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RESEARCH ARTICLE

Proximate Composition and Antioxidant Activity of Eleven Selected Wild Edible Nigerian Mushrooms

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ABSTRACT

Wild edible mushrooms of several species are grown in different part of Nigeria for various environmental variables and human food habits. reasons. In this study, the proximate and antioxidant activity of eleven selected wild edible Nigerian mushrooms including *Volvariellavolvacea, Daldiniaconcentrica, Lentinussubnudus, Schizophylum commune, Terimtomyces globules, Cortiarius-tramentarius, Termitomycesrobustus, Volvariellaesculenta, Pleurotuspulmonarius, Psathrellaatroumbonata and Auricularia auricular*were investigated. The mushrooms were harvested fresh, sun dried, pulverized and analyzed according to standard procedures. Proximate analysis showed high level of proteins (11.54-60.38%), crude fibre (3.94-35.88%), carbohydrate (4.17-35.48%), ash (16.44-36.60%), fat (1.28-14.29%) and folic acids (4.75-5.51g/g) in all species. Mineral analysis of all species indicated the presence of potassium, sodium, magnesium, manganese, calcium, copper and Iron. Potassium is of the highest amount in all species of plant (1370-5710g/100g). High antioxidant activity was also observed in these mushrooms with the species *Daldiniaconcentrica* and *Schizophylumcommune exhibiting* the strongest antioxidant activity with values as high as 53.94 and 53.55nm, respectively. These results therefore not only make these wild edible mushrooms popular to consume as good food sources but may also be valuable in drug development.

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INTRODUCTION

Mushrooms have continued to generate a lot of interest particularly in its consumption as food (Boa 2004), in the cure of diseases (Bender *et al*., 2001), in bioremediation and as important items of commerce in Nigeria (Osuji *et al.,* 2013) and globally. The increased interest in consumption of mushrooms as food is as a result of their nutritional, antioxidant and therapeutic values. Studies have shown that tropical mushrooms are highly rich in proteins, minerals, vitamins, crude fiber and carbohydrate with low fat and oil content. The protein content of mushrooms has been reported to be twice that of vegetables and four times that of oranges and significantly higher than that of wheat (Osuji *et al.,* 2004, Okwulehie and Odunze, 2004). The high level of vitamins in mushrooms particularly vitamin C and D has been reported as responsible for its antioxidative activity (Diez and Alvarez 2001). Mushrooms contains also an appreciable quantities of crude fibres, although, little information exist on Total Dietary Fibre (TDF) content of mushrooms. The crude fibre content values reported from many studies suggest that mushrooms are potential sources of dietary fibre (Goyal *et al*., 2008). Mushrooms generally contain low fat and oil content (Mattila *et al.,* 2001). Dueto the low fat and oil content, they are recommended as good source of food supplement for patients with cardiac problems or at risk with lipid induced disorders. Despite the many studies on nutrients and minerals contents of different mushroom species globally, little or no work has been carried out on the antioxidant activity in wild edible species in parts of Nigeria. Also there are several wild edible species of mushrooms which are yet to be exploited and it is to this end that the present work is aimed at investigating the proximate composition and antioxidant and content of eleven selected wild edible Nigerian mushrooms.

MATERIALS AND METHODS

Sample collection and preparation

The mushrooms used for this study were collected from logs of wood, palm logs and humus soil from different location at the base of forestry reserved area in

the department of Forestry Technology, Imo State Polytechnic Umuagwo, Nigeria. The mushrooms were uprooted, destalked, washed and sun-dried by constant exposure to sunlight for 2-4 days while turning the mushrooms to avoid fungal growth. The mushrooms were later milled to obtain mushroom meals (MMS) using mortar and pestle and this was stored in a container until needed for analysis.

Proximate Analysis

Proximate compositions of the mushroom flour were determined by the Official Methods of the Association of Official Analytical Chemists (2000). Ash, crude fibre, total carbohydrates and crude protein were determined by dehydration, Weende (Ouzouni *et al.*, 2009), DNS colorimetric and Kjeldahl (N x 6.25) methods, respectively (Ouzouni *et al.*, 2009).All the calculations were carried out on dry weight basis of the mushrooms. Mineral elements in the dry samples were determined by the wet digestion extraction methods by Association of Official Analytical Chemists (2000) and folic acid content was also determined using the spectrometric method (Mattila *et al.*, 2001).

