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Proximate and Nutrient Analysis of Selected Medicinal Plants of Tank and South Waziristan Area of Pakistan

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Abstract: Inhabitants of Tank and South Waziristan area of Pakistan are facing acute shortage of medicines and food. Purpose of this study was to evaluate the medicinal plants of the area for their nutrient and medicinal values and to recommend their preservation/propagation for medicinal and/or food purposes. The plants investigated were *Alhagi maurorum, Datura alba, Chenopodium album, Tecomella undulata, Withania coagulans and Berberis lycium.* The proximate parameters like protein, fat, fiber, carbohydrates, moisture contents, ash and energy values were obtained using Association of Official Analytical Chemists (AOAC) methods. Macronutrients (Ca, Mg, Na and K) and micronutrients (Fe, Cu, Zn, Cr, Cd, Pb and Ni) were analyzed by employing Atomic Absorption spectrophotometer. The study showed that *Datura album* has higher nutrient value than *Withania coagulans* and there exist a significant correlation among the results. Further, the plants were found to be useful for medicine and food purpose.

Key words: Proximate Analysis · Protein · Fiber · Macro- and Micronutrients · Tank · SWA

INRODUCTION

Market is full of synthetic drugs having high prices, severe side effects and affecting the ecology [1]. Whereas, the medicinal plants and the drugs derived from them are cheaper in cost, have lesser side effects and hence popular among the people [2]. According to a survey, 75-80% of the world's population relies over such plants as they are famous for healing several diseases and are considered as a healthy source for life [3-15]. Though, Pakistan has biodiversity in climate and in geographical situation and has valuable medicinal plants heritage, but its flora is neither properly explored for medicinal point of view nor for food value; in spite of the facts that medicinal plants are considered to be mostly rich in nutrients [16-24]. On the other hand the dwellers are victim of malnutrition and facing tremendous problems due to economic position of people, non-availability of standard drugs and food stuff in the area.

The prevailing situation has provoked us to analyze the bioactive plants with reference to micro and macronutrients and their food values. The following plants were selected for analysis based over their utility by natives as medicines and their reported bioactivity. *Chenopodium album* is antipyretic, antinociceptic, sperm immobilizing agent and hypertensive and is rich in iron contents [25-28]. *Tecomella undulata* has antifungal and antitermite, analgesic and anti-inflammatory property. It is used for the cure of syphilis, eczema and relaxant, cardio tonic and chloretic activities. Its leaves have oleanolic acid, ursolic acid and betulinic acid, compounds that are strong in prohibiting HIV [29-31]. Traditionally, *Alhagi maurorum* is used for gastrointestinal disorders, gastric ulcer and rheumatism [32-37]. *Withania coagulans* is used for treatment of diabetes mellitus and have antibacterial antifungal, anti-inflammatory, antitumor cardiovascular activity [28; 38-44]. *Berberis lyceum* is well known for its anti-inflammatory and immune-potentiating property [45]. The berbamine inhibits hepato-carcinogenesis and possesses anticancer activity [46, 47].

MATERIALS AND METHODS

Plants Collection: The plants were collected from Tank and South Waziristan region of Khyber Pukhtoon Khawa province, Pakistan in March–May 2008 and were

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identified by Prof. Dr. Muqarab Shah, Chairman, Department of Botany Hazara University, Mansehra. Specimen of each plant was deposited in the Herbarium of Botany Department, Peshawar University, Peshawar, KPK, Pakistan. The collected plant species, their family, botanical and local names are listed in Table 1.

Proximate and Chemical Analysis: Each collected plant sample was dried under the shade and was finely ground using an electric grinding machine (Model MX 491N, National) to raw flour separately. The analysis was then made using standard techniques provided by Association of Official Analytical Chemists (AOAC) [48].

