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MYCOCHEMICAL AND PROXIMATE COMPOSITION OF SELECTED MUSHROOMS IN LAPAI, NIGER STATE. NIGERIA

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ABSTRACT

In recent times mushrooms assumed greater importance in the diet of both rural and urban population because they are delicacies. However, most of mushrooms consumed were hunted from the wild without knowing their mycochemical composition. This practice is often associated with some degree of negativity and fatality. This study therefore investigated myco-chemical, proximate composition, minerals and vitamins content present in three selected and identified mushrooms namely; *Macrolepiota procera ,Pleurotus roseus* and *Cantherelle cibarius* collected from the wild in Lapai, Niger State, Nigeria. The samples were sundried and ground into powdered form and sieved. Mycochemical, proximate composition, minerals and vitamins analyses were carried out. The results revealed the presence of alkaloid, flavonoid and saponin in all the three samples The results on the proximate composition of the three mushrooms sampled revealed that carbohydrate content was significantly ($P< 0.05$) the highest in composition. It was 30.50% in *M. procera,* 28.8% in *P. roseus* and 29.2% in *C. cibarius.* Crude protein obtained were 9.8%, 11.43% and 10.2% in *M. procera, P. roseus* and *C. cibarius* respectively. However, the mineral composition analysis showed that the three samples were very rich in potassium and sodium but, poor in cobalt. The samples were also rich in vitamin A. *Macrolepiota procera* has the highest percentage moisture content (18.01%) which was significantly different ($P<0.05$) from others. Ash content and crude fibre of the three mushrooms were significantly different ($p<0.05$). The fat content was generally low with *M. procera* having (11.50%).*Pleurotus roseus* (13.65%) and *C. cibarius* (12.10%). *M. procera* has the highest potassium content of (6.80mg/l) while *C. cibarius* was lowest (5.40 mg/l). These mushrooms hold tremendous potentials in contributing to the protein, vitamin and mineral element needs of the people. Therefore, their commercial production and consumption especially those on low fat dietary food should be encouraged and their use as raw materials to the pharmaceutical industries is recommended.

Key words: **Mushroom, Proximate, Moisture content, Alkaloids.**

INTRODUCTION

Mushroom ((Basidiomycota)) is the fleshy, spore-bearing fruiting body fungus, typically produced above ground on soil or other food substrates. For several decades, mushrooms have been part of human diet. In the past, the consumption of mushrooms was as a result of the fact that they were delicacies and or food supplement. Some mushroom materials, including polysaccharides, glycoprotein and proteoglycans, modulate immune system responses and inhibit tumor growth, while few possess potential cardiovascular, antiviral, antibacterial, anti-parasitic, anti-inflammatory and ant-diabetic properties (Edeoga and Eriata, 2001; Okwulehie and Odunze, 2004) Currently, several extracts have widespread use in Japan, Korea and China, as adjuncts to radiation treatments and chemotherapy (Smith *et al*., 2002). Mushrooms can be used for dyeing of wool and other natural fibers. Before the invention of synthetic dyes, mushrooms were the source of many textile dyes (Mussak and Bechtold, 2004). Mushrooms and other fungi play a role in the development of new biological remediation techniques for example, using mycorrhizae to spur plant growth and filtration technologies also , using fungi to lower bacterial levels in contaminated water.

A good number of mushrooms are consumed by different tribal groups in Nigeria. People depending on their tribe slightly differ in the array of mushrooms consumed and reasons for their consumption (Akpaja *et al*., 2003). The Yoruba tribes however recorded the highest number of edible and medicinal mushrooms compared to the Hausa tribes (Akpaja *et al*., 2005; Gbolagade *et al*., 2006). The sporophore of mushroom is used as a good substitute for meat protein in several suburban Nigerian soups (Ene-Obong and Camovale, 1992). Its popularity as food in many rural villages especially in the southern zone of the country is ascribed to its substrate propensity, rapid growth, fruit-body longevity, incidences and distribution pattern (Osemwegie *et al*., 2006).

