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Nutritional Evaluation of Milky Mushroom *calocybe indica*) grown on different substrates

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Abstract
Milky mushroom (*Calocybe indica*) is a potential new species to the world mushroom growers. This species is suitable for hot humid Climate and can be cultivated indoor at high temperature and high humid areas. Milky mushroom is gaining popularity among the edible mushroom because of its white attractive robust sporocaps highest ptotein content long self life and taste. This variety of mushroom can be cultivated easily at home without much expenditure. The different substrates were tested along and in combination with spent wheat straw (SWS) to determine the effect of substrates nutritional level on the nutritive value of fruiting bodies produced. Mushroom have attracted to attention of human from very ancient times and the use of mushroom is an old as human civilization. Mature fruit bodies are C. Indica contains high protein content (19.72%) it has 12 amino acids. Out of all amino acids glycine is predomiment and the essential acids like tryptophan, methionine and Lysine conteut in dry weight baris are 0.92, 0.93 and 7.86 (mg/ 100g protein).

Keywords: Milky mushroom, Protein essential Amino acids

1. Introduction
Milky mushroom is a alternative source of a protein for a predominantly vegetarian population of this country has to concentrate on a vegetable protein. Mushroom has been recognized by FAO as food contributing to the protein nutrition the countries depending largely on cereals. The quality of mushroom protein is for superior to the vegetable and is a good as a just inferior to animal protein. It is because all the essential amino acids are present is mushroom most abundant amino acid is lysine. Mushroom are rich in lysine and tryptophan can effective by supplement the cereals in terms of protein quality gain in body weight of mice fed on mycelia of P sajor-caju and P. Ostreatus has been reported other indices of protein quality like chemical score. Essential amino acids, biological value protein score and nutritional value index also been employed in mushroom.
Mushrooms are good source of many vitamins specially those of B complex group but are relatively poor in fat soluble vitamin A, D, E and K. Amongst B Complex vitamin mushrooms are specially rich in thiamine (B) riboflavin (B2), niacin and biotin folic acid and vitamin B12, which are generally absent in plant feeds are present in mushroom though a small quantities. As little as 3 grams of fresh mushrooms may provide the recomended daily intabe of vitamin B12.
As a few calories high protein diet with almost no starch and sugars, mushrooms are the delight of diabeties due to high K: Na ratio. Few calories and low fat (rich in linoleic acid and lacking cholesterol). Mushroom are the choice of the dietician for those suffering with obesty hypertension and atherosclerosis (heart disease). Alkaline ash and high fibre content make them suitable for those suffering from hyperacidity.

Materials and method
The present experiment were carried out in mushroom cultivation rooms and research laboratory of the Department of plant Patnology and Biochemistry, N.D. University of Agriculture and Technology Kumarganj, Faizabad during 2006-2007 and 2007-2008. The treatment comparise 10 level of straw in which 1-5 levels are pure different Straw are 6-10 levels are Different pure straw with SWS (spent wheat straw).

Protein content-
The content of protein in dried fruiting bodies was determined by lowry's (1951) method depending on the quantitating colour obtained from the reaction of protein with folin's reagent.

The colour thus obtained was due to section of alkaline copper reagent with protein by reduction of phosphomolybdic and phosphotungstic acid by tyrosine and tryptophan present in protein.

Amina Acid content

Tryptophan content of fruiting bodies was determined by the method of Spies and Chamber (1959) [27]. Methionine content in dried fruiting bodies was analysed by using the method described by Horn *et al*. (1946) [16]. Lysine content was estimated by the method of Felker *et al* (1978).

Three types and non-reducing sugars were estimated separately using standard methods. The total sugar content was determined by the method of Dubois *et al* (1956) [8] wing phenol seagent. Reducing sugar content was determined by the method of Miller (1959) [27].

Non reducing sugars were obtained by subtraction of reducing sugar from total sugar.

Non reducing sugar= Total sugar- Reducing sugar

Fat content estimated by Soxhlet method is based on the extraction of fat using non polar solvent (petroleum ether 40-60bp) as given by AOAC (1970).

