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Full Length Research Paper

Proximate and nutrient analysis of selected vegetable species: A case study of Karak region, Pakistan

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Karak, an arid region, have limited water and land resources to cultivate various crops specially vegetables. However, a few seasonal vegetable are available to the local communities in meager quantities. The ash, carbohydrate, protein, moisture, fat, fiber contents, energy values and nutrient composition of eight vegetables' *Abelmoschus esculentus, Spinacia oleraceae, Praecitrullus fistulosus, Luffa acutangula, Allium sativum, Amaranthus viridus, Chenopodium album* and *Momordica charantia* were determined. Among these, *A. sativum, S. oleraceae* and *C. album* have the highest micro and macronutrients.

Key words: Proximate analysis, macro and micronutrients analysis, vegetable plants species, Karak, Pakistan.

INTRODUCTION

The increasing populations of the world food demands have overwhelmed the available land resources. Along with other food alternatives, vegetables are considered the cheep source of energy. Vegetables are very rich sources of essential biochemicals and nutrients such as carbohydrates, carotene, protein, vitamins, calcium, iron, ascorbic acid and palpable concentration of trace minerals (Prakash and Pal, 1991; Devadas and Saroja, 1980; Jimoh and Oladiji, 2005). These vegetables will continue to remain the basic source of energy for the developing countries (Camus and Laporte, 1976; Oyolu, 1980; Akwaowo et al., 2000).

District Karak is located in southern part of North West Frontier province (NWFP – Pakistan). It is an arid region, geographically located at 33° 07′ 12″N 71° 5′ 41″E (DCR, 1998). The land available for cultivation is only 3.32%. Most of the area is either sandy or covered with rough terrain of mountains which are rich source of coal, gas and salts (DCR, 1998). However, at places where water is available for irrigation, people are involved in small scale agriculture. The inhabitants mostly rely on the seasonal vegetables along with handsome amount of peanuts and pulses while meager amount of wheat is cultivated at patches.

Proximate and nutrient analysis of edible fruit and vegetables plays a crucial role in assessing their nutritional significance (Pandey et al., 2006). The considerable use of vegetable species by the local people in their diet motivated us to carry out the present proximate and nutrient analysis. The species includes; *Allium sati-vum, Praecitrullus fistulosus, Luffa acutangla, Amaran-thus viridus, Abelmoschus esculentus, Chenopodium album, Momordica charatia* and *Spinacia oleraceae*. The detail of each species is given in Table 1. Besides their usage as food item, these vegetable species are also exploited for their medicinal properties. Most of these species are utilized against various diseases by the local communities through their indigenous knowledge. The medicinal properties are given in Table 2.

These vegetable species were subjected to proximate and micronutrient analysis. In proximate analysis ash, carbohydrate, protein, fat, fiber, moisture and energy

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Table 1. Vegetables species, their details and status in the studied area.

Species	Family name	Local name	Parts used	Status
A. esculentus	Malvaceae	Bindi	Fruit	Cultivated
S. oleraceae	Chenopodiaceae	Saag	Leaves	Cultivated
A. sativum	Alliaceae	Lehson	Rhizome	Cultivated
P. fistulosus	Cucurbitaceae	Tenda	Fruit	Cultivated
M. charatia	Cucurbitaceae	Kareela	Fruit	Cultivated
L. acutangla	Cucurbitaceae	Thoriy	Fruit	Cultivated
A. viridus	Amaranthaceae	Ganhar	Leaves	Wild
C. album	Chenopodiaceae	Bathu	Leaves	Wild

Table 2. Medicinal uses of the vegetable species used by the local communities.