In Nigeria, the bulk of mushrooms consumed even in recent times, are hunted from the wild. This practice is often associated with some degree of negativity and fatality since poisonous ones could be inadvertently picked and eaten (Ogundana, 1997). This study therefore, investigated the mycochemical, proximate, minerals and vitamins contents of three selected popularly consumed mushrooms in Lapai, Niger State, Nigeria,to ascertain their nutritional composition and advice on their edibility.

MATERIALS AND METHODS

Collection and Preparation of Mushroom Samples

Fresh samples of different types of mushroom were collected between May and June 2013 at two weekly interval from the wild in Lapai, Niger State Nigeria. The mushrooms were taking to the Biology Department Laboratory Ibrahim Badamasi

Babangida University Lapai. Nigeria, where the samples were cleaned manually to remove any unwanted materials. The collected materials were sun-dried until they become brittle. Extract were prepared from the dry ground and sieved powdered samples. Samples of the mushrooms were deposited at the Herbarium of Biology Department in Ibrahim Badamasi Babangida University Lapai, Niger State, Nigeria.

Identification of Mushroom

The macroscopic structures were used. The cap was cut off and gill placed up-side-down overnight, a powdery impression reflecting the shape of the gills formed and the colour of the powdery print, called a spore print (white, brown, black, purple-brown, pink, yellow, and creamy) were used to identify them with the aid of fungal families of the world textbook (Dickinson and Lucas, 1982).

Mycochemical screening;

Alkaloids

To 2 ml of the extract, 1ml of HCl was added. The mixture was heated with few drops of Mayer's reagent.

Flavonoids

To 2 ml of the extract, three-drops of Ammonia solution was added. 0.5 ml of concentration HCl was further added to the mixture.

Saponins

To 2ml of the extract, five drops of olive oil was added. The mixture was shaken vigorously.

Determination of moisture content

The method of AOAC (1990) was employed using hot air drying oven. Empty clean crucible dish were dried in the oven at a temperature of 105^{o}C for one hour and cooled in a desiccators. Two grams (2 g) of the samples were weighed and put in to the dish and heated overnight (24 hours). The dish was then removed from the oven, cooled in a desiccators and weighed moisture content were calculated using

$$\% \text{ Moisture content} = \frac{\text{Loss in weight}}{\text{Sample weight}} \times \frac{100}{1}$$

Determination of ash content

The method of AOAC (1990) was used to determine the percentage of ash content. Two grams of each dried sample were weighed in to a pre-heated and cooled crucibles and incinerated in a muffle furnace at 200^{o}C for four hours. The ash was then cooled in desiccators and weighed. Ash content was calculated using.

$$\% \text{ Ash} = \frac{\text{Weight of Ash}}{\text{Weight of Sample}} \times \frac{100}{1}$$

Determination of crude fibre content

Two grams of the powered sample was weighed and placed in 500 ml conical flask containing 200 cm³ of 1.25% H_2S0_4 and boiled gently for thirty minutes. The content was filtered and the residue was scrapped back in to the flask with spatula. A 200 cm³ of 1.25% NaOH was added and allowed to boil gently for 30 minutes. The content was filtered and washed thoroughly with hot distilled water. The precipitate was rinsed once with 10% HCl and twice with ethanol. The content was allowed to dry and the residue was scrapped in to a weighed crucible and was dried overnight at 105°C in hot oven and later cooled in desiccators. The sample was then heated at 600°C for ninety minutes in a furnace. It was finally cooled in a desiccators and weighed again (AOAC, 1990).

The percentage crude fibre was calculated using the equation below.

$$\% \text{ Crude Fibre} = \frac{\text{Loss in weight on Ignition}}{\text{Weight of Sample}} \times \frac{100}{1}$$

Determination of crude fat content

Two grams each of dried samples was weighed in to a porous thimble, and its mouth covered with cotton wool. The thimble was then placed in an extraction chamber and then suspended above a receiving flask containing petroleum ether (BP. 40 – 60°C).

