Pak. J. Bot., 43(1): 427-434, 2011.

NUTRIENT EVALUATION AND ELEMENTAL ANALYSIS OF FOUR SELECTED MEDICINAL PLANTS OF KHYBER PAKHTOON KHWA, PAKISTAN

JAVID HUSSAIN[1-4*], FARMAN ULLAH KHAN[1], RIAZ ULLAH[1], ZIA MUHAMMAD[1], NAJEEB U REHMAN[1], ZABTA KHAN SHINWARI[3], IHSAN ULLAH KHAN[1], MUHAMMAD ZOHAIB[1-2,] IMAD-UD-DIN[2] AND SYED MURTAZA HUSSAIN[1]

[1]*Department of Chemistry, Kohat University of Science and Technology, Kohat 26000, Pakistan*
[2]*Department of Chemistry, Govt Post Graduate College Kohat, Pakistan*
[3]*Department of Biotechnology, Quaid-i-Azam University, Pakistan*
[4]*Department of Biological Sciences and Chemistry, College of Arts and Sciences University of Nizwa, Oman*

Abstract

The study was carried out to assess the nutritional value and mineral contents of four medicinal plants viz., *Aerva javanica* Burm.f, *Calotropis procera* Ait. f, *Datura alba* Nees, and *Nepeta suavis* Stapf., which are traditionally used as medicine in the Northwest Pakistan. Proximate analysis of plant sample determines that protein (21.353%) and ash (18.803%) was highest in *Datura alba*, carbohydrate (70.123 %) in *Aerva javanica*, energy (398.496 Kcal/100g), fats (12.595%) and fibre (40.150%) was highest in *Nepeta suavis*, while highest moisture (11.255%) was reported in *Calotropis procera*. In comparative assessment of the various species, the results showed that *Nepeta suavis* is the most significant species having higher concentrations of fat, fibre and energy values compared to the other species. The essential elements such as Fe, Cd, Cu, Mn, Pb, Cr, Mg and Na have been analysed using Atomic Absorption Spectrometric method from the medicinal plants in variable range.

Introduction

Plant based drugs have been in use against various diseases since time immemorial. The primitive man used herbs as therapeutic agents and medicament, which they were able to procure easily. The nature has provided abundant plant wealth for all living creatures, which possess medicinal virtues. The important values of some plants have long been published but a large number of them remain unexplored as yet. So there is a necessity to explore their uses and to conduct pharmacognostic and pharmacological studies to ascertain their therapeutic properties (Mushtaq *et al*., 2009).

Pakistan has been bestowed with ample wealth of plant resources and which have therapeutic properties more than 1,000 species have been reported which have medicinal values and used by marginal communities to cure various diseases (Latif *et al*., 2004; Mushtaq *et al*., 2009). Carbohydrates, fats and protein are the essential nutrients of life. The quality and quantity of proteins in the seeds are basic factors and important for the selection of plants for nutritive value, systematic classification and plant improvement programs (Nisar *et al*., 2009). Keeping in mind the importance of food component, four plants viz., *Aerva javanica*, *Calotropis procera*, *Datura alba* and *Nepeta suavis* were collected and subjected to proximate and nutrient analysis.

Aerva javanica belonging to the Family Amranthaceae is a perennial herb frequently woody whose flowers are dioecious (Hussein M. Alwadie, 2005).

Calotropis procera is a small shrub, belonging to the family Ascelpiadacea. Its trade name is Aak or madar (Gerhard et *al*., 1936).

*E-mail: afridiriaz@yahoo.com

Datura alba is a medicinal plant belonging to the family Solanaceae. All *Datura* plants contain tropane alkaloids such as scopolamine, hyoscyamine and atropine, primarily in their seeds and flowers (Preissel *et al*., 2002).

Nepeta suavis is a perennial herb belonging to the family Labiatae. The various crude fractions of this plant showed good biological activities such as antiglycation, antiplatelet, cytotoxicity and phytotoxicity (Hussain *et al*., 2010c).

Proximate and nutrient analysis of edible fruit and vegetables plays 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 plants species (Pandey *et al*., 2006). For this purpose, four medicinal plants species were analyzed to evaluate their nutritional value and mineral contents.

Materials and Methods

Plants collection: Whole parts of the selected four plant species were collected from Parachinar Kurram Agency and Kohat division NWFP Pakistan. All the plants were packed in the Kraft paper and herbarium sheets were prepared. These plants were identified and classified by a plant taxonomist of Botany Department, Kohat University of Science and Technology, Kohat. The voucher specimens (No# 320-323 DBK) were deposited in the herbarium of Botany Department, Kohat University. The whole plants were air-dried for 10 days and milled into powder with electrical grinder and finally stored in airtight bottles before analysis.