Species	Common name	Parts used	Uses
A. esculentus	Okra	Fruit	Demulcent, emollient and diuretic
S. oleraceae	Spinach	Leaves	As cooling agent and for vitality
A. sativum	Garlic	Rhizome	Bactericidal, aphrodisiac, bronchiodilator and antidiabetic
P. fistulosus	Squash melon	Fruit	-
M. charatia	Bitter guard	Fruit	Anthelmintic, stomachinc, antibilous, laxative, gout, rheumatism
L. acutangla	Ribbed Loofah	Fruit	Throat pain, fibers are to treat uterine bleeding
A. viridus	Amaranth	Leaves	Improves digestion, astringent
C. album	Goosefoot	Leaves	Laxative, anthelmintic, diuretic

values were analyzed while in essential nutrient's analysis; Cu, Ni, Pb, Co, Cr, Fe, Zn, Cd, Ca and Na were scrutinized.

MATERIALS AND METHODS

Plants collection

The eight vegetable species were collected from various areas of district Karak, NWFP Pakistan. The collected vegetables were packed in the Kraft paper and herbarium sheets were prepared. These vegetables were identified by a plant taxonomist of the Botany Department, Kohat University of Science and Technology, Kohat. The details of each plant species in respect of their local names, part used and collection areas are elaborated in Table 1.

Sample preparation

The study involved destructive sampling. The samples were washed under running water and blotted dry. The moisture content of the leaf samples was determined at 60℃ (AOAC, 1990). The dried matter obtained was ground to a fine powder and stored at 5℃ in air-tight containers prior to further analysis.

Proximate analysis

The proximate analyses (moisture, fiber, ash, crude fats, proteins and carbohydrates) of all the samples were determined. The moisture and ash were determined using weight difference method. Fiber content was estimated from the loss in weight of the crucible and its content on ignition. Carbohydrate was determined when the sum of the percentages of moisture, ash, crude protein, either extract and crude fiber were subtracted from 100. The nitrogen value which is the precursor for protein of a substance was determined by micro Kjeldahl method described by Pearson (1976), involving digestions, distillation and finally titration of the sample. The nitrogen value was converted to protein by multiplying a factor of 6.25. Carbohydrate was determined by difference method. All the proximate values were reported in percentage (AOAC, 1990; AOCS, 2000).

Macro and micronutrient analysis

The macro and micronutrients concentration of Cu, Ni, Zn, Pb, Co, Cd, Fe, Cr, Ca and Na of the eight selected vegetable species 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

Each experiment was repeated three times. The results are presented with their means, standard deviation and standard error. Correlation matrix was done using MS Excel 2003 version.

RESULTS AND DISCUSSION

Proximate analysis

The result of proximate analysis shows variant concentration/proportions of biochemicals and other contents. The moisture contents of each species are different.

Table 3. Result of the proximate analysis of the various vegetables.

Species	Moisture (wet)	Moistures (dry)	Ash	Fiber	Protein	Carbohydrate	Fat
A. esculentus	85.52 ± 0.02	7.259 ± 0.01	9.036 ± 0.01	14.71 ± 0.02	14.45 ± 0.02	62.05 ± 0.34	6.23 ± 0.01
S. oleraceae	90.62 ± 0.3	11.96 ± 0.01	23.97 ± 0.20	7.920 ± 0.02	23.74 ± 0.03	36.56 ± 0.04	3.79 ± 0.05
A. sativum	73.86 ± 0.01	7.24 ± 0.01	4.84 ± 0.08	1.86 ± 0.07	21.61 ± 0.01	57.28 ± 0.02	8.93 ± 0.06
P. fistulosus	94.84 ± 0.02	9.71 ± 0.12	10.05 ± 0.1	9.12 ± 0.04	15.41 ± 0.01	62.39 ± 0.07	2.21 ± 0.01
M. charantia	89.58 ± 0.3	8.06 ± 0.05	8.96 ± 0.01	16.62 ± 0.02	21.12 ± 0.08	56.02 ± 0.09	5.75 ± 0.09
L. acutangula	92.45 ± 0.05	10.25 ± 0.08	8.00 ± 0.08	10.25 ± 0.01	13.43 ± 0.06	66.05 ± 0.07	2.33 ± 0.1
A. viridus	92.95 ± 0.08	6.46 ± 0.22	22.84 ± 0.04	10.13 ± 0.05	16.41 ± 0.03	52.68 ± 0.9	1.83 ± 0.06
C. album	84.33 ± 0.01	12.21 ± 0.08	22.15 ± 0.09	9.76 ± 0.09	22.55 ± 0.03	41.58 ± 0.3	1.72 ± 0.01