The flask was then heated on hot mantle and the oil was extracted. The extraction continued for eight hours after which the thimble was removed from the soxhlet and apparatus was reassembled and heated over water bath, the flask containing the oil was disconnected, cleaned up and placed in an oven at 100°C for thirty minutes. The flask was then cooled in desiccators and weighed. The percentage crude lipid content was calculated using.

$$\% \text{ Crude Fat} = \frac{\text{Weight of oil Extracted}}{\text{Weight of Sample}} \times \frac{100}{1}$$

Determination of crude protein content

Two grams of the samples was weighed in to Kjeldahl digestion flask and catalyst mixture of ($NaSO_4$, $CuSO_4$ and selenium oxide in (10:5:1) were added to each samples which were followed by 10 cm³ of concentrated H_2SO_4. The content in the flask were then heated in the Kjeldahl digestion flask for one and half hours) ensuring that digestion was completed. The flask was cooled and the content diluted with 10 ml distilled water. The diluted content was filtered in to 100 ml volumetric flask and was made up to the mark with distilled water. Exactly 10 cm^3 of the aliquot was taken into digestion flask and 20cm^3 of 45% NaOH solution was added to it. The content was diluted to about 200cm^3 with distilled water and distilled using micro Kjeldahl distillation apparatus. The distillate was received into a flask containing 10cm^3 boric acid solution indicator after the distillation. The distillate was then titrated with 0.01MHCl to the end point (AOAC, 1990).

Crude Protein (%) =

$$\frac{TV \ X \ C \ X \ F \ x \ V1 \ x \ 100}{W \ x \ V2}$$

Where: TV = Titre Value of the acid; C = Concentration of acid used V1 = Volume of the distilled water used for diluting the digest; V2 = Volume of aliquot used for titration; W = weight of sample used; F = protein multiplication factor 0.0014

Determination of carbohydrate content

The method of James (1995) was used. The total amount of carbohydrate in the sample was obtained by using the weight difference percentage. This was done by subtracting the percentage sum of the food nutrients (% crude protein, % crude fat, crude fibre and ash) from 100% dry weight. Percentage carbohydrate was calculated, using the formula bellows;

Carbohydrate % =

100 – (Crude Protein + Crude Fat + Crude Fibre + Ash).

Determination of vitaminscontent

Ten grams (10 g) of the powdered sample was extracted with 2 g of Na_2SO_4 in 100 ml hot 95% ethanol for 30 min with occasional shaking in hot water bath. The extract was decanted, the volume was measured using measuring cylinder and sufficient water was added to bring it to 85% ethanol.

Using the formula:

90 x 95% = xml x 85%

$$\therefore \frac{90 \ x \ 95}{85}\% = x \text{ (Final Volume Extract)}$$

The solution was cooled in ice bath for 15 minutes; the ethanol extract was shaken with 30 ml of petroleum ether in a separating funnel. The bottom ethanol layer was run into beaker and the top petroleum ether was run into conical flask, the ethanol layer was returned to the separating funnel and were re-extracted using another 10 ml of petroleum ether and re-separated. All the petroleum ether extract were poured together and re-washed with 50 ml of 85% ethanol in separating funnel and the ethanol portion is run off (AOAC, 1990)

The optical density of the final petroleum extract which contained the element containing vitamin A was read at 450 mm with spectrophotometer.

The B-Carotene (Vitamin A) level was calculated using:

A = E1% x C L

Where A = Absorbance of the sample; E1% Extraction Coefficient of B-Carotene; L = Path Length.

