F. racemosa Roxb.	Tree	Leaf	Hair treatment
		Fruit	Diarhhoea, constipation, menorrhoea etc.
		Bark	Curing boils
F. bengalensis L.	Tree	Bark	Antihelminthic, joint pain, diabetes, diarrhea, wounds, cough and cuts.
		Leaf	Diaphoretic, vomiting.
		Fruit	Diabetes
		Prop roots	Diabetes, diarhhoea, body pain etc.

continuous intake of diets that are excessively high in a particular trace element can influence changes in the functioning, forms, activities of some organs or concentrations of such element in the body tissue and fluids can rise above the permissible limit (Obiajunwa et al., 2002).

In the present study, an elemental assay was done by using Flame Atomic absorption Spectrometry on some ethno medicinally important species of genus *Ficus*. Table 1 illustrates in detail the medicinal plants analyzed in this study, their botanical name, part used and their medicinal uses. And wild fruits as shown in Table 2 which is very useful for man's consumption both as food and medicine. Flame atomic absorption methods are referred to as direct aspiration determinations. They are normally completed as single element analyses and are relatively free of interelement spectral interferences. The use of special light sources produced by the cathode lamp is emitted from excited atoms of the same element which is to be determined and specific spectrum selection allows the quantitative determination of individual components of a multielement mixture.

MATERIALS AND METHODS

Sample preparation

The different parts of plants including leaves, aerial roots, fruits and bark were rinsed with tap water and then with distilled water in order to remove surface contamination and dried at 55 to 60℃ in an electric oven. The dried plant samples were then homogenized in pistil mortar.

Digestion and analysis of sample

0.25 g each of the powdered plant samples digested in 6.5 ml of acid solution (HNO_3, H_2SO_4, $HClO_4$ in ratio of 5:1:0.5). The corresponding solution was heated until white fumes had appeared. The clear solution was diluted upto 50 ml with distilled water and filtered with Watt man filter paper no.1. The standard working solutions of elements of interest were prepared to

Table 2. Concentration of elements (in mg/gm) in some wild edible fruits of genus *Ficus*.

Wild edible fruits	Na	K	Zn	Fe	Cr	Co	Cu	Ni	Pb	Mn	Ca	Mg	Cd
F. bengalensis L.	20.69	11.50	19.27	1.16	10.03	0.11	2.019	0.001	0.12	27.74	7.49	5.08	0.009
F. racemosa Roxb.	1.16	11.33	33.6	0.87	27.07	0.02	4.68	0.001	0.04	20.49	9.90	6.78	0.004
F. religiosa L.	2.64	11.33	20.49	0.51	20.36	0.01	6.96	0.0004	0.08	25.01	7.63	5.88	0.004
F. palmata Forrsk.	1.29	11.44	5.018	0.82	10.04	0.017	2.01	0.0009	0.06	10.01	6.19	6.97	0.001
F. microcarpa L.f.	2.89	11.29	25.2	0.77	15.78	0.01	5.01	0.0007	0.07	36.48	3.56	4.67	0.006
F. johannis Boiss.	0.73	11.44216	5.05	0.5182	10.02	0.0216	1.009	0.0005	0.038	25.01	7.456	3.83772	0.0052
F. sarmentosa Buch. Ham	1.0098	57.3	2.266	2.9902	19.19	0.024	0.254	0.0116	0.048	17.0007	24.9286	6.3064	0.0036
F. hispida L. f.	10.53	11.47	25.52	1.09	29.48	0.01	2.84	0.001	0.05	32.53	4.08	6.32	0.001
F. auriculata Wall.	4.72	11.5	7.03	0.8	13.03	0.019	1.8	0.0011	0.03	16.62	8.31	7.26	0.004

make the standard calibration curve. Absorption for a sample solution uses the calibration curves to determine the concentration of particular element in that sample. A Varian AA240FS atomic absorption spectrometer (AAS) was used for the determination of thirteen metals that is, Na, K, Ca, Mg, Mn, Zn, Ni, Co, Fe, Cu, Cr Cd and Pb. Cathode lamps used as radiation source. Air acetylene gas was used for all the experiments. This method provides both sensitivity and selectivity since other elements in the sample will not generally absorb the chosen wavelength and thus, will not interfere with the measurement.

RESULTS AND DISCUSSION

The analysis for various elements in the sampled medicinal plants indicated that K, Ca, Cr, Mn, Fe, Cu, and Zn were present in all samples which are responsible for curing many diseases. These elements play a vital role in the formation of secondary metabolites which are responsible for pharmacological actions of medicinal plants. In Tables 2 and 3 list the concentrations of minerals (in mg/g) in wild fruits and different organs of medicinal plants of genus *Ficus* determined by AAS.

Trace elements play both curative and preventive role in combating diseases. There is a vast scope to exploit the preventive medicinal aspects of various trace elements such as Cu, Cr etc., (Hameed et al., 2008). The level of iron (Fe) as shown in Tables 2 and 3 with values in the range of 0.51 to 1.98 mg/g in *F. religiosa* fruit and *F. religiosa* bark. While in wild edible fruits maximum Fe present in *F. sarmentosa*. It is an essential mineral to prevent anemia and cough associated with angiotensin-converting enzyme (ACE) inhibitors. As shown in Tables 2 and 3, Mn and Zn are the most abundant elements in edible fruits and medicinal parts of the following studied plants. Maganese (Mn) was found at the range of 0.132 to 54.96 mg/g in *F. benjamina* leaves and *F. bengalensis* aerial roots while in edible wild fruits higher concentration of Mn was found in *F. microcarpa.* It can help to assist the body in metabolizing protein, help the diabetic also metabolize carbohydrates and in treating diabetes. Zn deficiency may contribute to arrested sexual maturation, growth retardation and hair loss, delayed wound healing and emotional disturbance. Higher concentration of Zn in wild edible fruits was observed in *F. racemosa* (33.6 mg/g). K is helpful in reducing hypertension and maintaining cardiac rhythm. In the human body, the elements play vital role in many physiological reactions and their deficiency or excess can affect human health (Ekinci et al., 2004).