Result and Discussion

Protein content of milky mushroom (*Calocybe indica*)- Data on protein content of milky mushroom grown on different substrates have been given in under table no.1 the range of protein content in different substrates have been found from 17.76-19.72% and 17.82-19.65% during 2006-07 and 2007-08 respectively. The maximum protein content was found in T1 (19.72, 19.65%) followed by T5 (18.82, 18.86%) and T6 (18.79, 18.84%) treatment, while minimum protein content was recorded in (T8 17.76, 17.33%) Treatment. How ever significant difference was observed in all treatments regarding protein content of milky mushroom during the both years of experimentation.

The maximum protein content was obtained in T1. The protein synthesis in mushroom depends upon the number of factors including invironmental condition such light, temperature and water availability during fruiting bodies formation. Highest protein content was found in T1 treatment followed by T5 may be due to the digestibilily of straw which improved by the treatments of alkali. This breaks ester bonds between the lignin and cell wall polysaccharide making the nitrogen more available. It increase in crude protein content of milky mushroom as given by Chesworth *et al*. (2000) [5]. The increasing content of peotein due to the amino acids composition which vary in different substrates. Upto 50% of the protein in made up of RUBISCO enzyme. This enzyme is responsible the fixation of carbon dioxide in photosynthesis minimum protein content was reported in T8 may be due to less availability of nitrogen because of the application of spent wheat straw and pigeon pea straw. The nitrogen from there substrates may be les available of the fruiting bodies of milky mushroom on suggested by Chesworth *et al* (2000) [5]. Desai and Khanvilkar (1977) [7] also reported and increased in various enzymes involved in nitrogen protein and cobohydates metabolism.

Amino acids (Tryptophan, methionine and lysine content (mg/100g protein)-

The tryptophan content in all the treatments of milky mushroom on dry weight basis have been presented in under table no.1. Tryptophan content varied from 0.53-0.93 mg/100g protein and 0.58-0.90mg/100g protein during years 2006-07 and 2007-08 respectively.

Table 1: Protein and essential amino acids in milky mushroom.

Treatments	Protein content in milky mushroom on dry weight basis (%)		Amino acid content (mg/100g protein) 2006-07			Amino acid content (mg /100g protein) 2007-08		
	2006-07	2007-08	Tryptophan	methionine	lysine	Tryptophan	methionine	lysine
T1	19.72	19.65	0.92	0.93	7.86	0.90	0.96	7.92
T2	18.38	18.45	0.63	0.72	7.28	0.67	0.76	7.38
T3	17.88	17.82	0.58	0.68	7.15	0.61	0.72	7.33
T4	18.62	18.69	0.67	0.79	7.56	0.72	0.81	7.62
T5	18.82	18.86	0.82	0.81	7.65	0.83	0.84	7.74
T6	18.79	18.84	0.70	0.83	7.74	0.75	0.86	7.79
T7	18.31	18.38	0.54	0.69	7.17	0.61	0.72	7.19
T8	17.76	17.33	0.53	0.63	7.09	0.58	0.68	6.96
T9	18.48	18.59	0.61	0.71	7.46	0.65	0.75	7.38
T10	18.62	18.78	0.66	0.75	0.56	0.70	0.79	7.47
CD at 5% level	0.463	0.840	0.048	0.045	0.359	0.05	0.08	0.429

Maximum tryptophan content was recorded in T1 0.92-0.90 (mg/100 protein) followed by T5 (0.82, 0.83 mg/100 protein) T6 (0.70, 0.75 mg/100g protein) and T4 0.67, 0.72mg/100 protein). Minimum content of tryptophan was observed in T8 tryptophan content has got a fundamental sole in the biosynthesis of nicotinamide (vitamin B6) as well as in other metabolic process (Karlson 1968). Tryptophan being an essential amino acids is a precussor of auxin indole acetic acid. It acts in the metabolism as an activator of several enzymes such as carbonic anhydrase and alcohol dehydrogenase. The variation in tryptophan content was found due to nitrogen present in various substrates. Since nitrogen in a structural components of any amino acids therefore it may leads to increase in the synthesis of tryptophan. The presence of max. Amino acids content in T1 and T5 may be due to low activity of peroxidase enzyme which oxidise hydrogen peroxide amides and phenols. The similar range of tryptophan content was also reported by Gupta and Khanna (2002) [12]. They have also reported that mushroom grown on different substrates are rich in lysine and tryptophan the two amino acids which are. Lucking in cereals. Our results are in agreement to reddy and push pamma (1986) [22]. The results are well supported by Thakur *el al* (2006), Sharma *et al* (2000) and Upadhyay (1993) [29, 5] in mushroom species.

