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Proximate, mineral and amino acid values in wild *Pleurotus cervinus* species of Tropical Nigerian Savannah

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ABSTRACT

A wild edible species of *Pleutus cervinus* mushroom was picked up for analysis for proximate, mineral and amino acid values with a view to determining these very essential components in it. The experimental sample was obtained from the savannah grassland of the Nasarawa State University campus forest in tropical Nigeria. .Proximate analysis for percentage ash, crude protein, crude fibre, and carbohydrate were determined. Amino acid analysis was done by the use of the Technicon Sequential Amino acid Analyser (TSM).while analysis for a metal was done using the Atomic Absorbtion Spectrophotometer (AAS). The proximate analysis showed that this mushroom contains 33.25% protein, 29.01 and carbohydrate and 14.12%fat among others .Amino acid analysis revealed the presence of glutamic acid with the highest concentration of 9.23 g/100 protein followed by lysine with of 8.62 g/100 protein then leucine with 6.50 g/100 protein among others while cystein concentration was lowest at 0.32g/100 protein. The concentration of Calcium was the highest among metals analysed with 227.99mg/l followed by magnesium with 79.09, with copper having 62.77mg/l.The lowest concentration of 0.090mg/l was obtained for lead. The significance of these results for a wild non domesticated species of mushroom has discussed and followed with appropriate recommendations.

Key words: Proximte, mineral & amino acid values, *Pleurotus cervinus*, Tropical Nigerian Savannah.

INTRODUCTION

Nigeria lies on latitude 15 along the West African coastal Guinea Savannah. Its vegetatioin ranges from the less dense areas of the north to the more vegetative regions of the Norht Central and the highly vegetative rain forests of the Coastal Southern region.The vegetation has variables ranging from the grasslands,shrubs and trees. There are other components of this environment such as microorganisms including fungi among which are the mushrooms.

Mushrooms are fungi with great ecological import. They derive this attribute from their saprophytic behaviour being good decomposers of organic matter. In addition to this, some are edible in most parts of the world.

Mushroom consumption is commonplace amongst natives of Southern Nigeria (Fasidi and Jonathan, 1994) and the North Central Region of Nigeria (Egbere et al, 2003).The stuffs consumed are largely wild varieties. Consumption is by the natives who live in rural areas and constitute about 70% of the Nigerian population. These mushrooms are normally picked by agrarian farmers, when they grow naturally during rainy seasons in the wild bush and forested areas of the countryside. These same authors Egbere *et al*, (2003) have also reported about the sale of wild edible mushrooms along motor highways of Southern Nigeria. The use of

mushrooms as a food or food-flavoring materials due to their unique and subtle flavour has also been reported by Pei-Dih *et al* (2006).

Mushrooms are low in calories and contain high quantities of vegetable proteins in addition to vitamins and mineral ions (Gyar 2006). The food value of mushrooms is widely reported by Kuforiji et al (2003), and Gyar and Ogbonna (2006) with these authors indicate the proximate compositions such as crude proteins, fats, crude fibre and carbohydrates among others.

Oso, (1977) and Okhnouya (2006) have respectively among others, reported about - *Pleurotus tuber-regium* and *Pleurotus pulmonarius* cultivation in Nigeria. The commercial production of mushrooms remains nonetheless on a very low scale in Nigeria. However, the only few examples of mushroom farming in Nigeria are those seen in cities such as Ibadan, Lagos and Jos. To a large extent therefore, most mushrooms consumed in Nigeria are obtained from the wild. It is therefore the objective of this study to ascertain from the empirical perspectives, the proximate values, mineral ion contents and the amino acid composition of *Pluteus cervinus*, a very common edible species of wild mushroom. This is with the objective of ascertaining the food value or otherwise of this particular species and also obtaining relevant data on the species. Adequate recommendations would be made on these findings thereafter.

