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Full Length Research Paper

Nutritional and elemental analyses of some selected fodder species used in traditional medicine

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The present study was carried out to evaluate the nutritional value and elemental analysis of some fodder plant species. Proximate composition of proteins, crude fibers, fats and oils, moisture, ash contents and carbohydrates and elemental composition of aerial parts have been determined by using Atomic Absorption Spectrophotometer (AAS). A total of 16 elements; Na, Mg, Al, Si, P, S, Rb, K, Ca, Fe, Mn, Ti, Ni, Cu, Zn and Cl have been measured. Their concentrations were found to vary in different samples.

Key words: Nutritional and elemental analyses, fodder species, traditional uses.

INTRODUCTION

The World Health Organization (WHO) recognized traditional medicine or herbal medicine about 20 years ago and started exploring the possibilities to improve or popularize the herbal medicine already used by the people in developing countries of the world for thousands of years (Akerle and Heywood 1991). Herbs not only provide us chemicals of medicinal value but also provide us nutritional and trace elements (Zafar et al., 2010). Minerals and trace elements are chemical elements required by our bodies for numerous biological and physiological processes that are necessary for the maintenance of health. Those minerals that are required in our diets in amounts greater than 100 mg per day are called "minerals" and those that are required in amounts less than 100 mg per day are "trace elements." Minerals include compounds of the elements such as calcium, magnesium, phosphorus, sodium, potassium, sulfur and chlorine. Trace elements that are necessary for human health include iron, iodine, copper, manganese, zinc, molybdenum, selenium and chromium etc (Hendler and Sheldon, 1990).

All human beings require a number of complex organic/inorganic compounds in diet to meet the need for their activities. The important constituents of diet are carbohydrates, fats, proteins, vitamins, minerals and water (Indrayan et al., 2005). Every constituent plays an important role and deficiency of any one constituent may lead to abnormal developments in the body (Zafar et al., 2010). Plants are the rich source of all the elements essential for human beings. There is a relationship between the element content of the plant and its nutria-tional 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 (Newall et al., 1996). Qualitative or quantitative determination of mineral elements present in plants is important because the concentration and type of minerals present must often be stipulated on the label of a food. The quality of many foods depends on the concentration and type of minerals. What they contains also play a very significant role against a variety of degenerative diseases and processes, they may also prevent and reduce injury from environmental pollutants and enhance the ability to work and learn, some minerals are essential to a healthy diet (for example calcium, phosphorus, potassium and sodium) where as some can be toxic (for example

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Lead, Mercury, cadmium and aluminum). In the present study the nutritional value and trace elements content in *Amaranthus viridis*, Chenopodium *album*, *Medicago denticulata, Setaria viridis, Sonchus arvrnsis* are investigated.

MATERIALS AND METHODS

Sources of plant materials

Five medicinal plants including; *A. viridis*, *C. album*, *M. denticulata, S. viridis, S. arvrnsis* were analyzed in the form of aerial parts. Plants were collected from the fields and identified with the help of Flora of Pakistan (Ali and Qaiser, 2007). These plants were shade-dried at a temperature of 28 to 30°C for 14 days and powdered mechanically with a China herb grinder. The powder was kept in dry, clean, air tight glass jars and stored at 4°C until used.

Nutritional analysis

Ash contents, moisture contents, and crude protein were determined by Macrokjeldahl method while fats or ether extracts, crude fibers and carbohydrates were determined by standard methods following AOAC (Anonymous, 2000).

Elemental analysis

Samples in powder form were used for atomic absorption Spectrophotometer (AAS). Each plant material (0.25 g) was taken in 50 ml flask and add 6.5 ml of mixed acid solution that is, Nitric acid (HNO3), Sulfuric acid (H2SO4) and Perchloric acid (HClO4) (5:1:0.5) The samples were boiled in acid solution in fume hood on hot plate (model VWR VELP scientifical, Germany) . Thereafter, few drops of distilled water has beethe completion of digestion in completing indicated white fumes coming out from the flask added and allowed to cool. Then these digested samples were transferred in 50 ml volumetric flasks and the volume was made up raised to 50 ml by adding distilled water in them. Then the extract was filtered with filter paper (Whatmann No. 42) and filtrate were collected in labeled plastic bottles. The solutions were analyzed for the elements of interest utilizing atomic absorption spectrometer (Shimadzu AA-670) with suitable hollow cathode lamps. The percentages of different elements in these samples were determined by the corresponding standard calibration curves obtained by using standard AR grade solutions of the elements, for example K^{+}, Mg^{2+}, $Ca^{2+,}$ $Na^{+,}$ $Fe^{2+,}$ $Co^{3+,}$ $Mn^{2+,}$ $Cu^{3+,}$ C^{3r+}, $Zn^{2+,}$$Ni^{3+}$, Li^{1+}, Pb^{4+} and. Cd^{2+}..

