MINERAL PROFILE AND PROXIMATE STUDIES OF SELECTED NUTRACEUTICAL PLANTS OF DIFFERENT LOCALITIES OF PAKISTAN

Sanam Zarif Satti[1], Tanvir Ahmad Qureshi[2], Iftikhar Ahmad[3] and Sumara Zarif[4]

ABSTRACT

Five wild medicinal plants viz: *Bacopa monnieri, Bauhinia variegata, Berberis aristata, Caltha alba* and *Cordia obliqua,* were collected from different areas of Abbotabad, Murree, Swat and Azad Kashmir in the months of May-June, 2014 to analyze their nutraceutical potential. The results of proximate analysis indicated highest value of ash content (12.60%) in *B.aristata.* and fiber content (25.59%) in *C.obliqua.* Highest value of NFE (56.73%) was found in *B. monnieri.* Fats (9.70%) along with protein (17.53%) was reported high in *B. variegata* The minerals profile determined by Energy Dispersive X-rays Spectroscopy (EDX) divulged that among all the plant species highest amount of Carbon (C) in *B.aristata* (55.63%), Oxygen (O) in *C.alba* (44.93%), and Magnesium (Mg) in *B.monnieri* (0.55%) was recorded. Likewise promising concentration of Aluminum (Al) (0.23%) in *C.alba*, highest value of Silicon (Si) (0.33%) in *C.obliqua* and Phosphorus (0.32%) in *B.variegata* was observed, while Aluminum was not detected in *B. monnieri* and *B. variegata.* The highest level of Sulphur (S) (0.72%), Potassium (K) (4.37%), Calcium (Ca) (1.64%) and Chlorine (3.09%) was noted in *B. monnieri.*

INTRODUCTION

Plants are the fundamental module of selected recipes of folk medicines in remote areas of Pakistan. They are the key reserves for diets, medicines, pharmaceuticals intermediates, food additives and biological entities for various synthetic drugs (Ncube *et al.,* 2008). According to WHO about 80% of world population used natural resources for their primary health care needs. These plants are found as weeds across Pakistan and research literatures reveal that it is the key source of diversified bioactive molecules. Likewise, in other parts of Asia the population particularly, the rural people of India, Iran, Afghanistan and China etc. mostly depend on these wild plants (Farnsworth, 1994; Srivastava *et al.,* 1996). The research conducted in the last few decades reveals that the most common drugs are obtained from plants or other natural resources (Sukanya *et al.,* 2009).

1 Biochemist, Pakistan Forest Institute, Peshawar
2 Forest Chemist/DBSRD, Pakistan Forest Institute, Peshawar
3 Ph.D. Scholar, University of Agriculture, Peshawar
4 M. Phil Scholar, University of Peshawar

Moisture content is among the most vital and mostly used measurement in the processing, preservation and storage of food (Onwuka, 2005). High amount of moisture content proliferate microbial attack which causes spoilage (Desai and Salunkhe, 1991). The moisture content of any food is an index of its water activity and is used as a measure of stability and the susceptibility to microbial contamination (Scott, 1957; Frazier and Westoff, 1978; Davey, 1989).

Fiber helps in the maintenance of human health and has been known to reduce cholesterol level in the body (Bello *et al.,* 2008). A low fiber diet has been associated with heart diseases, cancer of the colon and rectum, varicose veins, phlebitis, obesity, appendicitis, diabetes and even constipation. Crude fiber enhances digestibility however its presence in high level can cause intestinal irritation, lower digestibility and decreased nutrient usage.

Lipid provides very good sources of energy and aids in transport of fat soluble vitamins, insulates and protects internal tissues and contributes to important cell processes. Tairo *et al.* (2011)

Diet is nutritionally satisfactory, if it contains high caloric value and a sufficient amount of protein. Ali (2010) also stated that any plant foods that provide about 12% of their calorific value from protein are considered good source of protein.

Minerals are considered to be essential in human nutrition. These minerals are vital for the overall mental physical well-being and are important constituent of bones, teeth, tissues, muscles, blood and nerve cells. They generally help in maintenance of acid-base balance, response of nerves to physiological stimulation and blood clotting (Hanif *et al.,* 2006). The macronutrient potassium is highly important because it is necessary for upkeep of the acid-base balance in the body, as well as the osmotic pressure. It plays an important role in the nerve impulse transmission of the muscle contraction because it has the ability to increase the muscle and nerve cells excitability.

