INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-5, Issue-1, Jan-Mar-2015 Coden: IJPAJX-USA Copyrights@2015 ISSN-2231-4490
Received: 20th Dec-2014 Revised: 9th Jan-2015 Accepted: 10th Jan-2015
Research article

AMINO ACID, FATTY ACID AND MINERAL PROFILE OF MUSHROOM *LENTINUS POLYCHROUS* LÉV. FROM WESTERN GHATS, SOUTHERN INDIA.

Ravikrishnan V[a], Prashantha Naik[a], Sanjeev Ganesh[b] and Madaiah Rajashekhar[a*]

[a]Department of Biosciences, Mangalore University, Mangalagangothri-574 199, Karnataka, India.
[b]Microctron Centre, Mangalore University, Mangalagangothri-574 199, Karnataka, India.
*Corresponding author: profmrajashekhar@yahoo.co.in

ABSTRACT: The mushroom namely, *Lentinus polychrous* Lév. (on dead wood) collected from the Western Ghat Forests of Southern India was subjected for amino acid, fatty acid and mineral analyses. A total of 17 amino acids were detected in the mushroom sample. All the essential amino acids were present, of which glutamic acid was predominant. The non-essential amino acids content of the mushroom includes alanine, aspartic acid and serine. In the case of fatty acids, ten components were identified, among them linoleic acid, palmitic acid and oleic acids were found to be the major ones. Atomic absorption spectrophotometric analysis indicated that the mushroom is a rich source of minerals namely, sodium (37.7±0.35 mg), potassium (104 ±0.76 mg), magnesium (177±0.0 mg), phosphorous (31.0±0.36 mg) and calcium (90.6±0.32 mg) per 100g.
Key words: *Lentinus polychrous* Lév. Mushroom, amino acid, fatty acid, minerals.

INTRODUCTION

Since time immemorial mushrooms are being used for food and medicinal purposes by humans. According to Romans, mushrooms are considered as 'Food for Gods'[1].The importance of mushrooms lies in its consumption as food, in pharmacology as medicine and also it has gained lot of importance as an item of commerce all over the world [2].The demand of mushrooms as food supplement is increasing as the nutritional and therapeutic values of mushrooms are known [3]. Several studies have been carried out on the chemical composition and nutritional qualities of different species of mushrooms [4, 5]. The wood decaying *Lentinus* species are edible as these contains significant amount of proteins, lipids, fats, minerals and vitamins [6]. The mushroom, *Lentinus polychrous* Lév. is edible and commonly consumed in north eastern and northern regions of Thailand [7]. The present study was to investigate the amino acid, fatty acid and mineral contents in *Lentinus polychrous* Lév.

MATERIALS AND METHODS

Lentinus polychrous Lév. was collected from the Agumbe forest (13°.50" N, 75°.09" E) of Western Ghats of Karnataka in the month of November 2012. Mushroom samples were washed thoroughly to remove debris as well as mud, cut into small pieces and dried at 60ºC in hot air oven. The dried sample was ground to fine powder and stored at –20ºC for further analysis.

Amino acid analysis

Amino acid analysis was performed by High Performance Liquid Chromatography (HPLC) [8]. Dried mushroom powder (0.1g) was hydrolyzed with 6N HCl (10 ml) in evacuated sealed tubes for 24 hrs at 110˚C. Later, the hydrolyzed samples were allowed to cool. The sample was filtered (Whatman filter paper; No.42) into a round bottom flask and evaporated till the acid content is completely removed. Finally, the volume was made up to 5ml (0.05N HCl) and derivatized to phenyl thiocarbomyl amino acid before injected to HPLC.

Fatty acid analysis

Fatty acids were extracted from the mushroom powder as per Soxhlet method [9]. Extracted fatty acid samples were esterified and later FAMEs were diluted (40 ml FAME sample + 960 ml n-hexane) in the sample vial. Methyl esterified sample (1µL) was injected to the chromatograph (GC-2010, Shimadzu, Kyoto, Japan) by an auto injector (AOC-20i, Shimadzu) and capillary column (BPX 70, SGE Analytical Science, Austin, TX). The Flame Ionization Detector (Shimadzu) was used for the detection of each elutant. The conditions set for analysis were as per protocol of Nareshkumar [10]. The split injection mode was used (split ratio 1:50)(conditions: terminal temperature was 225ºC; nitrogen and air were carrier gases; pressure was set to 114.9 k Pa; total flow was maintained at 68.9 ml/min; and column initial temperature was 100ºC with temperature increase rate of 5ºC/min).

