

Proximate Analysis and Mineral Composition of Edible Mushrooms in Parts of South Eastern Nigeria

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Abstract: Proximate and mineral analysis of three species of mushroom, *Plerotus tuber-regium*, *Plerotus squariosulus* and *Auricularia auricula* were examined in this work to determine their nutritional value. These mushrooms were found to contain on the average 4.54-6.54% of crude fiber; 5.84-7.25% of ash; 1.29-3.73% of fats and oil; 19.47-22.76% of protein; 11.25-12.88% of moisture and 31.31-36.25 cal of carbohydrate. The average mineral element content of the mushrooms were found to be 0.59-0.92% of potassium; 0.57-0.74% of sodium; 0.52-0.63% of calcium; 0.24-0.36% of magnesium; 0.28-0.37% of phosphorus and 3.115-3.635% of Nitrogen. These results show that these species of mushroom are highly nutritive. These findings were discussed in line with the importance and implications of the uses of edible mushrooms to man. [Report and Opinion. 2009;1(4):32-36]. (ISSN: 1553-9873).

Keywords: Proximate Analysis, Mineral Composition, Edible, Mushroom, South Eastern, Nigeria

1. INTRODUCTION

Mushroom is a fleshy, spore bearing fruiting body, a fungus, typically produced above ground on soil or on its food source. Mushroom is most often applied to fungi (Basidiomycota, Agaricomycetes, order Boletales and family Boletaceae) that have stem (stipe), a cap (Pileus) and gills (Lamellae) on the other side of the cap. Mushrooms can be found in the forest around the country (Zoberi, 1985). Mushrooms such as the *Pleurotus* species are known to be among the largest fungi or saprophytic eukaryotes composed of hyphae filament that thrives very well in damp or moist condition (Mirko, 1985). According to Mirko (1985), some mushrooms especially members of the genus *Amanita* (*Amanita* species) are extremely poisonous.

Mushroom cultivation serves as the most efficient and economically viable biotechnology for the conversion of lignocellulose waste materials into high quality protein food (Sohi, 1990). Mushrooms are found in areas with range of temperatures 20-40°C and grow well in agricultural wastes (Soberi, 1985). They require a moderate rainfall and PH range of 3-10 for growth (Chang and Feinandez, 1980). *Plerotus tuber-regium* is the most edible mushroom in Nigeria.

Clara (2001) reported that *Plerotus tuber-regium* is highly nutritive and very rich in protein and also eaten for its flavour and beneficial medicinal effect. The protein content of edible mushrooms is equal to that of corn, milk and legumes (Clara, 2001). Mushrooms have been food supplement in various cultures and they are cultivated and eaten for their edibility and delicacy considered as sources of proteins, vitamins, fats,

carbohydrates, amino acids and minerals (Clara, 2001).

Mushrooms have been considered healthy food because they contain high quality protein which contains all the essential amino acids, vitamins B, B₂, C and D and minerals such as A, K, Zn, Na, Fe, Mg, P and low fat (Bano, 1993).

Despite the medicinal, nutritional and economic importance of mushrooms as indicated by various authors and researchers, the nutritional values of some tropical edible mushrooms that are indigenous to South Eastern Nigeria have not been determined. This situation infers that people eat edible mushrooms without knowing their nutritional values. This justification informs this study whose aim is to determine the proximate values and mineral composition of three species of edible mushroom in parts of South Eastern Nigeria to be able to make deductions for general consumption on their food and mineral element values as well as their species differences as food items.

2. MATERIALS AND METHOD

Thirty (30) healthy, fresh and succulent mushrooms from the three species *Plerotus tuber-regium*, *Plerotus squariosulus* and *Auricularia auricular* were collected from Owerri and Orlu markets of Imo State, ten from each species. The samples were preserved in the chemistry laboratory of Imo State University, Owerri.

Proximate Analysis

The three edible mushroom species were analyzed for food composition according to the Association of

Official Analytical Chemists (AOAC, 1995). These include the determination of crude fiber, Ash, Crude Protein, Fat, Carbohydrate and Moisture content.