Methionine Content

The range of methionine content grown on different substrates of milky mushroom have been found from 0.63-0.93mg/100g protein and 0.68-0.96mg/100g protein during 2006-07 and

2007-08 respectively. The highest methionine content was exhibited in T1 (0.93-0.96mg/100g protein) followed by T6 (0.83, 0.86mg/100g protein) T5 (0.81, 0.84mg/100g protein) and T4 (0.79, 0.80mg/100g protein) lowest content of methionine was noticed treatment T8 (0.69, 0.68mg/100g protein). However significant differences was observed in all the treatments of milky mushroom regarding methionine content grown during both the years of experimentation. Methionine is a sulphur containing amino acid and involved in number of biochemical transmethylation reactions of vital significance in biological system. The variation in methionine content of mushroom grown on varius substrates varied due to transmethylation reaction which leads to formation of different amino acids. The similar range of methionine content grown on different substrates were also observed by Gupta and Khanna (2002) and Li and Chang (1982) [12, 17] similar observation were also reported by Cagam Pang *et al* (1966) [6].

Lysine Content in dry fruiting bodies were found in the range of (7.09-7.86mg/100g) and 6.76-7.92mg/100g) during 2006-07 and 2007-08 respectively. Maximum lysine content was recorded in T1 (7.86, 7.92mg/100g followed by (7.74, 7.79mg/ 100g protein) T5 (7.65, 7.74mg/100g) and T4 (7.56 - 7.62mg/100g protein) minimum lysine was recorded in T8 (7.09, 6.96mg/100g protein) all the treatments were found significant regarding lysine content grown on various substrates except treatment T8.

Lysine is a basic hydrophelic and essential amino acid which is involved in number of enzymatic reactions as given by Talwar and Srivatava (2003) [30]. High content of protein in mushroom also increased the lysine content of amino acids as it known that mushrooms are rich in lysine and tryptophan content as given by Gupta and Khanna (2002) [12]. The findings obtained in this study are in accordance with those reported by Thakur and Yadav (2006), Sharma *et al* (2006) and Upadhyay (1993) [29, 24] in mushroom species.

Total sugar content in all the treatments of milky mushroom on dry weight basis have been presented in table no.2. The total sugars content were ranged from 4.63-5.93% and 4.80-5.90% during 2006-07 and 2007-08 respectively. Maximum total sugars content was recorded in treatment T1 (5.93, 5.90%) followed by T5 (5.40%) T2 (5.35%), T6 (5.30%) and treatment T10 (5.44%) during 2006-07 while T5 (5.51%) T2 (5.48%) T10 (5.46%) and T6 (5.44%) during 2007-08. respectively. Minimum total sugar content was recorded in all the treatment regarding total sugars content of milky mushroom during both of the years of experimentation. Maximum total sugars content was found in T1 followed by T5 and T10. The result on this aspects are in conformity with Bano (1967) and Bajaj *et al* (1996) [3, 2]. The highest concentration of total soluble sugars was noticed in pinhead stage which decreased with the fruiting body development (Rai *et al* 1990) [20], Carbohydrate fracrion of Agaricus bisporus is reported to contain a large number of compounds like pentose methyl pentose, hexoses, disaccharides, amino sugars and sugar alcohol, reported by Holtz and Schistler (1971) [15]. Among sugars trehlose (Mushroom Sugar) and sugar alcohol mannitol have been demonstrated to play a key role in fruiting bodig formation and development in Agaricus bisporus as given by Hammond (1986), Gupta and Kappoor (1990), Singh (2002) and Srivastava (1996) [14, 13, 12, 28].

