

Proximate Constituents and Nutritional Value of Paddy Straw Mushroom (*Volvariella esculenta* (Mass) Sing.)*

G. KRISHNA MOHAN¹ and R. JEYARAJAN²

The proximate constituents of paddy straw mushroom (*Volvariella esculenta* (Mass) Sing.), in different stages of development were analysed to find out the nutritional value. The mature mushroom contained protein, crude fibre, crude fat, sugars, phenols, amino nitrogen and ascorbic acid. Its protein content was higher than the common vegetables. Though it contained four essential amino acids required for human nutrition, its food value in terms of calories was much lower than that of common vegetables.

The paddy straw mushroom (*Volvariella esculenta* (Mass) Sing.) is in great demand as a food delicacy in Southern India and its cultivation is extending at a fast pace. It has a better nutritional value than the white mushroom, *Agaricus bisporus* (Large) Sing. There are very few analytical reports on the proximate constituents of paddy straw mushroom, (Pilat, 1954; Zakia *et al.*, 1971 and Jeganathan, 1972). In order to find out the food value of *V. esculenta*, its proximate constituents were estimated in five stages of mushroom development, namely, tiny button, button, egg, elongation and mature stage and the results are reported.

MATERIALS AND METHODS

The reducing sugars, non-reducing sugars, total phenols and amino nitrogen contents were estimated colorimet-

rically by the methods described by Nelson (1944), Inman (1965), Bray and Thrope (1954) and Moore and Stein (1948), respectively. Crude fat was estimated by Sohlet's method (Anonymous, 1960). The estimation of crude fibre was done by the method of De (1965), protein by the modified biurette method (Alikhan and Youngs, (1973), ascorbic acid volumetrically (Ghosh *et al.*, 1966) and free amino acids by paper chromatography (Block *et al.*, 1955).

RESULTS AND DISCUSSION

The contents of moisture, protein, crude fat, crude fibre, ash, reducing sugars, phenols, amino nitrogen and ascorbic acid in five stages of development are presented in Table I. A careful scrutiny of the data revealed that the protein content was maximum in egg stages while the amino nitrogen

* Formed part of dissertation submitted by the senior author for the award of M.Sc. (Ag) degree to the Tamil Nadu Agricultural University, Coimbatore-3.

1. Instructor, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore-3.
2. Associate Professor (Plant Pathology) Fruit Research Station, Periakulam, Tamil Nadu.

TABLE I. Proximate constituents of *V. esculenta*

Constituents per 100 g fresh weight of mushroom	Tiny button	Stages			Elongation	Mature
		Button	Egg			
Moisture (g)	88.30	88.20	90.60		91.10	91.60
Protein (g)	1.90	1.41	2.67		1.96	2.42
Crude fat (g)	0.07	0.11	0.12		0.15	0.16
Crude fibre (g)	0.31	0.50	0.85		0.90	0.91
Ash (g)	0.80	0.59	1.15		1.15	1.20
Reducing sugar (mg)	16.10	28.80	24.00		16.10	49.20
Non-reducing sugar (mg)	7.90	25.20	3.60		4.30	14.40
Phenols (mg)	4.80	9.20	6.00		6.90	14.40
Amino nitrogen	67.20	91.20	66.00		81.00	80.90
Ascorbic acid (mg)	100.00	90.50	115.00		170.00	185.50

was maximum at button stage. The non-reducing sugars were maximum (25.2 mg) at button stage, while the contents of other constituents were maximum in the mature mushroom. There was 50 per cent increase in the content of ash, about two-fold increase in the content of crude fat, non-reducing sugars and ascorbic acid and about three-fold increase in the content of crude fibre, reducing sugars and phenols in mature mushroom over the tiny button stage.

In mature mushroom of *V. esculenta* the protein content was only 2.42 per cent as against 4.99 in *V. volvacea* (Pilat, 1954) and 2.25 to 3.9 in *V. diplasia* (Zakia *et al.*, 1971 and Jegathan, 1972). The crude fat in *V. volvacea* was 0.74 per cent as against 0.16 per cent in *V. esculenta* (Pilat, 1954). The content of crude fibre in *V. esculenta* was more or less the same as in *V. volvacea* and *V. diplasia*. The ash content of *V. esculenta* was 1.2

per cent in mature mushroom as against 0.76 to 1.46 per cent in other species of *Volvariella*. In *V. diplasia* (Jegathan, 1972) and *V. volvacea* (Pilat, 1954) a high content of sugars i.e. 1.44 to 3.32 per cent has been reported whereas in the present study the content of total sugars was only 0.063 per cent. So far, no report indicating the presence of phenols and amino nitrogen in the paddy straw mushroom is available in literature. These two constituents were present in all stages of mushroom development.