Antioxidant Activity determination

This was carried out using lipid peroxidation method in tissue homogenate. A weighed liver sample of 0.5g was homogenized in 19.5ml of potassium chloride solution, and the homogenate was stored at a temp of 0-4°C. To a first centrifuge tube, 2.0ml of the homogenate was added to 0.2ml of distilled water and 2.0ml of homogenate, 0.1ml of ascorbic acid solution and 0.1ml of mohr salt solution into second centrifuge tube; to the third centrifuge tube, same components as have been added to the second tube was added in addition to 1ml of trichloroacetic acid solution. The three centrifuge tubes were placed in a water bath at 37°C for 10 minutes and 1ml of trichloroacetic acid solution was added to the first and second tube. It was then centrifuged for 10 minutes at 3000rpm. Two ml of supernatant was poured into three clean test tubes and 1ml of thiobarbituric acid was added and placed in a boiling water bath for 10 minutes and was allowed to cool in ice to room temperature. The absorbance of the supernatant was then read at 532nm for the ten samples (Stroev, 1989).

RESULTS

Proximate composition

Proximate composition of the eleven selected wild edible Nigeria mushrooms showed the presence of high quantities of total ash (16.44-36.60%), crude fibre (3.94-35.88%), carbohydrate (4.17-35.48%), protein (11.54-60.38%) and low fat (1.28-14.29%) content in the various species (Table 1).

Table 2 shows the result of folic acid compositions. The highest level of folic acid was found in the species *Auricularia auricular* (6.51g/g) while the species *Terimtomyces globules* had the lowest amount (4.72g/g).

Antioxidant Activity

Antioxidant activity of the eleven selected wild edible Nigerian mushrooms is shown in Table 3. Amongst all species studied, *Daldinia concentriccommune* exhibited the strongest antioxidant activity with values ranging from 53.94 to 7.89nM.

DISCUSSION

The results obtained from the proximate analysis of all eleven species of wild edible Nigerian mushrooms showed that they are good sources of nutrients such as protein, dietary fibre and therefore can be ranked as protein rich food due to their relatively high protein content in the range of 11.42% in *Terimtomyces globules*spp to 60.38% in *Schizophylum communespp*. The most distinguishing feature of this analysis is the very high protein content (60.38%) in *Schizophylum communespp*. This value is higher than the values reported in previous studies on mushrooms (Osuji *et al*., 2013 and Aremu*et al.*, 2009). It is also higher than those reported for some protein- rich foods such as green vegetables (Li and Chang 1982), cowpea seeds (22.5%) and lima beans (23.3%) (Longvah and Deosthale, 1998). However the protein content of other species which was found to be in the range of 14.02-56.32% is in agreement of results from previous studies (Adejumo and Awosanya, 2005). The studied mushrooms can therefore be ranked as protein rich food for both humans and livestock thus can support the protein need of the poor peasants and solve the problem of malnutrition. Therefore the molecular studies and commercialization of these mushrooms should be encouraged.

Detection of Folic acid (vitamin B9) in all species within the range of 4.72 to 6.51g/100g shows that these mushrooms are rich in vitamins B9. Pharmaceutically, folic acid has been implicated in treatment of anaemia in sicklers and pregnant women (Aletorand Aladetimi, 1995, Qui *et al.*, 2000). This high content of vitamins in mushrooms is in correlation with the findings that mushrooms are rich source of vitamins, proteins and minerals (Edeoga and Gomina2000). Thus mushrooms hold tremendous potentials as a source of raw material for drug manufacture (Kadiri and Fasidi, 1992, Lattif *et al.*, 1996). In this Study, inhibition of lipid per oxidation (antioxidant activity) revealed that all ten species of wild Nigerian mushroom have antioxidant activity as they were able to inhibit per oxidation induced in liver homogenate. *Volvariellavolvacea, Daldiniaconcentrica, Lentinussub-nudus and Schizophylum commune*species elicited 46.38, 53.94, 52.10, 53.55nM antioxidant activity respectively compared to the standard, ascorbic acid (46.38nM) while the remaining species inhibited peroxidation to a lower extent (46.11-33.45nM). This result agrees with other findings that show that mushrooms are good source of vitamins and flavonoids and that most wild edible Nigerian mushrooms posses antioxidant activities (Osuji *et al*., 2013). Lipids peroxidation has been shown to result from cumulative effect of reactive oxygen species, which disturb the assembly of the membrane causing changes in fluidity and permeability, alterations of ion transport and inhibition of metabolic processes (Okwulehie and Odunze, 2004). These mushrooms particularly *Volvariellavolvacea, Daldiniaconcentrica, Lentinussub-nudus andSchizophylum commune*species therefore can be suggested to act as antioxidant agents.