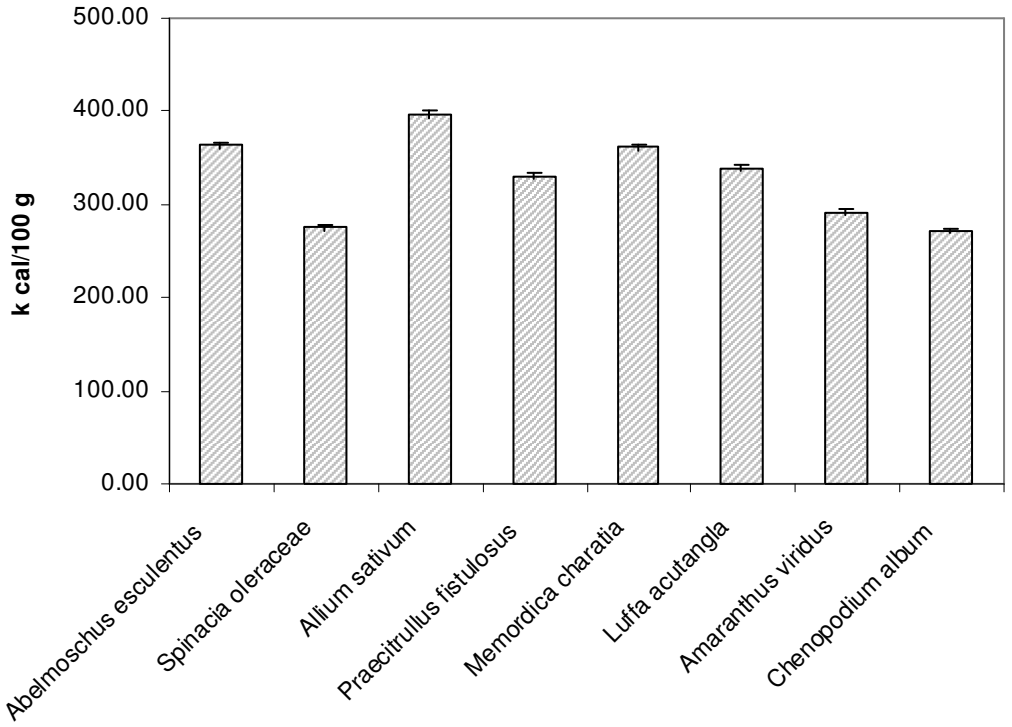

Figure 1. Energy values of the selected vegetable species.

Considering the overall percentage of moisture composition, it was highest in *P. fistulosus* followed by *A. viridus* and *L. acutangula* while other had comparatively lesser composition (Table 3). However, the moisture in dry condition was found more in *S. oleraceae* and *L. acutangula*. In case of ash contents, it was highest in *S. oleraceae* followed by *A. viridus* and *C. album* (Table 3).

Considering the results obtained from carbohydrate analysis, *L. acutangula* and *P. fistulosus* had prominent levels compared to other species (Table 3). From the results established after fat analysis, *A. sativum* had significant level of fat content followed by *A. esculentus* while rest of the species has lesser values (Table 3).

While analyzing the protein contents in the selected eight plant species, the results showed that *S. oleraceae* and *C. album* had highest concentration of protein as compared to other species (Table 3). Considering the resulted achieved from fiber analysis, it was high in *M. charantia* and *A. esculentus* compared to other species (Table 3).