The moisture contents were determined by drying the sample at 105°C in the oven up to constant weight. The crude protein value of the sample was assessed by determining total organic nitrogen using Micro-Kjeldahl's apparatus [49]. The crude lipids were extracted in petroleum ether at 40-60°C, using Sox-let apparatus and then evaporating the solvent up to dryness using rot-evaporator. For the estimation of the fiber contents, the dry outcome of lipid estimation was ignited and the ash contents were determined and taken as equivalent to fiber contents [2]. Carbohydrate contents of each sample were calculated using the difference method as stated below:

Carbohydrate (%) = 100- (moisture (%) + protein percentage (%) + lipid (%) + ash contents (%))

Whereas, the energy values of each sample was determined by using the following formula.

K calories/100 gm = 9 (crude fats (%)) + 4 (carbohydrates (%) + proteins (%))

Elemental Analysis: The plant was ignited to ash and the ash was dissolved in HCl to bring the ash in solution form. The macro- and micronutrients were then determined by using single beam atomic absorption spectrometer provided by Perkin Elmer; USA.

Statistical Analysis: Proximate and elemental analysis of each plant sample was carried out thrice for each parameter and the mean, standard deviation and standard error were calculated. Inter-element correlation was performed by using Statistical Package for Social Sciences (SPSS V.14).

RESULTS AND DISCUSSION

The proximate compositions and calorific values calculated over dry weight of the samples are displayed in Table 2. The moisture contents of the samples were 5.55% in *Berberis lycium* and 14.22% in *Datura alba.* Carbohydrates contents were highest among all the investigated parameters and were from 32.35% (*Withania coagulans)* to 92.65% (*Chenopodium album)* (Table 2). The low concentration of crude fat and ash was recorded in *Tecomella undulata* and in *Withania coagulans*; while the high contents were in *Datura alba* and *Chenopodium album* (Table 2). High value of protein and fiber were found in *Tecomella undulata* (18.32%) and *Chenopodium album* (15.21%), while the low contents were in *Withania coagulans* (4.51%) in *Alhagi maurorum* (3.33%). The highest calorific value was recorded in *Berberis lyceum* (485.70 Kcal/100g) followed by *Chenopodium album* (420.92 Kcal/100g) and *Withania coagulans* (261.33 Kcal/100g). The samples were found to be a good source of carbohydrates and to some extent of protein. The values obtained for all investigated parameters are in agreement with the values recorded in Microsoft Encarta Premium DVD 2009.

Elemental analysis of above six medicinal plants showed significant variation among macro- and micronutrients (Table 4). In case of macronutrients, out of all six reported species, *Datura alba* showed highest Ca contents (6329 mg/Kg) while *Tecomella undulata* (1321 mg/Kg) stood lowest. Similarly, highest concentration of Mg (45460 mg/Kg), K (14991 mg/Kg) and Na (895 mg/Kg) were found to be in *Chenopodium album, Alhagi maurorum* and in *Berberis lyceum,* respectively, while the lowest in *Alhagi maurorum* (1292 mg/Kg),

Table 1: Species collected for study with local name and families.

Species Name	Family Name	Local Name	Parts used	Status
Alhagi maurorum	Fabaceae	Thanda	Whole Plant	Wild
Datura alba	Solanaccae	Badalbangae	Seed/Whole Plant	Cultivated
Chenopodium album	Amaranthaceous	Batoo	Seed/Leaves	Cultivated/Wild
Tecomella undulate	Bigoniaceae	Rohida	Seed/Bark	Wild
Withania coagulans	Solanaceae	Paniry poda	Seed/Whole Plant	Cultivated/Wild
Berberis lyceum	Berberidaceae	Kashmal/ Ishkeen	Fruit/Roots bark	Wild

Table 2: Nutritional values of selected medicinal plant species*

Species Name	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fiber (%)	Carbohydrate (%)	Energy Values (Kcal/100g)
Alhagi maurorum	8.76 ±0.01	12.66± 0.02	6.56±0.02	4.88±0.01	3.33± 0.01	56.52 ±0.12	330.51± 0.01
Datura alba	14.22±0.02	6.58±0.00	12.10±0.19	16.49±0.01	9.21±0.09	65.64 ±0.06	290.40±0.21
Chenopodium album	9.13±0.31	21.15±0.03	15.21±0.00	3.92±0.02	7.58±0.07	92.65 ±0.02	420.92±0.30
Tecomella undulate	7.73± 0.01	4.52±0.03	9.44±0.06	2.52±0.11	18.3±0.01	74.08± 0.06	380.39±0.01
Withania coagulans	6.82 ±0.09	2.32±0.01	4.51±0.02	8.24±0.00	8.85±0.02	32.35 ±0.03	261.33±0.19
Berberis lycium	5.55± 0.00	7.75±0.01	7.67±0.03	5.32±0.01	13.5±0.20	46.99 ±0.23	485.70±0.35