Sample preparation: The samples were washed under running water and blotted dry. The dried matter obtained was ground to a fine powder and stored at 5ºC in air-tight containers prior to further analysis.

Proximate analysis: AOAC methods were applied to carryout proximate analysis of the samples for moisture, total ash, crude fiber, crude fats, proteins and carbohydrates (Anonymous. 1990). The moisture and ash were determined using weight difference method (Haro *et al*., 1968; Boussama *et al*., 1999 and Das *et al*., 1997). The determination of proteins in terms of nitrogen was done by micro Kjeldahl method involving digestions, distillation and finally titration of the sample (Pearson, 1976). The nitrogen value was converted to protein by multiplying to a factor of 6.25. The lipid content of the samples was done using Soxhlet type of the direct solvent extraction method. The solvent used was petroleum ether (boiling range 40-60 ºC) (Folch *et al*., 1957). The crude fibre was also determined by the method described by ((Haro *et al*., 1968, Boussama *et al*., 1999). The energy values (kcal/100 g) were determined by multiplying the values of carbohydrates, lipids and proteins by a factor of 4, 9, and 4 respectively, and taking the sum expressed in kilocalories (Onyeike *et al*., 1998; Imran. *et al*., 2007). The total carbohydrates were determined by difference method [100 - (proteins + fats + moisture + ash in percentage)] (Muller *et al*., 1980). All the proximate values were reported in percentage (Hussain *et al*., 2009a, b and 2010a, b).

Macro and micronutrient analysis: The elemental contents including Mn, Cu, Pb, Cr, Fe, Cd, Na and Mg of the four selected medicinal plant species were determined using Atomic Absorption Spectrometer mineral (Perkin Elmer AA Analyst 700). The results

were obtained while using a working standard of 1000 ppm for each of the species (Hussain *et al*., 2009a, b and 2010a, b).

Statistical analysis: Data obtained was analyzed statistically using statistical package i.e., Cohort V-6.1 (Co-stat-2003). Each experiment was repeated three times and values expressed are means ± standard deviation.

Results and Discussion

The result of proximate analysis shows variant concentration/proportions of biochemicals and other contents. After shade drying the moisture contents of each species are different. Looking at the overall percentage of moisture contents, it was highest in *Calotropis procera* followed by *Nepeta suavis*, *Aerva javanica*, while in case of ash contents, it was highest in *Datura alba* and *Calotropis procera* (Table 1).

According to the results revealed, *Nepeta suavis* and *Aerva javanica* had highest and significant level of energy values, while rest of the other plant species had minor values. Looking at the results obtained from carbohydrate analysis, *Aerva javanica* and *Calotropis procera* had prominent levels compared to other species (Table 1).

While analyzing the protein contents in the selected four medicinal plant species, the results showed that *Datura alba and Aerva javanica* had highest concentration of protein as compared to other species (Table 1). During analysis of fat contents it was observed that the level of fat was also very high in *Nepeta suavis* followed by *Calotropis procera* and *Datura alba* (Table 1).

Looking at the result achieved from fibre analysis, it was higher in *Nepeta suavis* followed by *Calotropis procera* and *Aerva javanica* (Table 1). The results of energy contents showed that *Nepeta suavis* and *Aerva javanica* had higher concentration compared to other species (Table 1).

Irvine (1992) reported carbohydrates, fats and ash in *Polygonum hydropiper*. According to Naseem *et al*., (2006) the percent levels of various ingredients in *Crotalaria burhia* were as carbohydrate 7.16 (2.55 reducing and 4.61 non-reducing), starch contents 5.45, crude fibers 27.2, crude fats 6.36, moisture 63.10 and ash 5.67. Similarly Nisar *et al*., (2009) also reported the percent level of various ingredients of *Indigofera gerardiana* Wall and *Crataegus Songrica* K. Koch as percent levels of moisture (4.8), ash (4.79) and fats (3.03), protein (3.7) and fibers (17.8) in *Crateagus songrica* and levels of moisture (3.06), ash (4.23) and fats (2.37), protein (3.7) and fibers (17.8) in *Indigofera gerardian*a.