Minerals

The powdered mushroom sample was digested in a tri-acid solution of nitric acid, sulfuric acid and perchloric acid (10:0.5:2, v/v). The digested sample was subjected for Atomic Absorption Spectroscopy (AAS) analysis [11].

Statistical analysis

Experimental values are given as means ± standard deviation (SD).

RESULTS AND DISCUSSION

The percentage composition of amino acids in the analyzed mushroom species is summarized in Table 1. A total of 17 amino acids were recorded. Glutamic acid was found to be the most abundant amino acid followed by alanine and aspartic acids. All the essential amino acids were present in adequate quantity. The results clearly indicate the potential utility of the wild mushroom species as a source of essential amino acids.

The analyzed mushroom contained large quantities of essential fatty acids. Unsaturated fatty acids levels were higher than saturated. The carbon chain lengths of fatty acids were from 12 to 18. Linoleic acid was the major fatty acid detected here. In addition to linoleic acid, palmitic acid, oleic acid, linolenic acid and lauric acid were the other abundant fatty acids in the mushroom.

Oils with high linoleic and oleic acid levels are very important for human health. Linoleic acid was the predominant polyunsaturated fatty acid and is the chief unsaturated fatty acid of mushroom lipids, which act as the precursor of mushroom alcohol (1-octen-3-ol). Together with two associated C_8 ketones (1-octen-3-one, 3-octane), this mushroom alcohol constitute the main volatiles and are considered as the major contributors to the mushroom flavor [12]. Linoleic and oleic acids were the major fatty acids in *Agaricus arvensis*, *Lactarius delisiosis*, *Leucopaxillus giganteus*, *Sarcodon imbricatus* and *Tricholoma portentosum* as reported by Barros et al [5]. About 16 amino acids were reported in *Cordyceps sinensis* [13].

The analyzed mushroom species contained the odd carbon number fatty acids namely, pentadecanoic acid which was also reported in other Indian edible mushrooms such as *Pleurotus sajor-caju* ,*Termitomyces microcarpus*, *Termitomyces tylerance*, *Cantharellus cibarius*, *Cantharellus clavatus*, *Lactarius deliciosus*, *Lactarius sanguifluus*, *Pleurotus djamor*, *Termitomyces mummiformis* and *Termitomyces shimperi*. Similarly heptadeconoic acid which was also observed in *Lactarius deliciosus*, *Lactarius sanguifluus*, *Helvella crispa*, *Hydnum repandum*, *Lentinus squarrulosus*, *Russula brevepis*, *Sparassis crispa* and *Termitomyces tylerance* [14].

Mushrooms serve as a good source of proteins, minerals with less carbohydrate and fat content [15]. Sodium, magnesium, potassium and calcium are the essential macronutrient minerals, if imbalance of minerals occurs at the level of the diet, intestinal absorption, cellular uptake or excretion it can cause disease or infection through their negative impact on immune functions [16].

Magnesium was the abundant mineral found here. The concentration of Mg was relatively high as reported for *Lentinus* species viz., *Lentinus sajor-caju*, *Lentinus cladopus* and *Lentinus squarrosulus.* Maximum amount of potassium and minimum of iron was recorded in *Lentinus polychrous* Lév. Compared to other species [6].

On the whole, the mushroom studied was found to be a good source of amino acids, fatty acids and minerals.

Table 1. Amino acid, fatty acid and mineral content of *L. polychrous* Lév. collected from the Western Ghats Forests of Karnataka.

Amino acid	**g/100 g protein**
Aspartic acid	10.73 ± 0.80
Glutamic acid	13.37 ± 0.22
Serine	10.51 ± 0.39
Glycine	5.55 ± 0.39
Histidine	1.82 ± 0.31
Arginine	3.38 ± 0.15
Threonine	4.30 ± 0.18
Alanine	11.29 ± 0.32
Proline	7.66 ± 0.29
Tyrosine	5.52 ± 0.00
Valine	5.42 ± 0.19
Methionine	2.25 ± 0.12
Cystein	1.92 ± 0.12
Isoleucine	3.61 ± 0.29
Leucine	7.64 ± 0.29
Phenylalanine	3.28 ± 0.16
Lysine	1.74 ± 0.13
Fatty acid	**g/100 g**
Lauric acid	6.80 ± 0.15
Myristic acid	3.90 ± 0.31
Pentadecanoic acid	1.90 ± 0.30
Palmitic acid	20.00 ± 0.37
Heptadecanoic acid	0.50 ± 0.10
Stearic acid	4.70 ± 0.36
Oleic acid	18.50 ± 0.15
Linoleic acid	25.30 ± 0.25
Linolenic acid	6.70 ± 0.23
Unidentified	11.70 ± 0.12
Minerals	**mg/100 g**
Iron	3.00 ± 0.30
Sodium	37.70 ± 0.35
Potassium	104.00 ± 0.76
Calcium	90.60 ± 0.32
Magnesium	177.00 ± 0.00
Phosphorous	31.00 ± 0.36

ACKNOWLEDGEMENT

Authors are thankful to the Board of Research in Nuclear Sciences (BRNS), DAE, Mumbai for financial assistance to carry out this study.