Potassium has an impact on carbohydrate metabolism and membrane transport. Calcium, potassium and magnesium are reported to be responsible for the repair of worn out cells, strong bones and teeth, building of red blood cells and for body mechanisms. Also, Ca and K are essential for disease prevention and control and may therefore contribute to the medicinal influences of the plant. Moreover, it was previously reported that containing rich amount of calcium may support the medicinal uses of plants (Jawhar *et al.,* 2004). The high concentrations of Ca are very significant because Ca is known to enhance the qualities of bones and teeth and also of neuromuscular systemic and cardiac functions. Silicon is important element to prevent the hardening of veins and

arteries. Chloride works with sodium and potassium to carry an electrical charge in dissolved body fluids and it also helps to regulate the pH in the body. Chloride is important for digestion of food and to absorb many trace elements that what we need to survive (Starlin *et al.,* 2012).

Magnesium participates in many biochemical and physiological processes in the body. It is necessary for the normal function of many different enzymes. The magnesium deficiency causes a variety of neurological and neuromuscular signs (cramps, pausing and altered muscle reflexes), and affects arrhythmia and myocardial infarction. In addition, magnesium regulates the sugar level in blood, affects the blood pressure. Iron is generally required for normal physiological functions by assessing numerous biochemical processes such as binding and transport of oxygen, electron transfer reactions, gene regulations, cell growth regulation and differentiations and immune system respectively.

The present study aims at determining the nutritional potential of wild medicinal plants viz: *Bacopa monnieri, Bauhinia variegata, Berberis aristata, Caltha alba, Cordia oblique*;

Berberis aristata belonging to family *Berberidaceae* is native to mountainous parts of North India and Nepal. In Pakistan many species of *Berberis* are found in hilly areas like Chitral, Gilgit, Kurram, Swat, Murree and Ziarat. Ethnobotanical studies indicate that the decoction of *B. aristata* leaves is commonly used to treat skin diseases, diarrhea, cholera, jaundice, eye and ear infections, as well as urinary tract infections.

Bacopa monnieri belongs to the family *Scrophulariaceae*, is a creeping, glabrous, succulent herb grows in marshy areas throughout India. Apart from India, Nepal, Sri Lanka, China, Taiwan and Vietnam, it is also found in Florida and other southern states of USA. It has been traditionally used to treat anxiety, anger, nerve pain, insomnia, learning problems and concentration difficulties. It is used as a laxative and curative for ulcers, inflammation, anemia, scabies, leucoderma, epilepsy and asthma.

Bauhinia variegata belonging to family *Leguminosae* is locally known as kachnar. The various parts of the plants viz., leaves, flower buds, flower, stem, stem bark, seeds and roots are used in fever, as tonic, astringent, diarrhea, dysentery, piles, edema, laxative, in skin diseases, wound healing, in obesity, stomatitis, antidote for snake poisoning, and as carminative. It is also distributed in most tropical countries, including Africa, Burma, and China. The various parts of the plant viz., flower buds, flowers, stem, stem bark, leaves, seeds and roots are practiced in various indigenous systems of medicine and popular among the various ethnic groups in India for the cure of variety of ailments (Arvind *et al.,*

2012).

Caltha alba belonging to family *Ranunculaceae* is widely distributed in wet lands in temperate regions of the Northern Hemisphere. In Pakistan the plant is found in Kashmir, swat and other surrounding areas. The plant is used as an antispasmodic and sedative and is a rich source of phenols, alkaloids, cyanogenic compounds and acrid principles.

Cordia obliqua locally known as Lasora belongs to family *Boraginaceae*. It is a deciduous tree with medium height and found throughout the mid Himalayas up to an elevation of 1470 meters. The fruit is sweet and have effects like slightly cooling, anthelmintic, purgative, diuretic, expectorant, and useful in diseases of the chest, urethra, dry cough, biliousness and chronic fever. It lessens thirst and the scalding of urine, removes pains in the joints, bad humors, burning of the throat and also good in diseases of the spleen. Seeds are utilized as an anti-inflammatory agent (Agnihotri *et al.,* 1987).

MATERIALS AND METHODS

Sampling of plant materials

Five medicinal wild plants viz: *B. monnieri, B. variegata, B. aristata, C. alba, C. obliqua* were collected from different areas of Abbotabad, Murree, Swat and Kashmir in the month of May-June in the year 2014 and analyzed for their nutraceutical potential, proximate analysis and Mineral analysis by standard method (AOAC, 2012).

All the plants were identified by the Taxonomist and were deposited at the Herbarium of Botany Department, University of Peshawar.

RESULTS AND DISCUSSION

Proximate Analysis

Proximate and nutrient analysis of edible plants and vegetables play a crucial role in assessing their nutritional significance. As various medicinal plant species are also used as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plant species. Fortunately, chemical composition diversity in plants also includes many compounds that are beneficial to humans such as nutrients and many other compounds with medicinal value.