Reducing sugar content in each treatments ranged from (2.16-2.98%) and 2.24-3.05% during 2006-07 to 2007-08 respectively. Maximum reducing sugar content was recorded in T1 (2.98, 3.05%) followed by T6 (2.88, 2.99%) T5 (2.63, 2.75%) and T10 (2.49, 2.60%) similar range of reducing sugar were also reported by Gupta and Kapoor (1990), Singh (2002) and Srivastava (1996) [13, 12]. The results arte agreement with Bano (1967) and Bajaj *et al* (1976) [3, 2]. The highest concentration of reducing sugar was noticed in pin heads stage which decrease with the fruiting bodies development Rai *et al* (1990) [20].

Table 2: Sugars (Total sugar, Reducing sugar and Non- reducing sugar content) in milky mushroom on dry weight bases (%)

Treatments	Sugar content (%)						Fat content (%)	
	2006-07			2007-08			2006-07	2007-08
	Total sugar %	Reducing sugar %	Non seducing sugar %	Total sugar %	Reducing sugar %	Non seducing sugar %		
T1	5.93	2.98	2.95	5.90	3.05	2.85	4.62	4.50
T2	5.35	2.43	2.92	5.48	2.50	2.98	4.11	4.15
T3	4.79	2.30	2.49	4.95	2.36	2.59	4.01	4.09
T4	5.18	2.54	2.64	5.33	2.61	2.70	4.23	4.28
T5	5.40	2.63	2.77	5.51	2.75	2.76	4.29	4.35
T6	5.30	2.88	2.43	5.44	2.94	2.50	4.34	4.38
T7	5.17	2.27	2.90	5.28	2.39	2.89	4.05	4.06
T8	4.68	2.16	2.52	4.80	2.24	2.56	3.90	3.95
T9	5.20	2.31	2.89	5.27	2.45	2.82	4.12	4.17
T10	5.28	2.49	2.79	5.46	2.60	2.86	4.19	4.22
CD at % level	0.478	0.165	0.485	0.590	0.425	0.516	0.92	0.91

Maximum non seducing sugar was achieved in T1 (2.95%) during 2006-07 and in T2 (2.98%) during 2007-08 followed by T7 (2.90, 2.89%) T10 (2.79, 2.86%) and T5 (2.77, 2.76%) during both the yrears. The highest concentration of Non seducing sugar noticed in pinhead stage which decrease. With the fruiting body development Rai *et al* (1990) and Bisasia *et al* (1987) [20, 4] have also reported that total sugar content, Reducing sugar content and Non reducing sugar of the substrates used for the cultivation of mushroom influence. The above sugars of the fruiting bodies because the sugar present in various substrates are taken up by the mycelium and translocated into the fruiting bodies which may be possible reason for variation in the sugar content of milky mushroom grown on different substrates. Maximam fat content (%) was noticed in T1 (4.62, 4.50%) followed by T6 (4.34, 4.38%) T5 (4.29, 4.35%) and T10 (4.19, 4.22%). It is well known fact that mushroom contain very low fat content as observed in various treatments given by Crisan and Sands

(1978) the fat content of mushroom includes all the classes of lipid compounds including free fatty acids mono, di triglycerides sterols esters and phospholipids mushroom also contain high postion of unsaturated fatty acid with no cholestesol used three may be regarded as health food Chesworth *et al* (2000) [5]. Similar results among the strains of mushroom were also reported by Shukla (2006) [25] in milky mushroom and Geda and Joshi (2006) and Bajaj *et al* 1996 [11, 2] in mushroom variety.