Determination of mineral ions composition

Analysis of some minerals were done through the washing of the samples, and drying the powdered preparation for two hours at 200°C and further drying at 500°C in the furnace until a constant weight was obtained. The samples were digested using nitric acid and made up to 50 ml with deionized water and then filtered. Sodium and potassium were determined using flame photometer model PFP7 clinical flame photometer Biochrom UK Jenway England. Atomic Absorption Spectrop-hotometer model AA320N Brain Scientific and Instrument England were used to determine copper, cobalt and cadmium. Three replicate of each was made (AOAC, 1990).

RESULTS

The results of mycochemical analysis (Table1) revealed the presence of alkaloid, flavonoid and saponins in all the three mushrooms sampled.

Table.1 Mycochemical screening of *Macrolepiota procera, Pleurotus. roseus* and *Cantherelle cibarius*

Mycochemical compound	*M. procera*	*P. roseus*	*C. cibarius*
Alkaloid	+	+	+
Flavonoid	+	+	+
Saponins	+	+	+

Key: + Presence

Table 2: Proximate composition of three sampled mushrooms (percentage)

Analysis	*Macrolepiota procera*	*Pleurotus roseus*	*Cantherelle cibarius*
Moisture Content	18.01 ± 0.2^{b}	9.50 ± 0.2^{e}	10.50 ± 0.1^{d}
Ash Content	15.50 ± 0.1^{c}	18.50 ± 0.1^{b}	21.00 ± 0.2^{b}
Crude Fibre	13.5 ± 0.1^{d}	17.00 ± 0.2^{b}	7.05 ± 0.2^{e}
Crude Fat	11.50 ± 0.2^{f}	13.65 ± 0.1^{c}	12.70 ± 0.1^{c}
Crude Protein	9.80 ± 0.1^{e}	11.34 ± 0.2^{d}	10.02 ± 0.1^{d}
Carbohydrate	30.50 ± 0.2^{a}	28.8 ± 0.1^{a}	29.2 ± 0.2^{a}

Values are means of three replicates (n=3).
Values along column with different superscript are significantly different (p<0.05).

The results on the proximate composition (Table 2) of the three mushrooms sampled revealed that carbohydrate content was significantly (P< 0.05) the highest food content. It was 30.50% in *M. procera,* 28.8%in *P. roseus* and 29.2% in *C. cibarius.* Crude protein was observed to be generally low in all he samples yielding 9.8% ,11.43% and 10.2% in *M. procera, P. roseus* and *C. cibarius* respectively. The ash and crude fibre content were not significantly different (P<0.05) in *P. roseus*. However, the mineral composition analysis showed that the three samples were very rich in potassium and sodium but poor in cobalt. The samples were also rich in vitamin A.

Table 3: Mineral composition of three sampled mushrooms (mg/l)

Mineral element	*Macrolepiota procera*	*Pleurotus roseus*	*Cantherelle cibarius*
Na	1.60 ± 0.1^{c}	1.20 ± 0.2^{b}	0.80 ± 0.2^{b}
K	9.80 ± 0.1^{a}	6.80 ± 0.1^{a}	5.40 ± 0.1^{a}
Cu	4.89 ± 0.2^{b}	0.43 ± 0.1^{c}	1.08 ± 0.1^{b}
Cd	0.29 ± 0.1^{d}	0.32 ± 0.2^{c}	0.40 ± 0.2^{c}
Co	0.18 ± 0.2^{d}	0.31 ± 0.1^{c}	0.33 ± 0.2^{c}

Values are means of three replicates (n=3). Values along column with different superscript are significantly different (P<0.05).

Table 4: Vitamin value of *Macrolepiota procera, Pleurotus roseus* and *Cantherelle cibarius*

Mushrooms species.	* Vitamin A level in I.U.
Macrolepiota procera	768.3 ± 0.2
Pleurots roseus	550.8 ± 0.2
Cantherelle cibarius	205.1 ± 0.2

*Values are means of three replicates.

