The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 10, 2025

HEALTH-PROMOTING NUTRITIONAL AND ELEMENTAL ANALYSIS OF SELECTED VEGETABLES FROM BANNU DIVISION, KPK, PAKISTAN

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DOI: https://doi.org/10.5281/zenodo.17906523

Keywords
Nutritional Assessment, trace elements,

Article History
Received: 11 July 2025
Accepted: 21 September 2025
Published: 11 October 2025

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Abstract
Five vegetable species Cucurbita pepo, Capsicum annum, Solanum melongena, Abelmoschus esculentus and Spinacia oleraceae were assessed for their nutritional intensity using standard techniques for nutrient composition and trace element analysis. In proximate analysis, ash, moisture, fat, fiber, protein and carbohydrates were evaluated while Ca, Na, Cu, Ni, Zn, Pb, Co, Cd, Cr and Fe were appraised in micronutrients analysis using AOAC methods and atomic absorption spectrometric techniques. The species shown variable results in case of proximate analysis, however, Cucurbita moschata have revealed higher percentage of carbohydrate, fiber, and energy values.

INTRODUCTION

Numerals of intricate organic compounds are entailed by all human beings as added (*Encyclopaedia Britannica*, William Benton, 1972) caloric prerequisites to accomplish the requirement for their muscular bustle. Carbohydrates, proteins and fats form the key portion of the diet, whereas minerals and vitamins form somewhat a minor part. As

vegetables form main portion of our diet; so their nutritive value is imperative.

The affluent cause of vital biochemicals and nutrients such as protein carbohydrates, fats, vitamins, carotene, calcium, iron, ascorbic acid and obvious concentration of trace minerals are the various vegetables (Oladiji, 2005).

Besides these biochemicals, the moisture, fiber, ash contents and the energy values of individual vegetable species have also been regarded of importance to the human health and the soil quality McSweeney et al, 2005)

These vegetables will continue to stay behind the crucial source of energy for the developing countries (Akwaowo et al., 2000) and Pakistan is one of them.

Five vegetable species *Cucurbita pepo*, *Capsicum annum*, *Solanum melongena*, *Abelmoschus esculentus* and *Spinacia oleraceae* are cooked in various combinations and are used as food items by the home communities of the Bannu region (Table 1). These species are either cultivated at large scale or in household gardening. To be acquainted with the various nutritional parameters, these species were tested for their proximate analysis, and thus the findings are presented here.

MATERIAL AND METHODS

Plants collection

Entire parts of the selected five species were collected from Bannu division KPK 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. The details of each species, in respect of their local names, families, parts used, and medicinal uses are elaborated in Table 1.

Table 1.Local names and medicinal uses of vegetables

Species Name	Family Name	Local Name	Parts Used	Medicinal Uses
Solanum melongena	Solanaceae	Bengan	Fruit	Antihaemorroidal And hypotensive
Abelmoschus esculentus	Malvaceae	Bhindi	Fruit	Demulcent, emollient and diuretic
Spinacia oleraceae	Chenopodiaceae	Saag	Leaves	As cooling agent and for vitality
Cucurbita pepo	Cucurbitaceae	Kado	Fruit	Diuretic, nervetonic and vermifuge
Capsicum annum		Chilly	Fruit	Stimulate the appetite,encourage bowl movements and strengthen immune systems depleted by colds.

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 5 °C in air-tight containers prior to further analysis.

Proximate analysi

The nutrients (moisture, ash, crude fats, proteins and carbohydrates) of all the samples were investigated through (AOAC 1990) method. The moisture and ash were determined using weight difference method. Crude fat was extracted by means of the Soxhlet apparatus with petroleum ether (40-60 °C) for 8 hrs. Crude fibers by successive digestion of the defatted sample with 1.25 % sulphuric acid and 1.25

% sodium hydroxide solutions. 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. Carbohydrates were determined by different method. All the proximate values were reported in % (AOAC 1990; AOCS 2000).

Micronutrient Analysis

The micronutrients contents, namely Cu, Ni, Zn, Pb, Co, Cd, Fe and Cr of the selected five vegetable were determined 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.

RESULTS AND DISCUSSIONS

The result of the present study shows variant concentrations of nutrients. The carbohydrate contents of each of the species are different. If we look at the whole percentage of carbohydrate composition, it was maximum in *Cucurbita pepo* (16%) followed by *Solanum melongena* (15%), *Abelmoschus esculentus* (14%) while other had comparatively lesser composition (Table 2).

In case of protein content, *Spinacia oleraceae* has significant composition of 17% while *Abelmoschus esculentus* have 13%, *Solanum melongena* 12%,, *Cucurbita pepo* 9% and *Capsicum annum* 9% (Table 2) respectively.