MATERIAL AND METHODS

Collection of Experimental Sample

*P.cervin*us species was collected in a basket by picking as in the method of Stammets and Chilton,(1983). Collection sites were the green glassland forest areas of the NSU Keffi Campus land mass. Samples were properly shaken to remove adhering soil particles, sun-dried for seven days to obtain a constant weight and then grounded to powder using a mortar and pestle in the Microbiology laboratory of the Nasarawa State University, Keffi.

The determination of proximate values of the mushroom species such as moisture content, crude fibre fat, total ash was done in triplicate using the prescribed methods of the AOAC (1990) and mean results obtained showing varying deviations. Nitrogen estimation was by the Micro-Kjeldahl method as carried out and described by Pearson (1976). Protein content was obtained by conversion through multiplication by 6.25.While carbohydrate value was determined by difference. All proximate values obtained were reported in per centage (%).

Analyses of minerals were done through ashing by drying at 200°C for two hours and drying at 550°C for 4 additional hours to obtain constant weight. The ash was then dissolved in volumetric flasks in distilled deionised water with a few drops of concentrated hydrochloric acid. Sodium and Potassium were determined as in the methods of Aremu *et al*, (2006) using a flame photometer (Model 405, Corning, UK). The determination of other metals was by the use of the Atomic Absorption Spectrophotometer (AAS Solar 969) in the analytical laboratories of the National Metallurgical Development Centre in Jos, Nigeria. All values were determined in triplicates with the use chemicals of analytical grade (BDH Analar, development centre Jos Nigeria, England) in the tests. The detection limit of the metals was earlier determined according to Techtron (1975) standards with the optimum analytical grade between 0.1 + 0.5 absorbance units with 0.87-2.22% coefficient of variation. Mineral ion concentrations were reported in mg/100g of mushroom weight.

Amino acid levels were determined by the standard methods of Speckman, Stein and Moore (1962). The experimental sample was dried to constant weight by oven (GZH-DH, China), and the fat extracted with chloroform/methanol (2; 1) ratio by means of a Soxhlet extraction apparatus as described by AOAC (1990). 0.3221g of defatted sample was then hydrolysed in a glass ampoule using 7ml of 6NHCL to expel oxygen and sealing the ampoule in an oven set at 105 ± 5°c and allowing for 22hours. After cooling, the sample was evaporated to dryness at 40°c under vacuum in a rotatory evaporator. The residue was then dissolved in 5ml acetate buffer (PH 2.0) and then cooled in a freezer. Between 5 and 10mg microlitres of the hydrolysate was then dispersed into a cartridge of the Technicon Sequential Multi-sample Amino Acid Analyzer (TSM) for an automated analysis of each

type of amino acid present in the sample. This empowerment was carried out in the amino acid lab. Amino acid values were recorded in g/100g protein of the University of Jos, Nigeria.

RESULTS AND DISCUSSION

The proximate values of the Mushroom analysed are show in Table 1. These results indicated that *P.cervinus* is a rich source of plant protein

Table 1: Proximate values of *P.cerninus* (%)

Analysis	%
Ash content	6.12 ± 0.23
Moisture content	17.5 ± 0.15
Crude protein	22.23 ± 0.25
Crude fibre	16.02 +0.21
Fat content	14.12 ± 0.19
Carbohydrate (by Difference)	29.01 + 0.17

Values are mean ± standard deviation of triplicate determinations

compared to some reported values of plant protein rich foods; Bean (*Vigna unguiculata*) (20.5+1.64) Onwuliri and Obu, (2002), Lima beans (*Phaseolus lunatus*) (2.2.7) Oshodi,(1993) and groundnut (23.2), the 25.10 + 0.25 value obtained for this mushroom can also be considered as a very high concentration . Ononogbu,(1988) had earlier noted that legumes are particularly a very rich source of protein. It is noticeable from these results, that this species of mushroom can be used as a protein supplement in human foods. These are similar results with the reports of Bano and Rajarathnam (1988) who observed that mushrooms could contain between 20-40% proteins on dry weight *2) basis. Our observed results show the adequacy of the consumption of this particular species of mushroom in Nigeria as a plant protein source. The cheapness of this commodity (which is a wild uncultivated food source) is of significance to the Nigeria pupilage whose protein needs are yet to be adequately met due to the high cost of meat protein.