The result on the moisture content (Table 2), showed that *M. procera* has the highest (18.01%) which was significantly different (p<0.05) from *P. roseus* (9.50%) and *C. cibarius* (10.50 mg/l). The ash content was observed to be highest in percentage (21.00%) in *C. cibarius* though not significantly different (p<0.05) from *P. roseus* (18.50%). The crude fibre in all the three mushrooms was significantly different (P<0.05) with the highest in *P. roseus* (17.00%) and lowest in *C. cibarius*(7.05%). The crude fat was (13.65%) in *P. roseus*, followed by *M. procera*(11.50%) and (12.70%) in *C. cibarius*. The crude protein in *P. roseus* was the highest (11.34%) followed closely by *C. cibarius* (10.02%) and the lowest is *M. procera* (9.50%). The percentage comparative of carbohydrate in the three mushrooms was very high but ,not significantly different (p<0.05). The highest percentage in carbohydrate was observed in *M. procera* (30.5%), followed by (29.2%) in *C. cibarius* and (28.8%) in *P.roseus*. Generally the carbohydrate and moisture content in all the three mushrooms were on the higher side. Crude protein was the lowest in *M. procera* and *P. roseus*.

The result of the mineral composition (Table 3) revealed that the three mushrooms sampled have high % composition of potassium level compared to other mineral content. *Macrolepiota procera* has (9.80%), *P. roseus* (6.80%) and *C. cibarius* (5.40%). All the three mushrooms shows presence of vitamin A (Table 4) with *M. procera* having the highest vitamin value 768.3 IU compared to the remaining two samples.

DISCUSSION

The study revealed the presence of alkaloid, flavonoids and saponins in the sampled mushrooms.The presence of these mycochemical compounds in the three fungi suggested that they have medicinal potentials. Therefore they may be useful as raw materials in the drug industries. These mycochemical has earlier been reported by Edoga and Eriate (2001), alkaloids have been reported to be of interest to pharmaceutical industry for the development of drugs. For example, alkaloid protect some plants from destruction by certain insect species and in the cure of malarial and as purgative (Rahila *et al*., 1994). Flavonoids have aroused considerable interest recently because of their potential beneficial effects on human health. It has been reported to have anti-viral, anti-allegic, anti-platelet, anti-inflammatory, anti-turmor and anti-oxidant activities (Haslam, 1996; Edeoga and Eriate, 2001). Flavonones has been reported to be used as anti-oxidant to combat carcinogenesis as well as ageing process. High flavonoids level may help provide protection against oxidative stress induced diseases by contributing along with other antioxidant vitamins, and enzyme to the total anti oxidative defence system of the human body (Donald and Crustobal, 2000). Saponins has been linked with a decrease in overall blood cholesterol, saponins have been used in the treatment of a number of cardiovascular disorders and conditions. Saponin was also reported to protect disease inversion by parasitic fungi and protect grains from weevil and other parasitic damages (Riaz and Chaudhary, 1993).

The results on the proximate and vitamin analysis showed that the three mushrooms are rich in all food nutrients, hence qualify as good food materials. This confirmed earlier report that mushrooms are rich sources of nutrients and compare favorably with meat, egg and milk (Akpaja *et al*., 2003). The crude fibre content values reported from many studies suggested that mushrooms are potential sources of dietary fibre. Due to their high content of vitamin, protein and minerals, they are considered as "poor man's protein." and they are recommended as good source of food supplement for patients with cardiac problems or at risk with lipid-induced disorders.

CONCLUSION

From this study, these mushroomsnamely; *M. procera*, *P. roseus* and *C. cibarius*) were found to be very rich in food nutrient such as mineral, vitamin, carbohydrate, protein and low fat content. They hold tremendous potentials in contributing to the protein, vitamin and mineral elements need of the people. Therefore, they are recommended as alternative to meat especially for those on low fat dietary food, as raw materials for the pharmaceutical industries and their commercial cultivation.

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