Magnesium (Mg) improves insulin sensitivity, protect against diabetes and its complications and reduce blood pressure. Sodium (Na) involves in the production of energy, transport of amino acids and glucose into the body cells, the range of Na concentration was 0.72 to 31.16 mg/g in the leaves of *F. auriculata* and in the bark of *F. religiosa*, while in edible fruits the highest concentration was found 20.69 mg/g in *F. bengalensis*. Copper (Cu) play important role in treatment of chest wounds and prevent inflammation in arthritis and similar diseases. Highest concentration of Ca was found in the fruits of *F. sarmentosa* which is 24.92 mg/g. Calcium overcome the problems of high blood pressure, heart attack, premenstrual syndrome, colon cancer and keeping the bones strong and reduces the risks of osteoporosis in old age.

Co and Ni require in little amount in human body. The maximum concentration of Co was found 0.11 mg/g in *F. bengalensis* fruits, and 0.04 mg/g in *F. bengalensis* leaves. Cobalt (Co) is necessary in very small amounts in all mammals

Table 3. Concentration of elements (in mg/g) in some medicinal plants of genus *Ficus.*

Species	Part used	Na	K	Zn	Fe	Cr	Co	Cu	Ni	Pb	Mn	Ca	Mg	Cd
F. microcarpa L.f.	Leaf	10.45	11.42	30.01	0.65	30.56	0.02	8.98	0.0006	0.07	39.04	12.5	6.85	0.006
	Bark	5.85	11.21	27.82	1.45	28.37	0.01	4.36	0.0006	0.12	36.63	9.00	4.66	0.004
F. lacor Ham.	Bark	4.86	10.66	8.091	1.228	7.03	0.019	0.012	0.0013	0.05	5.66	12.002	4.93	0.003
F. religiosa L.	Leaf	13.44	11.33	11.32	0.74	18.94	0.02	4.74	0.0006	0.09	38.41	16.41	6.84	0.000
	Bark	31.16	11.11	29.82	1.98	38.26	0.01	7.01	0.0007	0.08	50.74	7.94	4.6	0.01
F.auriculata Wall.	Leaf	0.72	11.43	4.04	0.7	2.02	0.028	1.08	0.0005	0.04	6.226	9.0	7.16	0.000
F. benjamina	Leaf	5.88	11.49	1.99	1.58	5.03	0.031	0.13	0.001	0.04	0.132	13.94	7.104	0.003
F. racemosa Roxb.	Leaf	2.93	11.43	30.21	1.23	21.28	0.02	1.58	0.002	0.05	13.77	6.47	7.02	0.002
	Bark	9.22	11.07	10.00	1.297	15.05	0.019	1.008	0.001	0.05	18.001	16.98	5.87	0.004
F. bengalensis L.	Bark	20.69	11.34	32.44	2.22	15.1	0.03	1.36	0.0007	0.25	49.94	10.55	3.28	0.017
	Leaf	6.89	11.41	28.09	1.23	12.41	0.04	1.09	0.0005	0.14	25.22	12.8	6.43	0.006
	Prop roots	7.98	11.41	50.76	1.07	25.94	0.02	4.84	0.0009	0.08	54.96	3.16	4.52	0.007

and is used to treat several different types of cancer in humans and treat anemia but the intake of high amount can cause heart diseases. The health benefits of nickel (Ni) are optimal growth, healthy skin, bone structure and involved in iron metabolism but it is required in low quantity, otherwise it may cause toxicity. The fruits of *F. sarmentosa* shows the highest concentration that is, 0.01 mg/g. Chromium (Cr) balancing blood sugar levels, regulates hunger, reduces cravings, protect DNA and RNA, improves heart function, helps control fat and cholesterol levels in the blood.

Lead (pb) is toxic metal and non-essential element for human body as it causes a rise in blood pressure, kidney damage, miscarriages and subtle abortion, brain damage, declined fertility of men through sperm damage, diminished learning abilities of children and disruption of nervous systems. Cd is also toxic and both toxic elements were detected at very low concentrations in some samples as negligible or absent in other samples and could be considered safe to consume. The absence of these heavy metals in all the samples suggested that most of the plants were collected from their unpolluted natural habitats and therefore reflects their natural levels of heavy metals (Obiajunwa et al., 2002).

The environmental factors including atmosphere and pollution, season of collection sample, age of plant and soil conditions in which plant grows effect the concentration of elements. As it varies from plant to plant and region to region.

Conclusions

In this study 13 elements were determined in different parts in different species of *Ficus* medicinal plant and wild edible fruits of *Ficus*. Among the various elements detected in different medicinal plants of same genus used in the treatment of various diseases. The data obtained in present study will be helpful in the synthesis of new modern drugs with various combinations of plants which can be used in the cure of many diseases ethnomedicinally. However, more detailed analysis of chemical composition of the

following medicinal plants is required.

The elemental results of wild edible fruits shows that many of these fruit contain elements of vital importance in man's metabolism and that are needed for growth, developments, prevention and treatment of many diseases. It is evident that they are important sources of essential mineral elements in reasonable concentrations which have required in treatment of many diseases.

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