RESULTS AND DISCUSSION

Health treatment is based on medicinal plants are being prescribed by doctors in the form of plant extracts, infusion or by direct ingestion of very fine powder of plant. Likewise, these are recommended as a nutritional supplement for the treatment of everyday problems such as stress and insomnia. There is a resurgence of interest in herbal medicine for the treatment of various ailments, chiefly because of the prohibitive cost of allopathic drugs, chiefly because of the prohibitive cost of allopathic drugs, their unavailability in remote areas and the popular belief that naturally occurring products are without any adverse side-effects (Hungard et al., 1988). Similarly Ahmad (2007) highlighted the importance of wild medicinal plants along road side verges (M-2) Pakistan.

From a medical point of view, the important constituents of plants are pharmacologically active compounds such as flavonoids, alkaloids, glycosides and similar other organic substances. In addition, medicinal plants contain essential and trace elements, which can be available to the human body on consumption of herbs and their extracts. Indeed today many, if not most, pharmacological classes of drugs include a natural product prototype. The search for pharmacologically active chemicals from plant sources has continued and many compounds have been isolated and introduced into clinical medicine. Modern medicine is now beginning to accept the use of standardized plant extracts. Present study was also conducted to enhance the same knowledge further and is focused to investigate chemical composition including estimation of nutritional value, trace elements / heavy metals of *A. viridus, C. album, M. denticulata, S. viridus* and *S. arvrnsis*.

Local uses

Plants analyzed in the present work with their botanical name, local name, part of the plant used and their medicinal uses are shown in Table 1.

Nutritional analysis

Table 2 shows the chemical composition of aerial parts of *A. viridis*, *C. album*, *M. denticulata, S. viridis, and S. arvrnsis*.

The ash content was highest in *S. arvrnsis* and lowest in *M. denticulata*. The crude protein content was highest in *C. album* and lowest in *S. viridis* and *S. arvrnsis*. Crude fiber content was found highest in *M. denticulate* and lowest in *Chenopodium album*. Kononov et al. (2005) reported that the highest dry weight yield (8.8 t/ha) was achieved using *Medicago falcata*; High moisture was found in *Sonchus arvrnsis* and low in *Chenopodium album*. Carbohydrate was highest in *Medicago denticulata* and lowest in *Chenopodium album*. Adetuyi and Akpambang (2006) reported moisture, ash, crude fat, crude fiber, protein and carbohydrate in *Sorghum bicolor.* Naseem et al. (2006) reported carbohydrates 7.16%, crude fiber 27.2%, moisture 63.10%, ash 5.67% and crude fat 6.36%. Alfawaz (2006) reported protein value 17.1 to 0.1 g/100 g, moisture 87.8 to 93.5 g/100 g, ash 14.6 to19.6 g/100 g and lipids 3.1 to 3.8 g/100 g in *Rumex vesicarius*. Khodzhaeva et al. (2002) reported the content and composition of lipids, proteins, flavonoids and carbohydrates in the aerial part of the *Rumex confertus.*

Elemental analysis

The data obtained are cited in Tables 3 and 4. The results

Table 1. Local uses of fodder species.

S/No.	Plant name	Local name	Family	Part used	Medicinal uses
1	*Amaranthus viridis* L.	Gunhar	Amaranthaceae	Leaves	Leaves are used as emollient; also used in scorpion and snake bite. Cocked as vegetable.
2	*Chenopodium album* L.	Bathwa	Chenopodiaceae	Whole plant	Laxative, anthelmintic; used in hepatic disorder and enlarged spleen. The roots are used in jaundice, urinary, problems and rheumatism. Fruit and roots are known as antidote to snake poison. Also used as pot herb.
3	*Medicago denticulata* Willd	Spashtary	Papillionaceae	Shoots	Plant is used as fodder and as pot herb.
4	*Setaria viridis* (L.) P. Beauv.	Wakha	Poaceae	Vegetative portion	Fodder for cattle.
5	*Sonchus asper* L.	Shawda pai	Asteraceae	Vegetative portion	The plant is diuretic, sedative, cooling, hypnotic, diaphoretic, antiseptic and expectorant; used in cough, bronchitis, asthma, curing constipation. Young shoots are eaten as salad and the leaves as vegetables. The plant is relished by horses and cattle.

Table 2. Nutritional analysis of the arial parts of fodder species.