The moisture content was determined by gravimetric method and calculated as follows:

$$\% \text{ moisture} = \frac{W_2 - W_1}{W_2 - W_1} \times \frac{100}{1}$$

Where W_1 = Wt of empty moisture can

W_2 = Wt of can before drying

W_3 = Wt of can + sample after drying

to a constant weight

The protein content was determined by Kjeldahl method. The total nitrogen was determined and multiplied with the factor 6.25 to obtain the protein as follows:

Equal wt of $W_2 = 14$

Let the titre blank value be x

1ml of 0.02N $H_2SO_4 = 14 \times 0.02 \text{MgN}$

1ml of 0.2N $H_2SO_4 = 14 \times 0.28 \text{MgN}$

This was contained in 10mls digest

50ml digest will contain $0.28 \times 50 \text{MgN}$

This was contained in 0.2g sample

$$\% \text{ N} = \frac{0.28 \times 50 \text{m}}{10} \times \frac{1}{103} \times \frac{100}{0.2}$$

$$\text{N} = 0.7 \times$$

$$\% \text{ crude protein} = 0.7 \times X 6.25$$

The x will be determined

The crude fiber was determined by the Weende method and calculated gravimetrically as % crude fiber as follows:

$$\text{Crude fiber} = \frac{W_2 - W_3}{\text{Wt of Sample}} \times \frac{100}{1}$$

Where W_2 = weight of crucible + sample after washing and drying in oven.

W_3 = Weight = Weight of crucible + sample as ash

The total ash was done using the furnace incineration gravimetric method (AOAC, 1995) and the weight of ash obtained in percentage as follows:

$$\% \text{ Ash} = \frac{W_2 - W_3}{\text{Wt of Sample}} \times \frac{100}{1}$$

Where W_1 = wt of crucible

W_2 = wt of crucible + material

The fat content was determined by the continuous solvent extraction method using a Soxhlet apparatus and calculated as

$$\% \text{ Fat} = \frac{W_2 - W_1}{\text{Wt of Sample}} \times \frac{100}{1}$$

Where W_1 = wt of empty extraction flask

W_2 = wt of flask and oil extract

The carbohydrate content was calculated by difference as the Nitrogen Free Extractive (NFE) as % NFE = 100% (a + b + c + d + e) where

a = Protein

b = Fat

c = Fiber

d = Ash

e = Moisture

The mineral elements were determined by the Dry Ash Extraction method of AOAC (1995) at National Root Crop Research Institute, Umudike as follows:

- Potassium and Sodium by flame photometric method
- Nitrogen by Kjeldahl method
- Phosphorus by the Vanadomolybdate (yellow) spectrometry method

Phosphorus content was given by the formula $g/100g = 100/W \times AU/AS \times VF/VA$ where W = wt. of sample analysed

AU = Absorbance of test sample

AS = Absorbance of standard solution

VF = Total volume of filtrate

VA = Volume of filtrate analyzed

Percentage calcium and magnesium was calculated as follows

$$\frac{100}{W} \times \frac{EW \times W}{100} \times \frac{VFT}{VA}$$

The nitrogen content was determined by Kjeldahl method as follows

Molecular wt. of $N_2 = 14$

Let the titre blank value be x

1 ml of 1N $H_2SO_4 = 14 \text{gN}$

X ml of 0.2N $H_2SO_4 = 0.28 \times \text{MgN}$

This was contained in 0.2g sample

$$\% \text{ N} = \frac{0.20 \times 50 \text{m}}{10} \times \frac{1}{10^3} \times \frac{100}{0.2}$$

%N = 0.7x. The X will be determined.

3. RESULTS

The results of the investigation are presented here according to the parameters investigated. The moisture content is highest in *A. auricular* (12.88%) followed by *Plerotus squarrosulus* (11.85%) and least in *Plerotus tuber-regium* (11.25%). Fig 1

The crude protein content is highest in *A. auricular* (6.54%) and lowest in *P. tuber-regium* (4.8%) fig 3. Ash content is highest in *P. tuber-regium* (7.25%) with least content in *A. auricular*, fig 4. Crude fibre is more in *A. auricular* and least in *P. tuber-regium*. Fig 3.

The highest fat content is found in *P. tuber-regium* (3.73%) and the least found in *A. auricular* (1.29%) fig 5. The highest carbohydrate content is found in *P. tuber-regium* (36.25%) and lowest in *A. auricular* (31.31%) fig 6.