The moisture content of 13.9% places this mushroom species as a highly very perishable food. Walde *et al*, (2006) have reported in their study that mushrooms are rapidly perishable commodities which start deteriorating immediately a day after their harvest. Reports by Sila and Gyar (2005) attribute this quick deterioration to the high water content in mushrooms-a case of high water activity (a/w). This attribute of moisture content imposes the urgent need for a quick preservation of harvested mushrooms if they are not to be consumed immediately. Studies by Walde *et al* (2006) have suggested suitable preservation methods for mushroom. The low fat content of 1.01% observed in this study is reminiscent of reports by Oei (1996) (0.03%).Because of the low fat content, Oei,(1996) recommended the use of mushroom food supplements for people with low fat requirements in diets. The low fat content of this species makes it adequate for use the formulation of weight restriction diets (Aremu .and Olonisakin, 2005). The fibre content of 4.15 + 0.19 is still adequate since this can be useful in slowing down the release of glucose in the blood stream. It has also been reported to have preventive action against colorectal carcinoma (Oyetayo and Ajayi, 2005). The carbohydrate content of 52.63 % adds up to make this mushroom a rich source of energy. Mushroom sugars do not cause diabetics hence their recommendation in the diets of such patients.

Table 2 is the result of metal analysis of the experimental specimen carried out using the Atomic absorption Spectrophotemeter (AAS). Of the nine metals analysed, the concentration in mg/l of

Table 2: Concentration of metal ions (mg/in 100g) of *P.cervinus* sample

Metal(s)	mg/l
Soduim (Na)	33.44 ± 0.3
Potassium (K)	41.09 ± 0.27
Iron (Fe)	31.79 ± 0.21
Copper (Cu)	62.77 ± 0.15
Calcium (Ca)	227.99 ± 0.16
Lead (Pb)	0.090 ± 0.19
Manganese (Mn)	1.88 ± 0.22
Magnesium (Mg)	79.09 ± 0.24
Chromium (Cr)	0.19 ± 0.16

Values are mean ± standard deviation of triplicate samples

Calcium (Ca) was the highest (227.99 + 0.16) followed by Magnesium (Mg) (79.09 + 0.24).Other minerals are;Soduim (Na) 33.44 + 0.3 Potassium (K) 41.09 + 0.27, Pa Iron (Fe) 31.79 + 0.21, Copper(Cu) 62.71,Manganese (Mn) 1.88 + 0.22 and Chromium (Cr) 0.19 + 0.16 corroborate the reports of Kuforiji, *et al* (2003).These results agree with those of Nwaje (2005) and Gyar and Ogbonna (2006) among others who have found out that mushrooms have minerals ions. Foods with high Ca content have a tremendous dietary advantage in lactating mothers (Etang *et a.,* 2006).It follows therefore, from this study that the mineral profile of this mushroom places it on a very high standing as a mineral food supplement in diets.

The concentration of the metals in this species is up to the intake values stipulated by the World Health Organization (WHO, 1993), and those of the Commission for European Communities (CEC).