*Values are the mean ± standard deviations of triplicate determination:

Table 3: Correlation matrix of proximate parameters

Parameters	Correlation Coefficient	p-value (extent of interdependency)	Status
Moisture Vs Ash	.13	.81 (>0.05)	Non-Significant
Moisture Vs protein	.54	.26 (>0.05)	Non-Significant
Moisture Vs Fat	.76	.07 (>0.05)	Strongly positively correlated
Moisture Vs Fiber	-.29	.57 (>0.05)	Non-Significant
Moisture Vs Carbohydrates	.39	.44 (>0.05)	Non-Significant
Moisture Vs Energy Value	-.46	.35 (>0.05)	Non-Significant
Ash Vs Protein	.67	.15 (>0.05)	Non-Significant
Ash Vs Fat	-.31	.55 (>0.05)	Weakly negatively correlated
Ash Vs Fiber	-.49	.35 (>0.05)	Non-Significant
Ash Vs Carbohydrates	.70	.11 (>0.05)	Non-Significant
Ash Vs Energy Value	.42	.40 (>0.05)	Non-Significant
Protein Vs Fat	.15	.84 (>0.05)	Non-Significant
Protein Vs Fiber	.03	.96 (>0.05)	Weakly positively correlated
Protein Vs Carbohydrate	.91*	.01 (<0.05)	Significant
Protein Vs Energy Value	.32	.54 (>0.05)	Non-Significant
Fat Vs Fiber	-.23	.66 (>0.05)	Non-Significant
Fat Vs Carbohydrate	-.21	.66 (>0.05)	Non-Significant
Fat Vs Energy Value	-.59	.24 (>0.05)	Moderately negatively correlated
Fiber Vs Carbohydrate	.08	.89 (>0.05)	Non-Significant
Fiber Vs Energy Value	.32	.45 (>0.05)	Non-Significant
Carbohydrate Vs Energy Value	.35	.50 (>0.05)	Non-Significant

Table 4: Concentration of Macro and Micro Nutrients of selected medicinal plant species in ppm (1ppm = 1mg)

Species Name	Ca	Mg	K	Na	Fe	Cu	Zn	Cr	Cd	Pb	Ni
Alhagi maurorum	2234	1292	14991	650	105.4	14.3	8.5	2.5	0.2	0.7	2.5
Datura alba	6329	20248	13535	190	80.2	8.3	95.8	4.6	1.5	2.6	1.4
Chenopodium album	4242	45460	10455	375	102.8	4.3	0.2	1.8	0.6	0.00	0.3
Tecomella undulata	1321	4021	3840	91	18.2	16.4	6.4	0.7	0.9	0.3	0.00
Withania coagulans	9260	35280	2450	125	98.8	2.2	40.2	0.6	1.4	1.9	1.8
Berberis lyceum	4621	3240	2640	895	76.2	0.6	25.5	2.8	2.1	0.4	2.2

Table 5: Descriptive Statistics

Parameters	Mean content	Std. Deviation
Moisture	8.71	3.00
Ash	9.16	6.82
Protein	9.25	3.89
Fat	6.89	5.06
Fiber	10.14	5.17
Carbohydrate	61.37	21.12
Energy value	361.50	83.97