In Ayurveda the leaves, seeds and the roots of *Aerva javanica* are used for treatment of kidney stones, and as astringent (Judd *et al*., 2008). It is diuretic and demulcent, effective in lithiasis, haedache and removes inflammation. The decoction of the plants is used as a gargle for toothache. Paste made up of leaves is used for inflamed parts of body and face acne (Rahmatullah and G.R. Bhatti. 2009).

The crude latex of *C. procera* and its protein fraction were found to possess high fibrinolytic and anti-coagulant activity both in rabbits and human plasma. The latex of the plant contains trypsin, an active lab enzyme and cardiac poison (Gerhard *et al*., 1936). Powder flower are used in cold cough and asthma. Root bark is used in dysentery. The tincture of leaves is used in intermittent fevers (Shinwari *et al*., 2006).

All *Datura* plants contain scopolamine, hyoscyamine and atropine. Because of the presenet of such tropane alkaloids, *Datura* has been used for centuries in some cultures as a poison and hallucinogen (Preissel *et al*., 2002). *Datura alba* is popular all over the

world for its medicinal uses in asthma, muscle spasm, whooping cough, hemorrhoids, skin ulcer etc. In India it is traditionally used for the relief of rheumatism and other painful infections (Babu *et al*., 2002).

Nepeta suavis belongs to family Labiatae. Hussain *et al*., (2008) reported a new ditertpene nepetolide and the same author (Hussain *et al*., 2010_C) also reported the various crude fractions of this plant showing good biological activities such as antiglycation, antiplatelet, cytotoxicity and phytotoxicity.

In comparative assessment of the various species, the results showed that *Nepeta suavis* is most significant species having higher concentrations of fat, fibre and energy values compared to the other species (Table 2). Looking at the correlation analysis of the selected parameters, it was found that similar parameter has highly significant correlation while among parameters the correlation is either non-significant or less significant or moderate relation. Ash and protein, ash and fibre, Carbohydrate and protein showed negative or non-significant correlation and similar pattern for other parameter as well (Table 2). However, significant correlation occurs between fat and fibre and fat and energy values. Protein also shows significant behaviour with fat and fibre, while the other parameter shows negative correlation (Table 2).

Elemental analysis: The result of the mineral composition shows that the four medicinal plants contains rich source of mineral elements, this result become so important when the usefulness of such mineral like Ca, Mg, P, K and Na in the body are considered. However, the lower Na content (0.1 g) is an added advantage because of the direct relationship of sodium intake with hypertension in human (Dahl, 1972). The elemental analysis of the medicinal plant species showed significant variation among different elements (Table 4). In case of Fe, it was highest in *Nepeta suavis* followed by *Calotropis procera* and *Aerva javanica*. Higher concentration level of Cu was detected in *Nepeta suavis*. However, comparable amount has also been found in *Clotropis procera*. While the analysis of Cr concentration showed, that *Calotropis procera* had the highest among all the species (Table 4). The concentration of Na and Mg was higher than other elements and the amount of Pb, Cd and Mn was minimum 0.057 to 1.663 ppm. It has been reported that for many plant species Cr proved to be toxic at 5 mg/L. In this regard, all the studied plants have very lesser concentration of Cr as compared to that of recommended level for toxicity in plants (Adriano, 1986). In case of Pb concentration, the suggested concentration in plant species is 2 to 6 mg/L (Broyer *et al*., 1972), so the analyzed plant species carries very lesser level of Pb, which further clarifies their use as food supplement or their medicinal benefits.

Conclusions

Conservation and use of medicinal plants has taken considerable amount of attention in recent years. The indigenous and marginal communities for curing various diseases from time immemorial have used it globally. Most of the plant species are also used as food supplement alongwith its oral decoctions. However, little have been done so far to verify the uses in this regard. The present research is an effort in doing so.

Our current study on nutritional evaluation of *Aerva javanica* Burm. f, *Calotropis procera* Ait. f, *Datura alba* Nees and *Nepeta suavis* Stapf have revealed that these plants are good source of nutrients (moisture, ash, proteins, fats, carbohydrates, fiber and minerals) and can be used as substrates deficit in either of these nutrients.

Table 1. Proximate Analysis of Selected Medicinal Plant Species.