The number of known amino acids detected in tiny button, button, egg, elongation and mature stages was 8, 9, 10, 8 and 8, respectively. (Table II.) Arginine was present only in tiny button stage. An unidentified amino acid with Rf value of 0.72 was detected between valine and phenylalanine in the egg stage. Among the ten essential amino acids required for human nutrition, five viz., tryptophan, valine, phenylalanine,

TABLE II. Free amino acids present in different stages of mushroom development

Amino acids	Free amino acids mg/100 g of protein				
	Stage of mushroom development				
	Tiny button	Button	Egg	Elongation	Mature
Arginine	485.0	—	—	—	—
Cysteine	330.0	429.0	280.0	—	100.0
Proline	1600.0	199.0	2112.0	1250.0	—
Tryptophan	145.0	5.2	181.0	80.0	72.0
Valine	11.5	0.5	8.0	18.0	16.4
Phenylalanine	8.0	2.0	21.0	19.5	13.2
Nor-leucine	4108.0	1.5	19.0	25.5	20.0
Leucine	50.0	—	66.0	11.0	88.0
Ornithine	—	0.8	4.0	—	—
Histidine	—	1.6	8.0	11.5	—
Threonine	—	—	—	—	—
Glycine	—	—	112.0	70.0	60.0
Glutamic acid	—	—	—	—	156.0
Unidentified	0.72	0.72	0.58	0.74	0.72
(Rf value)			0.72		

leucine and proline were found to be present in tiny button, button, egg and elongation stages and only four viz., tryptophan, valine, phenylalanine and leucine were present in mature mushroom.

Zakia *et al.* (1971) reported high contents of phenylalanine, valine and tryptophan in *V. diplasia*. Six essential amino acids which they reported to be present in the protein of *V. diplasia* were absent in the mature mushroom. Methionine and isoleucine were absent in *V. volvacea* mushroom but leucine was present in all stages except in tiny button stage (Orillo and Carangal, 1961). Both methionine and leucine were deficient in protein of *V. diplasia* (Zakia, *et al.*, 1971).

Conflicting claims have been made regarding the nutritional value of mushrooms. In earlier days, many believed that the mushrooms had high protein content comparable to meat and fish. But others considered that their nutritional value was next to none (Singer, 1961). From the analysis of proximate constituents of this mushroom, it was found that its protein content was 2.42 per cent as against 0.4 - 1.9 per cent in common vegetables like cucumber, lady's finger, brinjal, tomato and potato (Gopalan *et al.*, 1971). Further, the mature mushroom contained four essential amino acids required for human nutrition. The calculated food value in calories was 8.33, 6.85, 13.86, 9.27 and 11.37 in tiny button, button, egg,

elongation and mature mushroom respectively. This indicates that egg stage provides the maximum calories followed by mature mushroom. But these figures are much lower than the calories supplied by the common vegetables which range from 13 in cucumber to 97 in potato (Gopalan *et al.*, 1971). Thus, it may be concluded that mushrooms are superior to many vegetables in their protein content but inferior to them as far as the calorific value is concerned.

The senior author thanks the Tamil Nadu Agricultural University, Coimbatore for according permission to publish the thesis submitted for the award of M.Sc. (Ag) degree in Plant Pathology and the Indian Council of Agricultural Research, New Delhi for financial assistance.

REFERENCES

- ALIKHAN, S.T. and C.G. YOUNGS. 1973. Variation in protein content by field peas. *Canadian J. Pl. Sci.*, 53 : 37-41.
- ANONYMOUS. 1960. *Official Methods of Analysis*, A.O.A.C., Washington D.C., pp. 832.
- BLOCK, R. J., E. L. DURRAM and G. ZWEIG. 1955. *A manual of paper chromatography and paper electrophoresis*. Academic press Inc., New York, pp. 710
- BRAY, H.G. and W.V. THROPE. 1954. Analysis of phenolic compounds of interest in metabolism. *Meth. Biochem. Analysis* 1: 27-52.
- De, S.K. 1965. *Practical Agricultural Chemistry*, Narayan Publishing Home, Allahabad, pp. 232
- GHOSH, A.K., S.N. BHARGAVA and R.N. TONDON. 1966. Studies on fungal diseases of some tropical fruits. VI Post-infection change in ascorbic acid contents of mango and papaya. *Indian Phytopath.*, 19 : 262-68.
- GOPALAN, R., B.V. RAMASASTHRI, and S.C. BALASUBRAMANIAM. 1971. *Nutritive value of Indian foods*. Indian Council of Medical Research, New Delhi, pp. 257
- INMAN, E.D. 1965. Quantitative sugar changes in barley infected with a facultative parasite. *Phytopathology*, 55 : 341.
- JEGANATHAN, G. 1972. Studies on Certain mutants of *V. diplasia* (Berk & Br) Sacc. Unpub. M.Sc. Thesis, submitted to the Annamalai University, pp. 243.
- MOORE, S. and W. H. STEIN. 1948. Photometric ninhydrin method for use in the chromatography of amino acids. *J. biol. Chem.*, 176 : 367.
- NELSON, N. 1944. A photometric adoption of somogyi method for the detection of glucose. *J. biol. Chem.* 153 : 375.
- ORILLO, C. A. and A. R. CARANGAL. 1961. Nitrogenous constituents of *V. volvacea*. *Philippine Agric.*, 45 : 29.
- PILAT, A. 1954. *Mushroom*, Bylamsterdam, Czechoslovakia.
- SINGER, R. 1961. *Mushrooms and Truffles*. Inter Science Publishers Inc., N.Y., pp. 652.
- ZAKIA, B., K.S. SRINIVASAN and N.S. SINGH. 1971. Essential amino acid composition of the protein of a mushroom *V. diplasia*. *J. Fd. Sci. & Tech.*, 8 : 180.