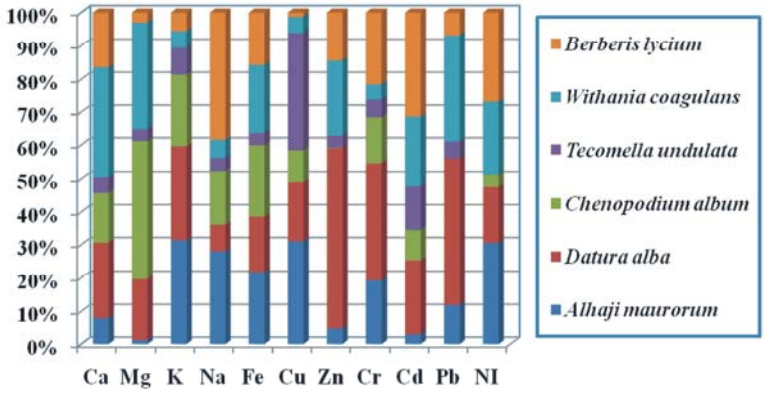

Fig. 1: Summary of the Macro &Micronutrients analysis of Medicinal Plants

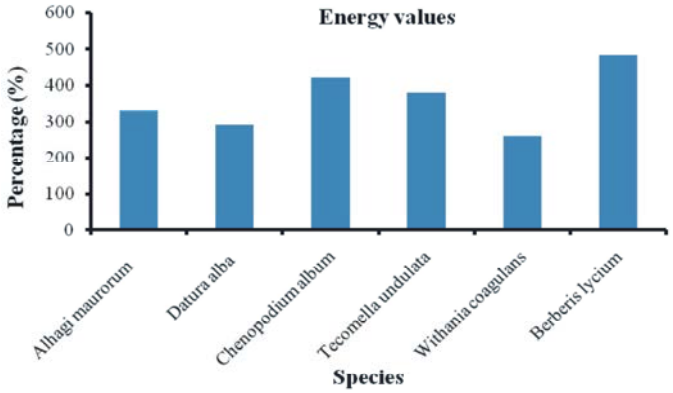

Fig. 2: Showing Energy value content in different plant species

Withania coagulans (2450 mg/Kg) and *Tecomella undulata* (91 mg/Kg). The results obtained for micronutrients analysis showed that the concentration level of Fe is extremely high in *Alhagi maurorum* as compared to *Tecomella undulate.* In case of Cu, it was highest in *Tecomella undulata* followed by *Alhagi maurorum.* Zn contents were highest in *Datura alba* (95.8 mg/Kg), followed by *Withania coagulans* (40.2 mg/Kg) and *Berberis lycium* (25.5 mg/Kg), which is in the expected range (25-150 mg/Kg) [50]. The other three species (*Alhagi maurorum, Chenopodium album* and *Tecomella undulata*) had below the stated range. The contents of Cr were below the toxic (10 mg/Kg) level in all the species while the contents of Cd, Pb and Ni were negligible (Table 3) [28].

We have also determined moisture, ash, protein, fat, fiber, carbohydrates contents and energy value of the investigated species. We simply calculated the bi-variable correlation co-efficient using the average for a replication of three observations (Table 3). We have tried to develop relationship between significance and non-significance value. It has been observed that there exists very strong correlation between carbohydrates and protein with a relationship value of 0.91. It can be therefore strongly concluded that the species having high contents of carbohydrate will also have high protein value. On the other hand, moderately negative correlation up to the extent of 0.57 was observed between fat and energy (Table 5).

CONCLUSION

Six medicinal plants *Alhagi maurorum, Datura alba, Chenopodium album, Tecomella undulata, Withania coagulans and Berberis lyceum* were investigated for their proximate analysis. The obtained results showed *Berberis lyceum* and *Datura alba* had highest carbohydrates contents among the investigated plants. The low contents of crude fat and ash were in *Tecomella undulata* (2.52%), *Withania coagulans* (2.32%); *Datura alba* (16.49%) and in *Chenopodium album* (21.15%). The high value of protein and fiber were in *Chenopodium album* (15.21%) and in *Tecomella undulata* (18.32%) while the low contents were in *Withania coagulans* (4.51%) and in *Alhagi maurorum* (3.33%). The highest calorific value was recorded in *Berberis lyceum*

(485.70 Kcal/100g). These results concluded that the plants are good source of carbohydrates and nutrients and up to some extent proteins.

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