Species name	Moistures (%)	Ash (%)	Carbohydrate (%)	Protein (%)	Fat (%)	Energy values (K cal/100 g)	Fibre (%)
Aerva javanica	7.324±0.062	14.233±0.065	70.123±0.020	7.165±0.008	1.153±0.013	319.535±0.106	29.186±0.002
Calotropis procera	11.255±0.031	17.618±0.051	62.387±0.049	3.156±0.007	5.582±0.006	312.419±0.128	29.493±0.014
Datura alba	7.287±0.025	18.803±0.047	50.059±0.023	21.353±0.006	2.496±0.007	308.100±0.056	6.016±0.002
Nepeta suavis	8.452±0.055	7.917±0.028	20.282±0.014	4.649±0.033	12.595±0.036	398.496±0.056	40.1506±0.027

± shows the standard deviation and standard error

Table 2. Correlation matrix of proximate parameters.

	Moisture	Ash	Carbohydrate	Protein	Fat	Energy values	Fibre
Moistures	1						
Ash	-0.188	1					
Carbohydrate	-0.424	0.655	1				
Protein	0.212	-0.739	-0.969	1			
Fat	0.001	-0.541	-0.522	0.573	1		
Energy values	-0.515	-0.435	-0.107	0.275	0.820	1	
Fiber	0.483	-0.664	-0.536	0.493	0.515	0.215	1

Table 3. Anova: Two-Factor without replication.

Summary	Count	Sum	Average	Variance		
Aerva javanica	7	447	63.8571	13208.80		
Calotropis procera	7	439	62.7142	12490.23		
Datura alba	7	412	58.8571	12328.14		
Nepeta suavis	7	489	69.8571	21086.14		
Moisture	4	33	8.25	3.583		
Ash	4	56	14	24.6		
Carbohydrate	4	202	50.5	481		
Protein	4	35	8.75	69.583		
Fat	4	20	5	24.6		
Energy values	4	1337	334.25	1826.91		
Fibre	4	104	26	204.6		
ANOVA						
Source of variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Rows	436.1071	3	145.369	0.350	0.789387	3.15
Columns	347210.9	6	57868.476	139.458	4.31E-14	2.66
Error	7469.143	18	414.952			
Total	**355116.1**	**27**				

Table 4. Elemental analysis of four selected medicinal plant species.

Species name	Elemental analysis (ppm)							
	Cu (ppm)	Mn (ppm)	Pb (ppm)	Cd (ppm)	Fe (ppm)	Cr (ppm)	Mg (ppm)	Na (ppm)
Aerva javanica	2.135	0.647	0.382	0.068	2.772	3.658	29.939	28.469
Calotropis procera	4.442	0.907	0.524	0.089	3.948	3.853	35.969	90.439
Datura alba	0.914	0.474	0.440	0.057	1.76	0.461	29.419	25.279
Nepeta suavis	12.44	0.325	0.135	0.099	8.176	0.332	10.989	7.262

Acknowledgment

The authors wish to thank the Higher Education Commission, Government of Pakistan for providing financial support for the current study under the National Research Program for Universities (NRPU).

References

Adriano, D.C. 1986. *Chromium. In trace elements in the terrestrial environment*, Springer Verlag, New York. p. 58-76.

Anonymous. 1990. *Official Methods of Analysis*. 15th Edn. Association of Official Analytical Chemists Washington, DC, USA.

Babu, M., A. Gnanamani, N. Radhakrishan and K. Priya. 2002. Haeling potential of *Datura alba* on burn wounds in albino rats. *J. Ethnopharmacology*, 83(3): 193-199.

Boussama, N., O. Ouariti, A. Suzuki and M.H. Ghorbal. 1999. *Cd-stress on nitrogen assimilation*, *J. Plant Physiol*., 155: 310-317.

Broyer, T.C, C.N. Johnson and R.E. Paull. 1972. Some aspects of lead in plant nutrition. *Forest Sci*., 21: 33-35.

Dahl, L.K. 1972. Salt and hypertension. *Am. J. Clin. Nutr*., 25: 231-244.

Das, P., S. Samantaray and G.R. Rout. 1997. *Studies on cadmium toxicity in plants*: a Review, *Environ. Pollut*., 98: 29-36.

Folch, J., Less M and Sloane-Stanely G.H. 1957. *J. Biol. Chem*., 226: 497.

Gerhard, Franz, 1936. *Annalen der Chemie*, 526: 252.

Haro, R.T., A. Furst and H.L. Falk. 1968. Studies *on the acute toxicity of nickelocene*. *Proc West Pharmocol Soc*., 11: 39-42.

Hussain, J., F.U. Khan, A.U. Khan and M.I. Choudhary. 2010c. Antiglycation, antiplatelet aggregation, phytotoxicity and cytotoxicity of *Nepeta suavis*. *Lat. Am. J. Pharmacy*.