The highest potassium content is found in *P. tuber-regium* (0.9%) and lowest in *P. squarrosulus* (0.59%) fig 7. *P. squarrosulus* has the highest sodium content (0.74%) while *P. tuber regium* has the least (0.57%) fig 8. Calcium was more in *P. tuber regium*

(0.6%) and least in *A. auricular* (0.52%) fig 9. Magnesium content was highest in *A. auricular* (0.36%) and least in *P. tuber regium* (0.24%) fig 10. Phosphorus is highest in *P. tuber regium* (0.37%) and least in *A. auricular* (0.28%) fig 11. The nitrogen content is

highest in *P. tuber regium* (3.65%) and lowest in *P. squarrosulus* (3.11%) fig 12.

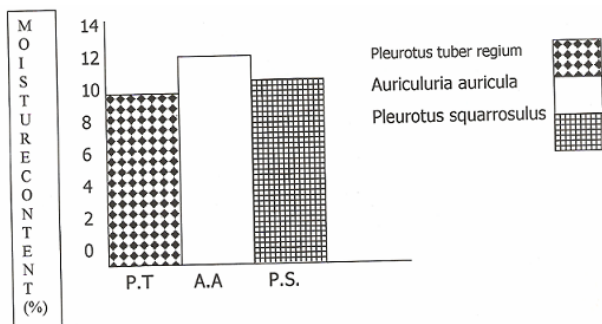


Fig 1: Moisture content of three mushroom species

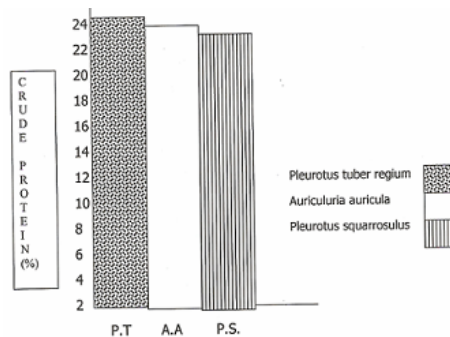


Fig 2: Crude protein content

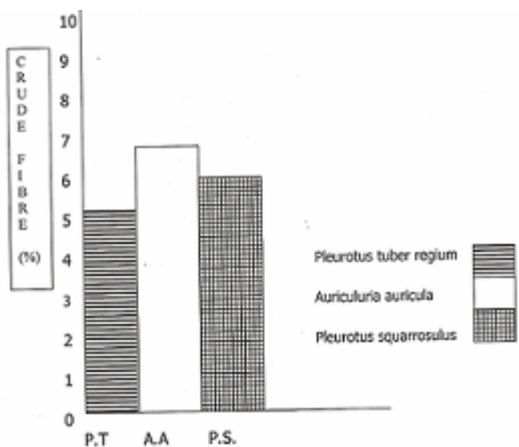


Fig 3: Crude fiber content

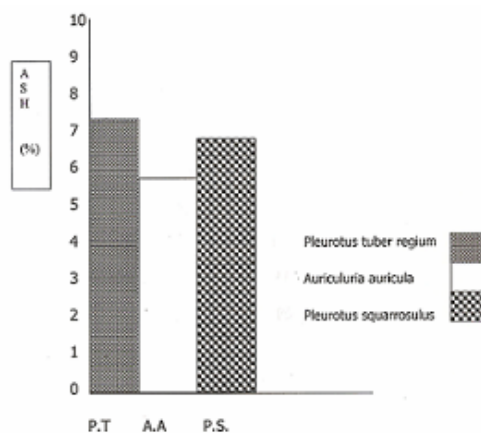


Fig 4: Ash content

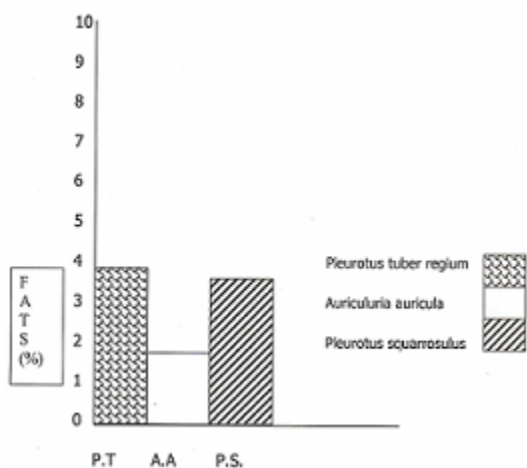


Fig 5: Fat content

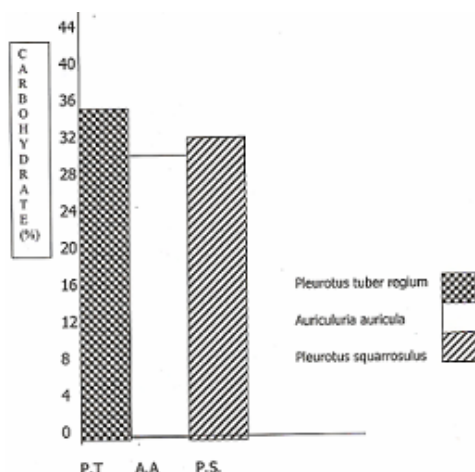


Fig 6: Carbohydrate content

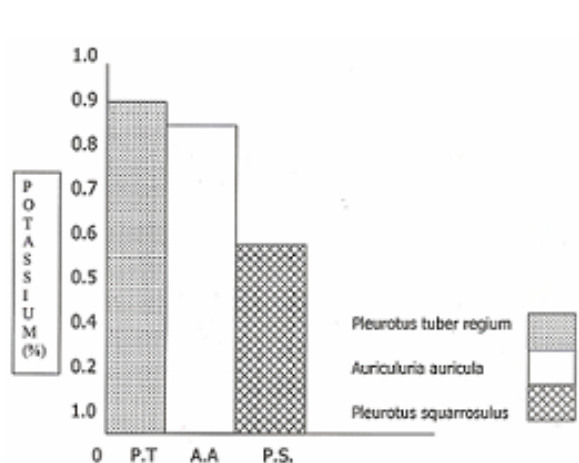


Fig 7: Potassium content

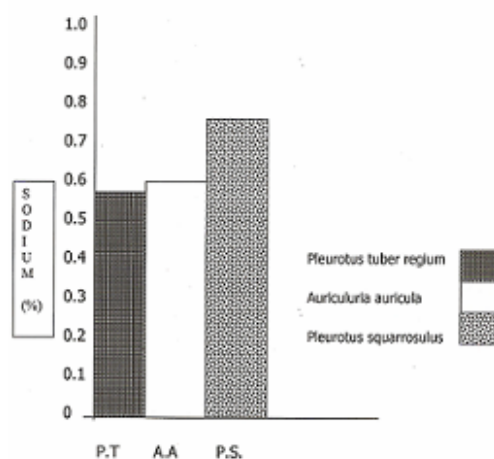


Fig 8: Sodium content

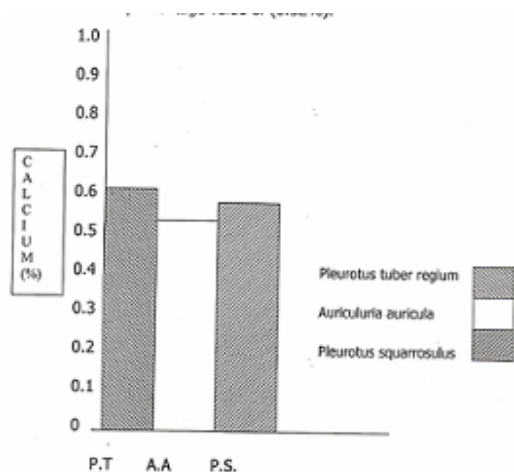


Fig 9: Calcium content

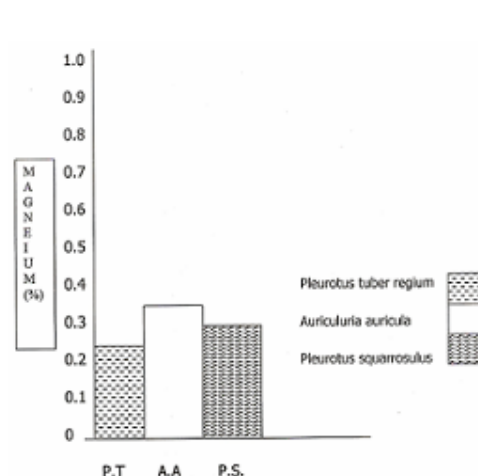


Fig 10: Magnesium content

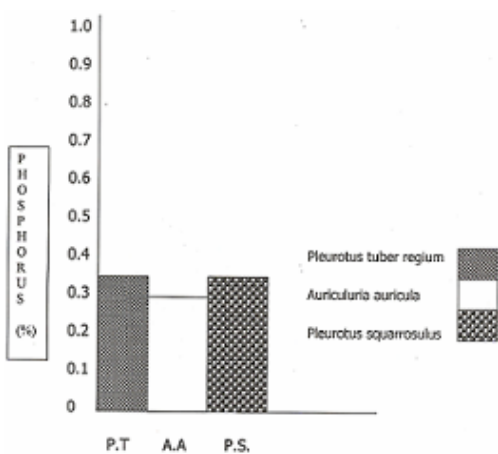


Fig 11: Phosphorus content

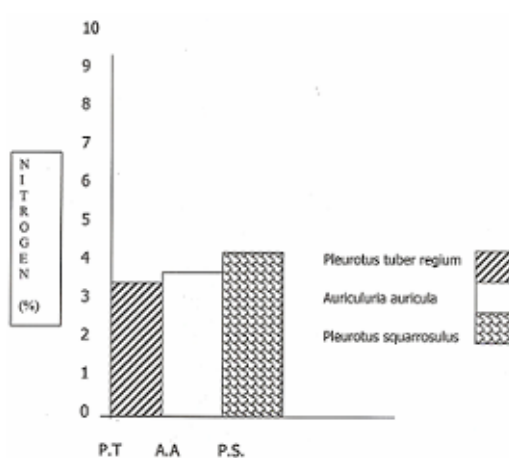


Fig 12: Nitrogen content

4. DISCUSSION