Table 1: Proximate Composition of 11 Selected Wild Edible Nigeria Mushroom Species.

Species	% Ash	% Fats	% Crude Fiber	% Crude Protein	% Carbohydrate
Vo Volvariellavolvacea	25.78±4.28	9.14±0.18	13.64±0.59	25.26±1.93	18.00±0.44
Daldiniaconcentrica,	32.37±5.67	8.95±0.35	15.72±0.23	32.38±0.22	8.20±0.39
Lentinussubnudus,	17.44±0.34	14.29±0.12	12.72±0.12	41.13±0.20	11.50±0.21
Schizophylum commune,	20.56±0.002	9.33±1.22	3.94±0.22	60.38±0.12	4.17±0.17
Terimtomyces globules	33.11±4.02	5.24±0.43	35.88±0.56	11.54±0.54	8.00±0.21
Cortiariustramentarius	32.44±0.012	5.44±0.03	10.97±0.23	29.78±0.12	11.51±0.21
Termitomycesrobustus,	32.65±0.45	4.43±0.17	11.42±0.21	35.46±0.87	11.67±0.27
Volvariellaesculenta,	36.60±0.24	8.78±0.53	10.98±0.52	14.02±0.01	8.18±0.15
Pleurotuspulmonarius	20.54±0.29	4.88±0.11	20.37±0.22	27.17±0.12	35.48±0.13
Psathrellaatroumbonata	32.88±0.012	1.28±0.11	16.76±0.23	41.21±0.23	15.00±0.22
Auricularia auricular	16.44±0.23	9.34±0.18	33.28±0.32	56.32±1.33	9.17±0.14

Table 2: Folic Acid Composition of 11 Selected Edible Wild Nigeria Mushroom.

Sample	Folic acid content (G/100G)
Blank/Standard	5.06±0.20
Volvariellavolvacea	5.07±0.39
Daldiniaconcentric	5.30±0.38
Lentinussubnudus	4.79±0.42
Schizophylum commune	5.02±0.40
Terimtomyces globules	4.72±0.42
Cortiariustramentarius	5.17±0.39
Termitomycesrobustus	4.93±0.41
Volvariellaesculenta	4.87±0.41
Pleurotuspulmonarius	4.75±0.42
Psathrellaatroumbonata	5.51±0.36
Auricularia auricular	6.51±0.46

Table 3: Antioxidant Activity of 11 Selected Wild Edible Nigerian Mushrooms

Species	Anti Oxidant Activity (nM)
Control	46.38±6.09
Volvariellavolvacea	49.74±6.95
Daldinia concentric	53.94±7.89
Lentinussubnudus	52.10±7.22
Schizophylum commune	53.55±7.99
Terimtomyces globules	38.78±8.00
Cortiariustramentarius	33.45±4.88
Termitomycesrobustus	33.45±4.88
Volvariellaesculenta	34.69±4.99
Pleurotuspulmonarius	46.11±7.23
Psathrellaatroumbonata	36.32±5.01
Auricularia auricular	42.17±4.56

The valuable pharmaceutical properties of mushroom may also be attributed to the presence of alkaloids which has been reported to have a stimulating effect, act as topical anaesthetic in Ophthalmology, powerful pain reliever, antipuretic action among other uses (Fasidi, 1996, Edeoga and Enata, 2001).

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. Many studies have attributed that antioxidant properties are due to the presence of flavonoids (Hammond, 1978 and Akindahunsi,2005, Schneider and Wolfling2004) hence may be a reason for the high lipid per oxidation inhibition found in certain species of the studied mushrooms.

Conclusion

Based on the result of these findings, it can be concluded that the eleven edible wild Nigeria mushrooms investigated can serve as a constituents of human diet supplying the body with proteins, minerals and vitamins thereby could be utilized as a cheap source of protein, energy, minerals and antioxidant supplement for both man and/or livestock.

However, these mushrooms are grown in the wild and therefore for improved utilization, there is need to grow them domestically.

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