Hussain, J., F.U. Khan, H. Hussain and S.T. Hussain. 2008. Nepetolide: A new diterpene from *Nepeta suavis*. *Z. Natureforschchung*, 63b: 591-594.

Hussein, M. Alwadie. 2005. Morphology and distribution of three genera of Amaranthaceae in the south western area of Saudi Arabia. *J. King Saud Univ*., 18, Science (1): 51-62.

Hussain, J., A.L. Khan, N. Rehman, Zainullah, S.T. Hussain, F. Khan and Z.K. Shinwari. 2009a. Proximate and nutrient analysis of selected medicinal plant species of Pakistan. *Pakistan J. Nut*., 8 (1): 620 -624.

Hussain, J., A.L. Khan, N. Rehman, M. Hamayun, T. Shah, M. Nisar, T. Bano, Z.K. Shinwari and I.J. Lee. 2009b. Proximate and nutrient analysis of selected vegetable species: A case study of Karak Region Pakistan. *African J. Biotechnol*., 8(12): 2725-2729.

Hussain, J., Riazullah, N. Rehman, A.L. Khan, Z. Muhammad, Farmanullah and S.T. Hussain. 2010a. Endogenous Transitional Metal and Proximate Analysis of Selected Medicinal Plants from Pakistan. *J. Med. Plant Res*., 4(3): 267-270.

Hussain, J., N. Rehman, A. L. Khan, M Hamayun, S. M. Hussain, Z. K. Shinwari. 2010b. "Proximate and Nutrients Evaluation of Selected Vegetables Species from Kohat Region Pakistan" Pakistan. *Pak. J. Bot*., 42(4): 2847-2855.

Irvine, F.R. 1992. Supplementary and emergency food plants of West Africa. *Economic Botany*, 6(1): 23-40.

Imran, M., Talpur F.N, Jan M.I, Khan A and Khan I. 2007. *J. Chem. Soc. Pak*. 29: 500.

Judd, W.S., C.S. Campbell, E.**A**. Kellogg and P.F. Stevens. 2008. *Plant Systematics: A Phylogenetic Approach*, Third Edition. Sinauer Associates, Inc. Sunderland, MA

Latif, A., H. Ahmad, S. Begum, S.K. Hussian and S.M. Adnan. 2004. Medicinal and other economic plants as substitute to forest logging in Miandam and Sulatanr Valley-Swat. *Proc. of international workshop on conservation and sustainable use of Medicinal and aromatic plants in Pakistan*. WWF- Pakistan.

Nisar, M., S.A. Tariq and I. Ullah. 2009. Nutritional levels of *Indigofera gerdiana* Wall and *Crataegus songrica K. Koch, Pak. J. Bot*., 41(3): 1359-1361.

Muller, H.G. and G. Tobin. 1980. Nutrition and Food Processing. Groom Helm Ltd, London, UK

Mushtaq, A., Q. Rahmatullah, A. Muhammad, A.K. Mir and Z. Muhammad. 2009. Traditional herbal remedies used for the treatment of diabetes from district Attock (Pakistan) *Pak. J. Bot*., 41(6): 2777-2782.

Naseem, R., K. Mahmud and M. Arshad. 2006. Chemical composition and antibacterial activity of *Crotalaria burhia* from Cholistan Desert, Pakistan. *Hamdard Medicus*, 49(4): 49-52.

Onyeike, E.N and Ikru P.R. 1998. *J. Appl. Sci. Environ. Mgt*., 1: 27.

Pandey, M., A.B. Abidi, S. Singh and R. P. Singh 2006. Nutritional evaluation of leafy vegetable paratha. *J. Hum. Ecol*., 19: 155-156.

Pearson, D. 1976. *The Chemical Analysis of Foods*. 7th ed. Churchill Living stone, London.

Preissel, Ulrike and H.G. Preissel. 2002**.** *Brugmansia and Datura: Angel's trumpets and thorn apples*. Buffalo, New York: Firefly Books. pp. 106-129.

Rahmatullah. Q and G.R. Bhatti. 2009. Folklore uses of amaranthaceae family from Nara desert, Pakistan, *Pak. J. Bot*., 14(4): 1567-1572.

Shinwari, Z.K, T. Watanabe, M. Rehman and T. Yoshikawa. 2006. *A Pictorial guide to medicinal plants of Pakistan*, Kohat University of Science and Technology. P. 89.

(Received for publication 25 January 2010)