REFERENCES

[1] Cheung, P.C.K. 2008. Mushrooms as Functional Foods. John Wiley and Sons. Inc. Hoboken, New Jersey. ISBN: 978-0470-05406-2.

[2] Egwim, E.C., Elem, R.C., Egwuche, R.U. 2011. Proximate composition, Phytochemical screening and antioxidant assay of ten selected wild edible Nigerian Mushrooms. Am J Food Nutr, 1, pp. 89-94.

[3] Akram, K. and Kwon, J. 2010. Food irradiation for mushrooms: A review. J Korean Soc Appl Biol Chem, 53, pp. 257-265.

[4] Diez, V.A., Alvarez, A. 2001. Compositional and nutritional studies on two wild edible mushrooms from northwest Spain, Food Chem, 75, pp. 417-422.
[5] Barros, L., Baptisa, P, Correira, D.M., Casa, S., Oliveira, B., Ferreira, I.C.F.R., 2007. Fatty acid and sugar compositions and nutritional value of five wild edible mushrooms from Northeeast Portugal, Food Chem, 105 (1), pp. 140-145.
[6] Gulati, A., Atri, N.S., Sharma, S.K., Sharma, B.M. 2011.Nutritional studies on five wild *Lentinus* species from North-West India. World J Dairy Food Sci, 6, pp. 140-145.
[7] Thetsrimuang, C., Khammuang, S., Chiablaem, K., Srisomsap, C, Sarnthima, R. 2011. Antioxidant properties and cytotoxicity of crude polysaccharides from *Lentinus polychrous* Lév. Food Chem, 128, pp. 634-639.
[8] Fierabracci, V., Masiello, P, Novelli, M., Bergamini, E. 1991. Application of amino acid analysis by high-performance liquid chromatography with phenyl isothiocyanate derivatization to the rapid determination of free amino acids in biological samples. J of Chrom B: Biomed Sc and App, 570(2), pp. 285–291.
[9] Xiao, L., Mjøs, S.A., Haugsgjerd, B.O. 2012. Efficiencies of three common lipid extraction methods evaluated by calculating mass balances of the fatty acids. J Food Compos Anal, 25, pp. 198-207.
[10] Nareshkumar, S. 2007. A gas chromatography method for fatty acid analysis of coconut oil using capillary column, J Plantn Crops 35, pp. 23–27.
[11] AOAC, 2006. Official Methods of Analysis, 18th edition. Association of Official Analytical Chemists, Washington, DC.
[12] Fons, F., Rapior, S., Eyssartier, G., Bessiere, J. 2003. Volatile compounds in the Cantharellus, Craterellus and Hydnum genera. Cryptogamie Mycol, 24(4), pp. 367-376.
[13] Li, C., Li, Z., Fan, M., Cheng, W., Long, Y., Ding, T., Ming, L., 2006. The composition of *Hirsutella sinensis*, anamorph of *Cordyceps sinensis*. J Food Compo Anal, 19 (8), pp. 800-805.
[14] Kavishree, S., Hemavathy, J., Lokesh, B.R., Shashirekha, M.N., Rajarathnam, S., 2008. Fat and fatty acids of Indian edible mushrooms. Food Chem, 106, pp. 597–602
[15] Smith, P.G., Koch, I., Reimer, K.J., 2007. Arsenic speciation analysis of cultivated white button mushrooms *Agaricus bisporus* using high performance liquid chromatography-inductively coupled plasma mass spectrometry, and X-ray absorption spectroscopy. Environ Sci Technol, 41, pp. 6947–6954.
[16] Kiremedijian-Schumacher, L, Roy, M., Wishe, H.I., Cohen, M.W., Stotzky, G., 1994. Supplementation with selenium and human immune cell functions. II. Effect of cytotoxic lympghocytes and natural killer cells. Biol Trace Elem Res, 41, pp. 115–127.