The results depicted in table 1 showed moisture, ash, fiber, fat, protein and NFE content of various plant species. The moisture content of selected plant

species ranged from 6.26-13.70% which is in close proximity with Ooi *et al.* (2012) who reported 8.33 g/100g of moisture content for *Peperomia pellucida.*

It was observed that among all the plants highest ash content (12.60%) was found in *B.aristata* and lowest value was observed in *C.alba* (8.3%).

The fiber content observed during our research work was ranged from 7.23-25.59% which is at par with the study of Abolaji *et al.* (2007) who reported 4.21% and 12.14% of crude fiber in *P. polyandra* and *X. aethiopica*. Therefore the examined plants could be recommended as crude fiber source in the diet as a result of their relative high crude fiber content.

The crude fat or lipid content observed in the present study ranged between 3.26-9.70%. Similar justifications was also given by *Tairo et al. (2011) who recorded 6.70% and 3.12%* of lipid content in *C. siamea and M. angolensis.*

The crude protein content examined during the current research work ranged from 5.60-17.53% which is in line with the results of investigated values 2.10 and 7.09 crude protein content in *Xylopia aethiopica* and *Parinari polyandra*. Ali (2010), which also supports our findings

The NFE of the selected medicinal plants in our study ranged from 44.05-56.73% which clearly indicates that carbohydrates are the primary ingredient and major class of naturally occurring organic compounds that are essential for the maintenance of plant and animal life and also provide raw materials for many industries.

Table 1. Proximate composition of different plant species collected from various locations of Pakistan

Plant species	Moisture (%)	Ash (%)	Fiber (%)	Fat (%)	Protein (%)	NFE (%)
B. aristata	13.70	12.60	10.06	6.56	12.30	44.76
B. monneria	12.33	10.33	9.46	4.36	6.76	56.73
B. varigata	6.26	9.43	11.53	9.70	17.53	45.53
C. alba	9.76	8.30	14.90	5.23	13.06	48.73
C. obliqua	7.30	10.50	25.59	3.86	8.68	44.05
SE of Mean	0.34	0.29	0.65	0.28	0.46	0.73
LSD ($p<0.05$)	Sig	Sig	Sig	Sig	Sig	Sig

SE = Standard Error; LSD = Least Significant Difference; Sig = Significant

Minerals analysis

The results depicted in Table 2 showed the mineral profile of different plant species. In case of magnesium (Mg), highest value was observed for *B. monnieri* (0.55%) and promising concentration of Al (0.23%), Si (0.33%) and P (0.32%) was recorded in *B. araristata*. Al was not detected in *B. monnieri* and *B. variegata*, whereas Si was found lowest in *B. aristata* (0.12%) Likewise highest amount of S (0.72%), K (4.37%) and Cl (3.09%) Ca (1.64%) was recorded in *B. monnieri* among all the examined plants. It was suggested from the present findings that all plant species possess appreciable amount of minerals which help them to regulate various physiological functions. Results of mineral profile of selected plant species in the present study are in close proximity with Bibi *et al.* (2006) who evaluated C, O, Na, Mg, Al, Si, Cl, K, Ca and Fe in different parts of *V. odorata* and C, O, Mg, Al, Si, K, Ca, Fe, S, Na, Cl, B, P and Zn in different parts of *Alstonia scholaris.* and reported chloride, nitrogen and potassium in *Nicotiana tabacum*.

Table 2. Minerals profile (%weight) of different plant species collected from various locations of Pakistan

Plants species	Elements									
	C	O	Mg	Al	Si	P	S	K	Ca	Cl
B. aristata	55.63	42.85	0.17	0.15	0.12	0.28	0.14	0.63	0.39	NT
B. monniera	48.65	35.5	0.55	NT	0.32	0.15	0.72	4.37	1.64	3.09
B. varigata	55.3	39.13	0.26	NT	0.24	0.32	0.26	2.81	0.57	NT
C. alba	51.95	44.93	0.29	0.23	0.29	0.22	0.10	1.91	0.43	0.34
C. obliqua	49.89	42.23	0.21	0.15	0.33	0.30	0.14	1.58	0.28	0.25
SE of Mean	0.70	0.72	0.01	0.03	0.08	0.02	0.02	0.16	0.08	0.12
LSD ($p<0.05$)	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig

SE = Standard Error NT = Not Tested; LSD = Least Significance difference; Sig = Significant

CONCLUSIONS

From the present study it was concluded that:

1. All the examined plants are good source of fat, fiber, protein therefore they should be included in our daily life to overcome different physiological disorder.