According to the results revealed, *A. sativum* and *A. esculentus* had highest and significant level of energy values (Figure 1) while rest of the other plant species had minor values.

Considering 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

Table 4. Correlation matrix of the various parameters studied for the proximate analysis of selected plant species.

	Moisture (wet)	Moistures (dry)	Ash	Fiber	Protein	Carbohyd rate	Fat	Energy values
Moisture (wet)	1.0							
Moistures (dry)	0.2	1.0						
Ash	0.3	0.4	1.0					
Fiber	0.5	-0.1	0.0	1.0				
Protein	-0.4	0.4	0.4	-0.3	1.0			
Carbohydrate	0.1	-0.6	-0.8	0.2	-0.8	1.0		
Fat	-0.8	-0.5	-0.6	-0.2	0.3	0.2	1.0	
Energy values	-0.5	-0.6	-0.9	0.0	-0.2	0.7	0.8	1

Table 5. Micronutrient composition of the selected plants species (the concentration is given in ppm).

Species	Cu	Ni	Zn	Pb	Co	Cd	Fe	Cr	Ca	Na
A. esculentus	13.2	< 0.006	64.6	< 0.015	< 0.009	< 0.0008	45.2	< 0.003	11.9	175
S. oleraceae	10.8	< 0.006	42	< 0.015	< 0.009	< 0.0008	248.6	< 0.003	425	2
A. sativum	6.2	< 0.006	43.2	< 0.015	< 0.009	< 0.0008	22.8	< 0.003	12.7	39.5
P. fistulosus	14.4	< 0.006	48.6	< 0.015	< 0.009	< 0.0008	166	< 0.003	12.2	66.9
M. charantia	14	< 0.006	72.4	< 0.015	5	< 0.0008	139	< 0.003	16	45.47
L. acutangula	24.6	< 0.006	68.4	< 0.015	< 0.009	0.8	145	< 0.003	10.5	55.5
A. viridus	17.8	42.4	63.8	< 0.015	3.8	< 0.0008	419.4	< 0.003	39	458
C. album	18.4	< 0.006	61.6	< 0.015	9.8	0.6	1638	< 0.003	22	372.9

moderate relation (Table 4). Ash and fat showed negative or non-significant correlation while ash and protein showed moderate correlation (Table 4). Fat and carbohydrate showed significant correlation with energy values; however, the rest of the parameters showed non-significant or no correlation.

Micro and Macro-nutrients analysis

The micronutrients analysis of the vegetable species showed significant variation among different micronutrients (Table 5). In case of Cu, it was highest in *L. acutangula* followed by *C. album*. Fabulous concentration level of Fe was revealed in *C. album.* The level of Zn was highest in *M. charantia* while the concentration of Co was highest in *C. album*. In case of Cd concentration, *L. acutangula* had the highest among all the species (Table 5).

The remaining nutrients like Ni, Pb and Cr had negligible concentration levels (Table 4). It has been reported that for many plant species Cr proved to be toxic at 5 mg/l (Macnicol and Beckett, 1985). In this regard, all the studied vegetables 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 - 6 mg/l (Broyer et al., 1972); however, the plant species under investigation carries very lesser level of Pb, which further clarify their use as food supplement.

The Ca concentration in *S. oleraceae* is highest among all the vegetable species having 425 ppm concentration while *A. viridus* has the concentration of 39 ppm (Table 5). *S. oleraceae* is used chiefly by the local communities of the Kohat region. In case of Na, *A. viridus* has the highest concentration of 458 ppm followed by *C. album*, which has a concentration of 373 ppm (Table 5).

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Conclusion

Karak, an arid region, is bestowed with ample natural wealth of plant species. The local people depends on these species for food and medicines. To fulfill the nutritional needs of the local people various vegetable species are cultivated and collected from wild. The nutritional values of the eight vegetable species were analyzed for evaluation of proximate parameters. *A. sativum, S. oleraceae* and *C. album* have some of the highest micro and macronutrients.

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