Incidentally, the results obtained in this study indicate that this mushroom contains useful minerals in superlative values, with the only exception being Na with 33.44mg/l. In this case, if this mushroom variety is to be used for Na dietary requirements. This study shows the high potential of this species as a source of mineral ions.There are several reports on the nutritional importance of foods containing mineral ions. Specifically, Turan *et a*l., have indicated that Phosphorus is associated with the growth and maintenance of bones, teeth and muscles. On the other hand, Mg is an important mineral in connection with circulatory disease such as ischemic heart disease and calcium metabolism in bones .Iron is an essential trace element in the formulation of hemoglobin and in the normal functioning of the central nervous system and in the oxidation of carbohydrate proteins (Ladan, *et al*., 1996). Magnesium is useful as an essential microelement in human nutrition acting as an activator of many enzymes (McDonald, et al., 1995 and this species has some reasonable concentration of this element. Comparatively,the Mn level in this experimental species is higher than the value reported in some vegetables namely, Spinach (0.5mg/l) lettuce (0.3mg/l) and cabbage (0.2mg/l), (Turan *et al, 2003*). The presence of all these metals therefore makes this mushroom species a suitable human food.

Results of amino acid analysis of this mushroom are presented in Table 3. There are twenty amino acids found in nature as components of protein (McDonald, *et al,* 1995). In the study, seventeen types of amino acids were detected in the experimental species. The results indicate that non-essential amino acids (histidine, aspartic acids, glutamic acids. glycine and alanine) were lower in concentration with cumulative values of (45.81%) compared to the essential amino acids (Isoleucine,cystine, threonine and Lysine with higher concentration with cumulative value (54.19%). Among the essential amino acids, Lysine and Leucine were found to be in higher concentration with 8.62 + 0.16 and 6.50 + 0.15 respectively while glutamic and aspartic acids were the predominant of the non-essential acids with 9.23 + 0.24, and 6.20 + 0.19 in that order. The highest concentrations of amino acids in this mushroom species were those of glutamic acid lysine and leucine (9-23 + 0.24, 8.62 + 0.16 and 6.50 + 0.15) respectively.

Table 3: Results showing the mean concentrations of amino acid (g/100 protein) in triplicate samples of *P.cervinus* using the TSM (analyzer)

S. no	Amino acid	Concentration (g/100 protein)
1	Lysine	8.62 ± 0.16
2.	Histidine	6.16 ± 0.25
3	Arginine	1.57 ± 0.23
4	Aspartic acid	6.20 ± 0.19
5	Threonine	4.92 ± 0.18
6	Serine	3.33 ± 0.23
7	Glutanic	9.23 ± 0.24
8	Proline	1.41 ± 0.14
9	Alanine	5.78 ± 0.17
10	Glycine	3.63 ± 0.22
11	Cystein	0.32 ± 0.26
12	Valine	4.26 ± 0.25
13	Methionine	4.34 ± 0.19
14	Isoleucine	5.29 ± 0.15
15	Leucine	6.50 ± 0.15
16	Tyrosine	1.66 ± 0.18
17	Phenylalanine	3.54 ± 0.15

Reports of high concentration of glutamic acid in other mushroom species are not available to these authors and this should make for further study. However, Adeyeye (2004) has reported high glutamic acid concentrations in legumes. The concentration of methionine in this study (4.34 + 0.19) was observed to be greater that that of soya beans reported by Temple and Aliyu (1994).

A general look at the results in this study therefore indicates the presence of food substances, mineral ions and amino acids. The results show this species as a nutritionally very valid food substance. It is therefore a very good source of protein for a third world country like Nigeria where meat protein is not easily affordable due to high and prevailing low income amongst the lower class peasants.

CONCLUSION

Recent studies by Walde *et al* (2006) and Gyar and Ogbonna (2006) on food attributes of certain wild mushrooms *(Agaricus bisporus* and *Pleurotus flavus,* and *Macrolepiota procerus*) respectively showed the food nutrient and mineral values of these species. This study has also elucidated the very high food, mineral and amino acid contents of *P.cervinus*. A continued study of wild edible species of mushrooms should therefore be encouraged since this could lead to a plethora of information on the importance of these species of organic fermenters, as a good source of food. The results obtained in this study have shown that this species of mushroom. *P. cervinus* is a rich source of plant protein, carbohydrate, mineral irons and amino acids. *P. cervinus* species used in this study was obtained from the wild and this food attributes make it a very good bioresource.

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