2. The crude methanol extract of all plants species have appreciable mineral contents which are healthy food source and nutritionally very important nutraceutical potential. Therefore they may be used to fulfill dietary requirements.

REFERENCES

Agnihotri, V. K., S. D. Srivastava, S.K. Srivastava, S. Pitre and K. Rusia. 1987. Constituents from the seeds of *Cordia obliqua* as potential anti-inflammatory agents. Ind. J. Pharm. Sci. 49: 66-69.

Arvind, N., N. Sharma and M. F. Singh. 2012. Spectrum of Pharmacological Activities from Bauhinia variegata: A Review. J. Pharm Res. 5: 792-797.

AOAC. 2012. Association of Official Analytical Chemists. Official Methods of Analysis 19th Edition (George Latimer.ed.). AOAC Intl, Arlington, Virginia.

Ali, A. 2010. A comparative study of nutrients and mineral molar ratios of some plant foods with recommended dietary allowances. J. Food Sci. Technol. 2: 104-108.

Abolaji, O.A., A.H. Adebayo and O.S. Odesanmi. 2007. Nutritional qualities of three medicinal plant parts (*Xylopia aethiopica, Blighia sapida* and *Parinari polyandra*) commonly used by pregnant women in the Western part of Nigeria. Pak. J. Nut. 6: 665-668.

Bibi, S., G. Dastagir, F. Hussain and P. Sanaullah. 2006. Elemental composition of *Viola odorata* Linn. Pak. J. Plant. Sci. 12: 141-143.

Bello, M.O., O.S. Falade, S.R.A. Adewusi and N. O. Olawore. 2008. Studies on the chemical compositions and antinutrients of some lesser known Nigeria fruits. Afr. J. Biotechnol. 7: 3972-3979.

Davey, K.R. 1989. A predictive model for combined temperature and water activity on microbial growth during the growth phase. J. Appl. Microbiol. 65: 483-488.

Desai, B.B. and D.K. Salunkhe. 1991. Fruits and vegetables. In: Salunkhe DK, Desh-pande SS (Eds). Foods of Plant Origin. Production, Technology and Human Nutrition, AVI, New York, pp. 301-355.

Frazier, W.S. and D.C. Westoff. 1978. Food Microbiology. 3rd Edition, McGraw Hill, New York, pp. 278-298.

Scott, W.S. 1957. Water relations of food spoilage microorganisms. Advan. Food Res. 7: 84-127.

Ncube, N. S., A. J. Afolayan A. I. and Okoh. 2008. Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods

and future trends. Afr. J. Biotech. 7: 1797-1806.

Onwuka, G. I. 2005. Food Analysis and Instrumentation; Theory and Practice. Naphthalic prints, Surulere, Lagos, Nigeria, pp. 219- 230.

Ooi, D., S. Iqbal and M. Ismail. 2012. Proximate composition, nutritional attributes and mineral composition of *Peperomia pellucida* L. (Ketumpangan Air) grown in Malaysia. Molecules. 17: 11139-11145.

Srivastava, J., J. Lambert and N. Vietmeyer. 1996. Medicinal Plants: An Expanding Role in Development. The World Bank, Washington, D.C. p. 18.

Starlin, T., C.A. Raj, P. Ragavendran and V.K. Gopalakrishnan. 2012. Phytochemical screening, functional group and elemental analysis of *Tylophora Pauciflora* wight and arn. Int. Res. J. Pharm. 3: 180-183.

Sukanya, S. L., J. Sudisha, P. Hariprasad, S. R. Niranjana, H. S. Prakash and S. K. Fathima. 2009. Antimicrobial activity of leaf extracts of Indian medicinal plants against clinical and phytopathogenic bacteria. Afr. J. Biotech. 8: 6677-6682.

Tairo, T.V., T.N. Jesse, W.C. Lukhoba and V.M.L. Herbert. 2011. Nutritive and antinutritive qualities of mostly preferred edible woody plants in selected dry lands of Iringa District, Tanzania. Pak. J. Nut. 10: 786-791.

Farnsworth, N. R. 1994. The role of medicinal plants in drug development. In: Natural Products and Drug Development. (Eds.): S. Krogsgaard-Larsen, S. BroggerChristense, H. Kofod. Munksgaard, Copenhagen.

Hanif, R., Z. Iqbal, M. Iqbal, S. Hanif and M. Rasheed. 2006. Use of vegetables as nutritional food: Role in human health. J. Agric. Biol. Sci. 1: 18-20.

Jawhar, M., G. Rabert and M. Jeyaseelan. 2004. Rapid proliferation of multiple shoots in *Solanum trilobatum* L. Plant Tissue Cult. 14: 107-112.