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Phytochemical Analysis of Protein and Amino Acid Composition of Shade Dried Leaves of Some Wild and Cultivated Plant Species

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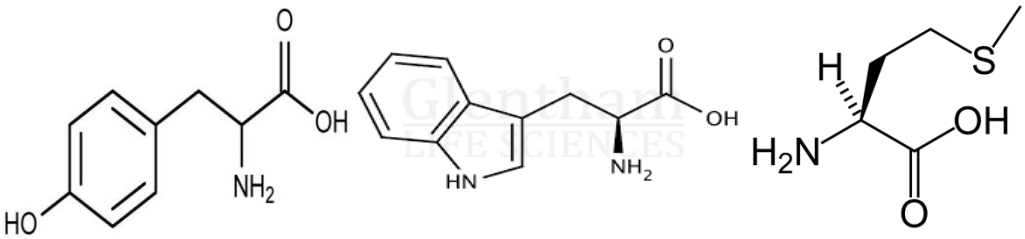
Abstract: ***The present study aims to evaluate the proximate composition of proteins (Crude as well as soluble protein) and some amino acids in shade-dried leaf samples. The photosynthetic active green foliage of grasses, legumes and other plants contains in general high amounts of proteins and amino acids. Protein is a food component that has functional properties that affect the properties of food products. In the present investigationshade driedleaves samples from seven different plant species viz. Berseem (Trifolium alexandrium L.), Alysicarpus vaginalis L. var. stocksii., Alternanthera paronychioides St. Hil., Cabbage (Brassica oleracea L. var. capitata), Radish (Raphanus sativus L.), Adulsa (Adhatoda vasica Nees.), and Bauchi (Psoralia corylifolia L.) were prepared and was assessed for proteins and amino acids. The prepared sample has 6-26% crude protein and 1-14% soluble protein. The amino acids like methionine and tryptophan range from 0.171-2.262 g / 16gN.***

Keywords: Protein, Amino acid, Leaves, Methionine, Tryptophan, shade drying

1. Introduction and Review of Literature

Green plant leaves are an excellent source of protein. The leaves of a few species mostly leafy vegetables are at present utilized by man. Phytochemical investigations have revealed diverse kinds of chemical constituents in various plants and have been enumerate as an inception of precious chemicals and some of them have been used as drugs. Abundant data demonstrated that protein is one of the most important nutrients in human and domestic animal nutrition (Altschul, 1958; Abbott, 1966; Milner, 1968).

They are particularly valuable as muscle and nerve builders, rather than as a source of energy. Protein is the most important aspect of nutrition in the human diet as it is connected with growth, maintenance and several other processes of life. The chief attribute of proteins are the presence of high nitrogen, sulphur and phosphorous content. The nutritive value of protein is explained by its digestibility as well as by the availability and amount of various essential amino acids. Amino acids are the building blocks of protein, which in turn represent the basic foundation of protoplasm.



(Proteins) (Amino acid-Tryptophan) (Amino acid-Methionine)

The proteins are the precursors in the formation of secondary metabolism molecules and these molecules were involved in cell signaling, gene expression, hormone synthesis, phosphorylation of protein and antioxidant capacity (Moran-Palacio et al.2014). The biological value of protein depends on the make-up of amino acids (Longeneker 1963). The dietary protein provides a metabolic reserve of amino acids from which new body proteins are synthesized. The consistent presence and proper composition of all the amino acids are the most important factor for the normal functioning and development of an organism. The deterioration in health status takes place if changes occur in the composition of amino acids (Agbadi et al.2017).

It was further stated that the content of amino acids and proteins would be increased if the leaf samples were subjected to different drying methods e. g. sun and shade drying (Gladys, 2011; Omah, etal.2022). The dehydration of leaf sample can is responsible for the concentration of a fair amount of proteins and amino acids (Sonkamble and Pandhure, 2017). The dried leaf sample can improve its shelf life without significantly altering the rich nutritional benefits of the vegetable (Abioye, et al.2014). Dried leafy vegetables

are generally tasty, nutritious, lightweight, easy to prepare, and easy to store and use (Oulai, et al.2016). In some of the southern countries, where populations do not provide refrigerators, the people of this region can preserve the vegetables by shade drying method (Acho, et al.2016). In light of all these published reports attempts were made in the present study to analyse the protein and some amino acid contents of dried leaves samples of different plant species.