The results of the proximate analysis of the three species of edible mushroom show that the mushroom are richly endowed with protein fibre, ash, moisture, fat, carbohydrates and mineral elements. This agrees with the finding of Moore and Chi (2005) that edible mushrooms have high nutritional attributes and potential applications in industries.

Plerotus tuber-regium has the highest protein content though low in crude fiber content of the three species. *Plerotus tuber-regium* also has the highest ash, fat and moisture content. This is in conformity with the findings of Bano (1993) who studied *T. robustus* and *P. atroumbonata*. *Auricularia auricular* and *P. squarrosulus* recorded low protein, ash, fat and carbohydrate contents when compared with *P. tuber-regium*. The relative high carbohydrate content as well as food energy values in these mushrooms suggests that they are food items (Chukwu, 2000). The high moisture content of protein especially in *A. auricula* suggests that great care must be taken in their handling and presentation as high moisture contents promote susceptibility to microbial growth and enzyme activity (Chukwu, 2000).

The results show that the three species of mushrooms were rich in Nitrogen and were found to contain reasonable levels of Pottasium, Sodium and calcium. This is in agreement with results of the study of some cultivated mushrooms (*Agaricus bisporus* and *Pleurotus osterotus*) (Edogo and Gomina 2000). They also reported that mushrooms are considered as sources of proteins, vitamins, fats, carbohydrates, amino acids and minerals. However, the three species of mushrooms studied here presented low levels of magnesium and phosphorus and these minerals are required for metabolic reactions.

5. Conclusion

The results of the proximate analysis of the three species showed that *P. tuber regium* had the highest levels of crude protein, ash, fat and carbohydrate. *A. auricula* recorded the highest moisture and fibre contents. It can be reasonably concluded following the results of this study that these edible mushrooms hold tremendous promise in complementing the protein and minerals supply deficiencies prevalent in developing countries like ours.

The results of the study showed appreciable levels of fibre which is known as anti-tumorigenic and hypochlestralaemic agent. This implies that mushrooms hold special attraction and may be recommended for people with Cholesterol related ailment (Kadiri and Fasidi 1990). Due to high level of most mineral elements in the species, the three mushrooms can be essential for normal metabolic reaction, transmission of nerve impulse, regulation of water and salt balance and

rigid bone formation.

The results suggest that the mushrooms hold great promise of alleviating the problem of protein supply deficit prevalent in this country since mushrooms are highly nutritional and can compare favourably with egg, meat and milk. However, for the nutritional potential of mushrooms to be realized, sustained efforts must be geared towards the husbandry (cultivation) and popularization of the more nutritious species like *P. tuber regium*, *A. auricula* and *P. squarrosulus*.

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