S/No.	Plant name	Part used	Ash (%)	Crude protein (%)	Crude fiber (%)	Moisture (%)	Carbohydrate (%)
1	*Amaranthus viridis* L.	Arial parts	18.42	31.19	15.21	5.54	40.86
2	*Chenopodium album* L.	Arial parts	19.23	34.31	14.82	4.53	36.55
3	*Medicago denticulata* Willd	Arial parts	11.77	27.06	25.62	5.71	50.61
4	*Setaria viridis* (L.) P. Beauv.	Arial parts	20.85	20.53	16.15	5.0	49.98
5	*Sonchus arvrnsis* L.	Arial parts	21.78	20.53	15.11	6.72	44.87

showed that *Amaranthes viridus, Chenopodium album, Medicago denticulata, Setaria viridus* and *Sonchus* arvrnsis exhibits the highest concentration of the elements Mg, Si, S, Ca, Cl, K and Fe (Table 3). The highest more concentration of Mg was found in *Medicago denticulate* (4.08 %), Si was in *Sonchus arvrnsis* (4.80%), S and K was in *Medicago denticulate* (3.82%, 4.65%), Cl was in found in *Sonchus arvrnsis* (3.00%) and Fe was found in high concentration in *Medicago denticulate* (4.92%). Ni and Cu were found only in *Amaranthes viridus* and *Medicago denticulate* in

Table 3. Elemental analysis of the arial parts of fodder species (in high concentration).

S/No.	Plant name	Part used	Na (%)	Mg (%)	Al (%)	Si (%)	P (%)	S (%)	Cl (%)	K (%)	Ca (%)	Fe (%)
1	*Amaranthus viridis* L.	Arial parts	0.28	3.34	0.89	2.98	1.7	2.24	1.46	4.35	3.52	1.52
2	*Chenopodium album* L.	Arial parts	0.30	2.54	0.48	1.44	1.55	1.44	1.00	3.65	3.85	0.93
3	*Medicago denticulata* Willd	Arial parts	1.48	4.08	1.26	3.77	1.85	3.82	3.68	4.62	3.93	4.92
4	*Setaria viridis* (L.) P. Beauv.	Arial parts	0.93	2.28	0.55	1.65	1.39	0.91	2.48	4.11	3.16	1.16
5	*Sonchus arvrnsis* L.	Arial parts	0.45	1.63	1.33	4.80	0.83	3.6	3.00	3.54	4.00	2.21

Table 4. Elemental analysis of the arial parts of fodder species (in low concentration).

S/No.	Plant name	Part used	Mn (%)	Ti (%)	Ni (%)	Cu (%)	Zn (%)	Rb (%)
1	*Amaranthus viridis* L.	Arial parts	0.08	0.12	0.04	0.05	0.24	0.03
2	*Chenopodium album* L.	Arial parts	0.14	0.08	-	-	0.26	0.06
3	*Medicago denticulata* Willd	Arial parts	0.22	0.46	0.14	0.25	0.69	0.07
4	*Setaria viridis* (L.) P. Beauv.	Arial parts	0.06	0.08	-	-	0.20	0.01
5	*Sonchus arvrnsis* L.	Arial parts	0.12	0.23	-	-	0.16	0.02

low concentration (Table 4). Mn, Ti, Cu, Zn and Rb were found in low concentration (Table 4). Kaneez et al. (2001) stated that Mg in the plant lowers the cholesterol level but alleviates heart diseases. Mg is being investigated in migraine headache and attention deficit hypersensitivity disorder. Mg plays an important role in regulating the muscular activity of heart, maintains normal heart rhythm and also converts blood sugar in to energy. Iron (Fe) deficiency is associated with myocardial infection.

Calcium is needed in the development of bones and teeth, regulates heart rhythm, helps in normal blood clothing maintain proper nerve and muscle functions and lowers the blood pressure. Mn is essential for normal functioning of central nervous system and is a good anti-oxidant (Bibi et al., 2006). The presence and con-centrations of various elements in different plant depend on the composition of the soil, water and fertilizers used as well as permissibility, selectivity and absorbability of plants for the uptake of these elements. Hence, the observed variations in concentration of the elements are attributed to the nature of the plant as well as its surroundings (Udayakumar and Begum, 2004). Trace elements are essential for all forms of life and having wide range of clinical applications that play a key role in the treatment of various diseases (Kaneez et al., 2001).

The elements Fe, K, Mg, Na, Ca, Co, Mn, Zn and Cu have been classified as essential elements, Ni, Cr are possibly essential while Cd, Pb and Li are non essential elements for the human body. Among the various elements detected in different medicinal plants used in the treatment of different diseases. It is interesting to note that some of the medicinal plants used by local physician and common people have high concentration in the range of ppm of Mn, Fe, Cu, Zn etc. The concentration of K and Ca are in the percentage level. Zn is important in wound healing and also functions as an antioxidant. The researchers are trying to link the contents of the trace elements and medicinal values of the plants (Zafar et al., 2010). This is for the first time that such an exhaustive work on elemental content has been carried out on the medicinal plants. The data obtained in the present work will be useful in synthesis of new herbal drugs with various combinations of plants, which can be used in the treatment of different diseases at global level generally and in Pakistan particularly.

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