2. Materials and Methods

During the present investigation, seven different plants viz. Berseem (*Trifolium alexandrium* L.), *Alysicarpus vaginalis* L. var. stocksii., *Alternanthera paronychioides* St. Hil., Cabbage (*Brassica oleracea* L. var. capitata), Radish (*Raphanus sativus* L.), Adulsa (*Adhatoda vasica* Nees.), and Bauchi (*Psoralia corylifolia* L.) were chosen as a protein source. These plant materials were authenticated at the Department of Botany, RTM Nagpur University, Nagpur. The plant material was collected early morning at one kg of green foliage and dried in a laboratory at room temperature i. e. by shade drying method.

The batches of freshly harvested green foliage were kept for drying in the morning and a decrease in weight was recorded every two days till these gave constant weight. These dried samples were pulverized and sieved through 65 mesh screens, packed in polythene bags and stored under a dry cool place until used for various biochemical analyses.

Quantification of Methionine and Tryptophan: The estimation of amino acids like methionine and tryptophan was done according to Sadasivam and Manickam (1996) from shade-dried leaf powder samples of selected plants.

Quantitative estimation of crude protein (CP): It was estimated by the Micro-kjeldahl method suggested by Davys *et al*. (1969).

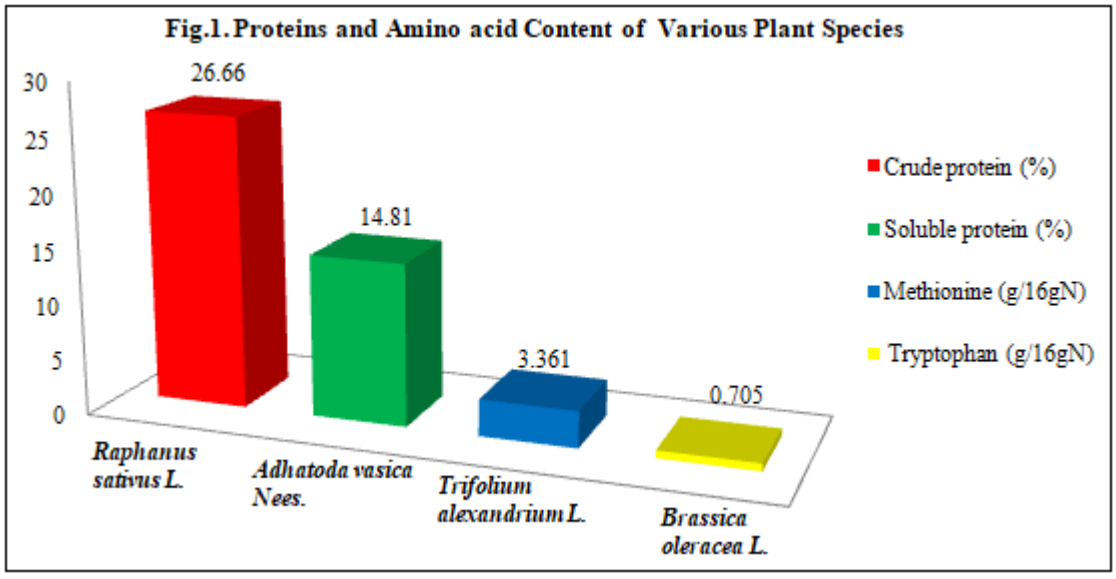
Protein estimation by Lowry's method: Protein estimation of dried leaf samples was done by following Lowry's method given by Sadasivam and Manickam (1996).

3. Results and Discussion

The Protein and amino acid composition of the shade-dried materials of selected plants were presented in Figure.1. and Table No.1. The maximum value for crude protein content was reported in *Raphanus sativus* L. (26.66%) and *Alternanthera paronychioides* St. Hil. (26.14%), soluble protein in *Adhatoda vasica* Nees. (14.81%). However, the minimum value for crude protein and soluble protein was reported in *Sorghum bicolar* L. (6.76%) and (1.90%) respectively. The remaining plant species show crude protein content in the range of 11-23% and soluble protein content in the range of 5-8%.

