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Full Length Research Paper

Proximate composition and metal evaluation of four selected medicinal plant species from Pakistan

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Proximate composition and levels of metals in four commonly consumed species, *Sonchus eruca*, *Melia azadirchta*, *Withania coagulans* and *Fagonia indica*, were investigated for the first time. Ash, carbohydrate, protein, fiber, fat and moisture were arranged on dry basis, while Cu, Pb, Co, Cd, Fe, Cr, Mg and Na were also investigated in metal analysis using association of official analytical chemists (AOAC) methods and atomic absorption spectrometric techniques. However, *M. azadirachta* was found to be rich in fiber content and energy values. The results of metal analysis showed that *M. azadirachta* had the highest concentrations of the metals like Cu, Mn, Cr and Fe while *S. eruca* contain higher concentration of Na as compared to other three species.

Key words: *Sonchus eruca*, *Melia azadirchta*, *Withania coagulans* and *Fagonia indica*, proximate composition, metal analysis.

INTRODUCTION

Pakistan has good potential with the variety of medicinal plants due to its varied climatic and edapic factors, which reflects diversity and valuable medicinal plant heritage. Such diversity of plants is found in few countries. That is why our plants have played an important role in herbal medicine (Rizwi, 1998). For this reason *Sonchus eruca, Melia azadirchta, Withania coagulans and Fagonia indica,* were collected and subjected to proximate and metal analysis. *S. eruca* belongs to the family Asteraceae. It is the largest family of angiosperms (Bremer, 1994). Many species of genus *Sonchus* are used by the local communities to cure various diseases and has also been reported for many important chemical constituents. These are used in cough, bronchitis and asthma. The leaves are applied to swellings, while its latex is used for the treatment of eye diseases (Ambasta, 1920). *F. indica* belongs to family *Zygophyllaceae,* is a small spiny shrub, widely distributed throughout Pakistan. This plant is claimed to be a remedy for tumor in their early stages A (tta-ur-Rahman et al., 1984). The *M. azadirachta* belongs to family *Meliaceae,* which contains sufficient amount of phospholipase enzyme, whose activity markedly increased in the presence of calcium, manganese and zinc. But it was decreased by the addition of ethylene diaminetetra acetic acid (EDTA) (Dahot et al., 2001).

W. coagulans belongs to Dunal family Solanaceae commonly known as Indian cheese maker. It is a rigid, gray under shrub, 60 -120 cm high occurring in drier parts of India. The identified hypoglycemic and antidiabetic potentials of fruits of *W. coagulans* were due to the significant presence of Mg and Ca in the extract (Dolly et al., 2009). The fruit and seeds of *W. coagulans* are use as diuretic, asthma, allergy, stomach ulcer and polluitice (Ihsan, 2008, Sultan et al., 2007). Due to their medicinal importance, these plants species were subjected to proximate and metals analysis.

MATERIALS AND METHODS

Plants collection

The medicinal plant species were collected from various areas of N.W.F.P Pakistan. The collected plants were packed in the kraft paper and herbarium sheets were prepared. A plant taxonomist of

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Table 1. Quantity of the plant material used for each of the experiments of proximate analysis.

Parameter	Quantity (g)
Moisture	3.0
Ash	1.0
Protein	0.5
Fat	3.0
Fiber	3.0
Carbohydrate	3.0

Botany Department, Kohat University of Science and Technology, identified these plants.

Sample preparation

All samples were prepared then dried in an air-circulating oven in the laboratory and ground manually into a fine powder, using a manual grinder. The powder of each sample was sieved through mesh 300 µm and stored in an airtight cellophane bag as stock sample in a refrigerator until required for analysis. The moisture content of the leaf samples was determined at 60°C (AOAC, 1990). The dried matter obtained was ground to a fine powder and stored at 5°C in airtight containers prior to further analysis. For carbohydrate and energy values, Association of Official Analytical Chemists Washington, DC, USA (AOAC, 1990) method was followed, while for other proximate parameters the quantities used are given in Table 1.

Proximate analysis

The proximate analysis (moisture, fiber, ash, crude fats, proteins and carbohydrates) and energy content of the samples was determined, using the methods of the Hussain et al. (2010).

Metal analysis

The metal concentration of Cu, Mg, Mn, Pb, Na, Cd, Fe and Cr of the species and products was done using atomic absorption spectrometer (Perkin Elmer AA Analyst 700). The results were obtained while using a working standard of 1000 ppm for each of the species.

Statistical analysis

Means and standard deviations were calculated for three independent determinations for each variable except for total carbohydrate, which was simply obtained by difference. Correlation matrix was done using MS Excel 2003 version.

RESULTS AND DISCUSSION

The proximate compositions (on dry weight basis) and the calorific values of the samples studied are given in Table 2. The result of proximate analysis shows variant concentration/proportions of biochemical and other contents. The moisture content of each species was different. Looking at the overall percentage of moisture composition, it was highest in *S. eruca* (12.72 ± 0.02) followed by *F. indica (*11.13 ± 0.03), while other had comparatively lesser composition (Table 2). In case of ash contents, it was highest in *F. indica* (15.68 ± 0.08) followed by *W. coagulans (*14.24 ± 0.22) (Table 2). For energy values the results showed that *M. azadirachta* had the highest energy contents followed by *W. coagulans (*Table 2), while the rest of the other plant species had insignificant values. Looking at the overall results obtained from carbohydrate analysis, *W. coagulans and F. indica* had prominent levels as compared to other species (Table 2). While analyzing the protein contents, the results showed that *S. eruca and M. azadirachta* had highest concentration of protein value as compared to other species (Table 2).