In the same way *Solanum melongena* showed highest fat content (24.8%) than *Abelmoschus esculentus* (23.9%) while others had low fat contents respectively (Table 2).

While analyzing the fiber content of the vegetable species, *Capsicum annum* had 31.2% followed by *Solanum melongena* having 17.8% of the share. However, the other species, *Spinacia oleraceae*, *Abelmoschus esculentus*, and *Cucurbita pepo* had nominal percentage (Table 2).

According to the results revealed, *Solanum melongena* had highest (477.37%) and significant level of energy value as compared to other species (Table 2) while during the ash experimentation *Spinacia oleraceae* had prominent level (21%) of ash contents compared to other species (Table 2). Comparing the moisture content in dry vegetable species, the results showed that *Spinacia oleraceae* had 19.1% of moisture in dry form while *Solanum melongena* had 8.5% level of moisture compared to other species (Table 2).

In comparative assessment of the various species, the results showed variation in concentration of different species (Table 2).

Table 2. Nutritive value of selected vegetables from Bannu region

Plant species	Ash	Moisture	Protein	Fat	Fiber	Carbohydrate	Energy Values
Solanum melongena	8.78	2.89	14.34	24.81	13.55	49.18	477.37
Abelmoschus esculentus	8.83	3.96	16.17	23.94	10.88	47.1	468.54
Spinacia oleraceae	21.00	19.15	20.82	10.94	10.88	28.09	291.7
Cucurbita pepo	6.28	8.54	10.77	16.82	17.85	57.59	424.82
Capsicum annum	5.18	5.05	11.13	22.6	31.2	56.04	472.08

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 (Table 3). Ash and moisture, ash and fat, ash and fiber showing negative or insignificant correlation and similar pattern for another parameter as well (Table 2).

However, moisture (D) and fats and protein and fats have shown significant correlation (Table 2).

Table 3. Correlation matrix of proximate parameters

	Ash	Moisture (D)	Moisture (W)	Protein	Fat	Fiber	Carbohydrate	Energy Values
Ash	1							
Moisture (D)	-0.527	1						
Moisture (W)	0.166	-0.019	1					
Protein	0.209	0.473	0.354	1				
Fat	-0.660	0.851	0.150	0.694	1			
Fiber	-0.516	0.088	-0.359	-0.783	-0.282	1		
Carbohydrate	0.360	-0.279	-0.099	0.227	-0.208	-0.424	1	
Energy Values	0.418	-0.001	-0.002	0.797	0.287	-0.885	0.508	1

shows negative correlation

Micronutrients composition

The micronutrients analysis shows that *Abelmoschus esculentus* had the highest concentration of Cu, Ni, Zn, Pb, Co, Cd, Fe and Cr compared to other species (Table 3). It has been reported that for many plants species Cr proved to be toxic at 5 mg/l. In this regard, all the plants studied 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 clarify their use as food supplement. The positive impact of zinc supplementation on the growth of some stunted children, and on the prevalence of selected childhood diseases such as diarrhoea, suggests that zinc deficiency is likely to be a significant public health problem, especially in developing countries (Osendarp et al, 2003; Sian et al, 2002). According to FAO's food balance data, it has been calculated that about 20% of the world's population could be at risk of zinc deficiency. The average daily intake is less than 70 µg per day (Holt et al, 2004). Thus, *Abelmoschus esculentus* represents the highest value of Zn (Table 4). The findings stimulate recommendation on-farm cultivation on large scale to relieve the Zn deficiency.

Table 4.Elemental composition of selected vegetables.

	Micronutrients (ppm)							
Species Name	**Cu**	**Ni**	**Zn**	**Pb**	**Co**	**Cd**	**Fe**	**Cr**
Solanum melongena	15	<0.007	30	<0.013	<0.009	<0.0004	271	<0.002
Abelmoschus esculentus	14	<0.004	53	<0.018	3	<0.0008	367	<0.002
Spinacia oleraceae	11	<0.003	25	<0.011	2	<0.0003	330	<0.003
Cucurbita pepo	14	<0.003	33	<0.015	<0.007	<0.0008	28	<0.001
Capsicum annum								

Conclusion

Bannu region, where the canal irrigated area is very fertile, has bequeathed with abundant natural wealth of vegetable species. Local people depend on these species for food and for medicines. To fulfill the nutritional needs of the local people various vegetable species are cultivated. The nutritional values of the five vegetable species were analyzed using the standard AOAC methods for assessment of proximate parameters. Among the five vegetable species examined for nutrient analysis, *Solanum melongena*, *Abelmoschus esculentus* and *Spinacia oleraceae* proved to be scooped with trace nutrients while high level of proximate parameter.

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