The data on amino acid content shows that the methionine content was found higher in Berseem (*Trifolium alexandrium* L.) and lower amount in *Alternanthera paronychioides* St. Hil. i. e.3.361 g /16gN and 1.167 g /16gN respectively, the remaining plant species shows the methionine content in the range of 1.279-1.980 g /16gN. Similarly, the value of tryptophan content was found to be maximum in *Brassica oleracea* L (0.705 g /16gN) and minimum in *Alternanthera paronychioides* St. Hil. (0.171 g /16gN). The remaining plant species exhibits the values of tryptophan between 0.176 g /16gN to 0.571 g /16gN.

Fig.1. Proteins and Amino acid Content of Various Plant Species



All the results obtained were statistically analyzed with software (Graph pad prism 4). The findings of the present study were compared with the available reports. It seems that the results obtained during the present investigation were comparable with the results reported by various workers.

FAO/WHO (1973) recommended the methionine requirement in food material as 2.20g/16gN. Gladys, (2011) reported the increased content of proteins in two vegetables i. e. *Amranthus aquatica* and *Telfairia occidentalis* by sun and shade drying methods. The *Amranthus aquatica* shows 6.47% (in sun-dried sample) and 5.50% (in shade dried sample) as compared to 3.50% content of protein in fresh leaves samples. Simillarly, *Telfairia occidentalis* shows

5.77% (in the sun-dried sample) and 5.44% (in shade dried sample) as compared to 4.70% content of protein in fresh leaves samples. Abioye, et al. (2014) reported significantly higher protein content in the shade-dried leaf samples of *Adansonia digitata L*. their results show that the shade-drying method is more efficient than other all drying methods. Oulai, et al. (2016) also reported higher values of protein content in the shadow/shade drying leaf samples of five vegetables i. e. *Amaranthus hybridus, Andasonia digitata, Ceiba patendra, Hibiscus sabdariffa* and *Vigna unguiculata* as against the raw leaf samples.

Acho, et al. (2016) studied the protein content in leaves of *Basella alba, Colocasia esculenta, Corchorus olitorius, Solanum melongena* and *Talinum triangulare*. The protein content of 15 days of dehydrated leaves was in the range of 9.13-19.05 g per 100 g. The protein content of 15 days of dehydrated leafy vegetables increased by 3 to 12-fold compared to the fresh samples. Sonkamble and Pandhure, (2017), also reported a higher amount of proteins in the shade-drying leaf samples of *Spinacia oleracea* (spinach), *Raphanus sativus* (Radish), *Rumex vesicarius, (*Chuka), *Vigna unguiculata* (cowpea) and *Cyamopsis tetragonoloba* (Guar) as compared to the sun-drying and oven-drying methods.

However, Garti, et al. (2018) is of opinion that the sun drying method retained more nutrients than shade drying of leaves when they compared their studies on drying methods in leaves of Hibiscus *cannabinus.* Achimugu and Emmanuel, (2021) also showed a higher content of proteins in shade dried leaf sample (16.2956%) as against the fresh leaf sample (4.855%) in *Vigna unguiculata*. Omah, et al. (2022), compared different drying methods such as sun drying, shade drying and blanched leaves and obtained higher protein content i. e.22.0%, 20.0% and 4.75% as against 4.50% in fresh leaves sample of *Bryophyllum pinnatum*.

4. Conclusion

All these results suggest that the considerable nutrient contents of shade-dried leafy samples make them good sources of food supplements to meet the nutritional requirements for animals as well as for the human population.

Conflict of Interests: The authors declare that there is no conflict of interest regarding the publication of this paper.

Table 1: Protein and Amino acid composition of shade-dried leaves samples of various plant species

Name of the Plants	Crude protein (%)	Soluble Protein (%)	Methionine (g/16gN)	Tryptophan (g/16g N)
Alysicarpus vaginalis L.	23.43	6.64	1.279	0.277
Trifolium alexandrium L.	21.66	5.22	3.361	0.254
Alternanthera paronychioides St. Hil.	26.14	5.83	1.167	0.171
Raphanus sativus L.	26.66	8.34	1.520	0.176
Brassica oleracea L.	11.03	5.55	1.560	0.705
Psoralia corylifolia L.	19.78	8.19	1.980	0.336
Adhatoda vasica Nees.	22.39	14.81	1.846	0.339
Sorghumbicolar L.	6.76	1.90	2.262	0.571
Mean	19.7	7.06	1.87	0.354
Std. Deviation	7.15	3.72	0.70	0.190
Std. Error	2.53	1.32	0.25	0.067
Coefficient of variation	36.22%	52.72%	37.51%	53.65%

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