The results of fat analysis showed that *S. erua* and *F. indica* had higher concentration as compared to other species (Table 2). Looking at the results obtained from fiber analysis, it was higher in *M. azadirachta* and *S. eruca* as compared to other species (Table 2). The highest calorific value of 332.01 kcal/100 g was recorded in *M. azadirachta,* followed by 327.57 kcal/100 g in *W. coagulans. S. eruca had* the lowest calorific value of 267.56 kcal/100 g. Moisture content, dry matter, crude protein, crude fat, ash, total carbohydrate and caloric value did not differ significantly at the 5% level. Autoclaving and cooking slightly increased the moisture level. Crude protein, crude fat and ash contents were decreased by autoclaving and were further decreased by cooking (Onyeike et al., 2002).

Looking at the correlation analysis of the selected parameters, it was found that similar parameter has high significant correlation while among other parameters the correlation is either non-significant or less significant or moderate relation (Table 3). Carbohydrate and ash, protein and fat, fat and moister showing positive or significant correlation and similar pattern for other parameters as well (Table 3). However, ash and protein, ash and fiber, fat and carbohydrates showed negative or non-significant correlation (Table 3).

ANOVA analysis

Two-way analysis of variance (without replication; ANOVA) was carried out to know the relation and variance of the proximate parameters and the results obtained therein against the selected species analyzed. The ANOVA analysis shows that the proximate parameters and the plants species have no or less interdependency (Table 4). While taking proximate parameters as factors, for almost all the plant species, there was insignificant factorial dependency of each of the parameter. However, taking in consideration the medicinal plant species against the proximate parameter,

Table 2. Proximate values of the selected medicinal plant species in their raw form.

Constituent	*S. eruca*	*M. azadirchta*	*W. coagulans*	*F. indica*
Energy value	267.56 ± 0.21	332.01± 0.08	327.57 ± 0.10	305.06 ± 0.17
Carbohydrate	18.28 ± 0.07	62.78 ± 0.01	65.43 ± 0.03	64.25 ± 0.30
Protein	42.72 ± 0.20	14.89 ± 0.13	11.3 ± 0.30	6.48 ± 0.15
Fiber	36.29 ± 0.1	45.44 ± 0.05	15.10 ± 0.09	18.69 ± 0.10
Fat	2.59 ± 0.03	2.37 ± 0.20	2.29 ± 0.09	2.46 ± 0.01
Ash	10.62 ± 0.09	11.09 ± 0.33	14.24 ± 0.22	15.68 ± 0.08
Moisture	12.72 ± 0.02	8.87 ± 0.01	6.694 ± 0.15	11.13 ± 0.03

Values are mean ± standard deviations of triplicate determinations.

Table 3. Correlation matrix of proximate parameters.

Constituent	Energy value	Carbohydrate	Protein	Fiber	Fat	Ash	Moisture
Energy value	1						
Carbohydrate	0.911204	1					
protein	-0.81418	-0.98106	1				
Fiber	-0.11133	-0.38408	0.484845	1			
Fat	-0.94427	-0.85149	0.75432	0.326385	1		
Ash	0.308564	0.648378	-0.76685	-0.88461	-0.38107	1	
Moisture	-0.88153	-0.73913	0.624777	0.311781	0.982181	-0.28121	1

Shows negative correlation.

Table 4. Summary of the ANOVA analysis.

Summary	Count	Sum	Average	Variance
S. eruca	7	387	55.28571	8920.905
M. azadirchta	7	474	67.71429	14063.57
W. coagulans	7	440	62.85714	14013.14
F. indica	7	421	60.14286	12085.14
Energy value	4	1231	307.75	875.5833
Carbohydrate	4	209	52.25	522.9167
protein	4	73	18.25	261.5833
Fiber	4	114	28.5	207
Fat	4	8	2	0
Ash	4	50	12.5	5.666667
Moisture	4	37	9.25	7.583333

the species also shows insignificant variation for each of the parameter (Table 5).

Metals analysis

The metals analysis of the medicinal plant species showed significant variation among different metals (Table 6). The results showed that *M. azadiarchta* had the highest concentrations of the metals like Cu, Mn, Cr and Fe while *S. eruca* contain higher concentration of Na as compared to the other plant species, similarly *W. coagulans* contains higher level of Mg as compared to other three species. 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 the Pb concentration, the suggested concentration in plant species is 2 to 6 mg/L (Broyer, 1972). However, the plant species under investigation carries very lesser level of Pb, which further clarifies their use as food supplement.

Table 5. Factorial variation of the ANOVA analysis.

ANOVA						
Source of variation	***SS***	***df***	***MS***	***F***	***P-value***	***F crit***
Rows	566.4286	3	188.8095	0.669726	0.581589	3.159908
Columns	289422	6	48237	171.1013	7.14E-15	2.661305
Error	5074.571	18	281.9206			
Total	295063	27				

Table 6. Metal concentration in the medicinal plants species.

	Concentrations (ppm)							
Specie name	**Fe**	**Cu**	**Mg**	**Mn**	**Cr**	**Cd**	**Na**	**Pb**
S. eruca	2.804	2.554	11.69	0.340	0.519	.037	39.549	0.418
M. azadirachta	3.917	7.210	16.819	0.378	3.797	.116	17.659	0.686
W. coagulans	1.695	4.042	31.509	0.323	3.637	.080	22.309	0.544
F. indica	2.013	0.307	10.459	0.192	0.016	.062	8.825	0.540

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