References

1. AOAC. Official methods of analysis "Association of Official Analylical Chemist" Washinton D.C. 20044 9th edition. 1970.
2. Bajaj M, Vadnera S Soni, GL, Khanna PK. Nutritional evaluation of P Florida. An International Journal of mushroom research and Devlopment. Mushroom Society of India. Solan 1996;5(5):101-104.
3. Bano Z. Studies on mushroom with particular references to caltivation and submerged propagation of P. flobellatses. Ph.D. Thesis. Uni. of Maysore India. 1967.
4. Bisaria R, Madam M, Bisaria VS. Mineral content of mushroom, plurotus sajor caju cultivation on different agro water. Mushroom J. Tropics 1987;7:53-60.
5. Chesworth. JM, Stuchbury T, Scafe JR. I.N An introduction to Agrcultural biochemistry, Chapman and Hall Publication, New Yark 2000, .348
6. Champang GB, Cruz LJ, Espirlu SG, Santaga RG, Juliano BOP. Studies on the extraction and composition of rice protein, cereal chemistry 1966;43:145-155.
7. Desai BB, Khanvilkar SGK. Improvement of protein quality and nutrional composition of Bangal gram 1977.
8. Dubois M, Chillies RA, Hamelton JK, Rabess PA, Amith F. Annl chem. 1956;28:350.
9. FAO. "Food composition table for use in East Asia" food policy and mutr div food agric organ UN. Rome 1972.
10. Felker C, Libanurka CK, Wainer G. Crop Sci, 1998;18(3):489-490.
11. Geda AK, Joshi PK. nutritional quality of mushroom Emerging areas in mushroom diversity production and post Harvest development I.G.A.U. Raipur 2006, 55-56.
12. Gupta M, Khanna YP. Natritional value of mushroom J. Res. S.K. U.A.S.T. J. 2002;1(2):96-108.
13. Gupta Savita, Kapoor VP. Carbohydrate analysis of some edible mushroom veg Sci 1990;17(2):227-229.
14. Hammond JBW. Carbohydrate and mushroom growth mushroom J 1986;165:315-321.
15. Holtz RB, Schislor LC. lipid metabolism of agaricus bisposus (large) sing Analysis of sporphore and mycelial lipids lipids 1971;6(3):176-180.
16. Horn JM, Jones DB, Blum AE. Colorimetric determination of methionine in protein and food J Bio Chem 1946;1(16):313.
17. Li GSF, Chang ST. Nutritive value of V. Volvacea in tropical mushroom biological nature and cultivation methods (Chang S.T. and Quimio T.H. Eds). The Chinees Uni press Hong Kong 1982;199-219.
18. Lowery OH, Rosebasough NJ. Fars AL, Randall R.J. Protein measurment with follins phenol reagent J. Biol chem 1957;193:265-275.
19. Miller GL. Use of dinitro salicylic acid reagent for determination of reducing sugar. Chem 31:426-428.
20. Rai RD. Upadhyay RC, Sexena S. Protecin amino acids and sugar during fruit body development P. Citrinopileatus Indian J. Mushroom 1990;16:35-38.
21. Ramsbottom J. Mushroom and toadslool Collins 14th james's place London 1953, 3-4.
22. Reddy MV, Pushpamma P. Effect of storage an amino acids and biochemical quality of protein in different varieties of rice and sorghum. Nutrition reports 9th 1986;33(1):703.
23. Sharma SR, Upadhyay RC. Scope and cultivation of specially mushroom in india. Recent advance in the cultivation technology of edible mushroom N.R.C.M. Chambaghat Solan 2002, 229-243.
24. Sharma VP, Sharma SR, Kumar Satish. Comparative studies on substrates treatment method for cultivation of *calocybe indica* J. of mycologist plant pathology India society of mushroom 2006;36(2):145-148.
25. Shukla CS. Advance in production technology of milky mushroom C. Indica. In Emerging areas in mushroom diversity production and post harvest development compendium of lectures Thakur M.P. Shukla C.S. and Saxena R.P.I.G.A.V. Raipur 2006, 26-32.
26. Singh A, Pandey S, Gupta OP. Singh and Pandey S. Nutrient Status of different pasts of mushroom J.N.K.V.V. Research Journal 2002;36:104-105.
27. Spies JT, Chamber DC. Chemical determination of tryptophan in protein's Analytical chem.1959;21:1249.
28. Srivastava DK. Stuies on oyster mushroom C.P. citrinopileatus M.S.C. thesis Narendra Deva Agril Uni Fzd. 1996.
29. Thakur MP, Yadav V. Modern technologies of caltivating paddy straw mashroom in a commercial scale Emerging areas in mushroom diversity. Production and post harvent development indira Gandhi Agil Uni. Raipur 2006, 11-12.
30. Talwar GP, Srivastava LM. In textbook of biochemistry and human biology prentice hall of India New Delhi 2003, 48-50.