European Journal of Food Science and Technology
Vol.3, No.2, pp.57-63, May 2015
Published by European Centre for Research Training and Development (www.eajournals.org)

NUTRITIONAL COMPOSITION AND SOME ANTI-NUTRITIONAL FACTORS OF THREE EDIBLE MUSHROOM SPECIES IN SOUTH EASTERN NIGERIA

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ABSTRACT: *Studies on nutritional composition and some anti-nutritional factors of three edible mushroom species in South Eastern Nigeria such as Termitomyces sp, Russula sp and Pleutotus tuber regium was carried out. Standard analytical methods were used to obtain the proximate composition, mineral composition, vitamin C content anti-nutritional factors (phytin, hydrocyanide, and tannin). The moisture content was highest in the Russula sp (90.2%) and lowest in the Pleutorus tuber regium (60.7%). On the average the crude protein was 41.7%, 30.3% and 15.4% on dry mass basis (dmb) for Termitomyces sp, Russula sp and Pleutorus tuber regium respectively, while the values for crude fibre were 5%, 17.9% and 13.5 respectively. Carbohydrate content ranged from30.2 to 55% while fat content ranged from 3.6% to 7.8% (dmb). Mineral composition indicated appreciable amounts of iron 2093.3 ppm in T. robustus and Rusular 1830.0 ppm and 2001.6 ppm respectively. Other mineral elements such as potasium and phosphorus were also appreciable. The least in all the species examined was Calcium. Vitamin C content was very low (0.01- 0.04 %) in all the species. Phytic acid content ranged from 0.94 – 0.75mg/100g, Hydrocyanic acid from 0.04 – 1.0mg/100g, and tannin was from 0.04 to 0.13 which is quite low to give adverse effect.*

KEYWORDS: Nutrient composition, Antinutrients, local edible Mushrooms, South Eastern Nigeria.

INTRODUCTION

Edible mushrooms are fungi and belong to the class Basidiomycetes. They have been found to provide a rich addition to the diet in the form of protein, carbohydrate, mineral, vitamins and enzymes (Manzi *et al*.,1999). Studies on edible mushroom have resurfaced as world nutrition is observed as shifting from processed to natural foods. This has almost led to warning for people to stay away from un-natural foods (Ogazi, 2010 and Ihediohanma *et al* 2014) due to uncertainty surrounding their safety.

This consciousness has opened up research interest into lesser known natural foods with the inquest to identify and evaluate their composition in order to improve quality and encourage their production and consumption. This is also in line with the recommendation of FAO (1987) in recognition of the role of minor crops in nutrition and food security.

The consumption of edible mushrooms in Nigeria is seasonal. Most people only consume them because of their unique flavors and not really for their nutritional composition. At the moment mushrooms are only hunted and harvested from the wild, however, if the food composition is elucidated and people get aware of certain important components of it, this will encourage cultivation and subsequent industrial production. The aim of this work is to evaluate the nutrient composition of three local species of mushrooms commonly consumed in the Eastern Nigeria namely *Termitomyces s*p, *Russula* sp, and *Pleteurotus tuber regium*.

MATERIALS AND METHODS

Materials

The fresh edible mushrooms *Termitomyces, sp Russula sp and Pleurotus tuber – regium* used in this work were collected during the season in the local markets in Umuguma near Owerri in Eastern Nigeria. Scientific identification of the mushrooms were done in the Department of Crop Science Federal University of Technology Owerri, Imo State, Nigeria.

Proximate Composition

Analysis for the composition of moisture, fat and protein, crude fibre and ash were done according to the method described by AOAC (2000). Carbohydrate was analyzed by difference. This was obtained after subtracting the total organic nitrogen, lipid ash and fibre from the total dry matter in accordance with AOAC (2000).

Determination of Mineral Elements

Mineral elements were determined according to the method described by AOAC (2000) for Mg, Ca, Cu, Fe, and flame photometer for Na and K. Total phosphorus in the samples was also determined by the molybdate method according to the modified method of AOAC (2000) The method involved wet digestion with a mixture of nitric, sulpheric and pechloric acids, using an atomic absorption spectrophotometer (AAS, Model sp9).

Determination of Anti-nutrients

Phytate was determined using the method described and modified by Aletor (1995), This involved measuring the phosphorus in the sample aliquot after the sample was extracted with 0.5m HCL and later digested in 60% $HClO_4$ and HNO_3. The absorbance of the solution was read at 700nm and matched in with the calibration curve of the standards. Hydrocyanic acid (HCN) content was determined by method described by AOAC (2000) which involved collection of distillate from kjeldahl flask in NaoH solution and titrated against solution of $AgNo_3$.

Tannin content was determined using a modified prussian blue method described by Earp et al (1981). Vitamin C (Ascorbic) acid was determined by the modified method of AOAC (2000). This involves the use of diehlorophenol indophenols dye (DCPIP) dye and titrated against standard ascorbic acid solution while repeating the same with sample solution.

RESULTS AND DISCUSSION

Proximate composition

The mean moisture content of the samples are shown on Table 1. The moisture content of the fresh mushroom samples were 87%, 90.3% and 60.7% respectively for *Termitomycess sp, Russula sp and Pleurotus tuber regium*. The moisture content is an important indication of the nutrient density of the samples as well as its shelf life. Pleutorus tuber regium had the lowest moisture content (60.7%) and traditionally they are usually easily sundried, smoked and stored soon after harvest. However the other mushroom species are known for their high perishability due to their higher moisture content. Moisture contents ranging from 85.4% to 94.7% has also been reported by Manzi *et al*., (1999).

Table 1 also showed the moisture content of the samples reduced after three days of storage at ambient conditions to values of 40.2%, 35% and 50.1% respectively for *Termitomyces sp, Russula sp and Pleurotus tuber regium.* This implies a percentage moisture loss of 53.71, 61.19 and 17.16 respectively. Russula spp which had the highest moisture content also recorded the highest percentage moisture loss. Le Roux and Danglot (1972) also reported moisture loss of 10-25% after storage of *Agaricus biosporus* for four days.

The protein content on a dry mass basis (dmb) was 41.7%, 30.3% and 15.4% for *Termitomyces sp, Russula sp and Pleurotus tuber regium* (Table 2). *Russula sp* recorded the highest values for ash (16.0%) and crude fibre (17.9%). However the highest carbohydrate values (55%) were observed in the *Pleutorus tuber regium* while the lowest was *Russula sp* (30.2%). This may explain why the ground dry *Pleutorus tuber regium* is used locally as a binder, bulking agent (in melon cake-a local snack) or a thickener in soups.

The variation in values among the mushroom species is an indication of the extent of variability between mushroom species. Such variability between species as well as within species has also been reported by Chang and Hedge (1978) and Aletor (1995). This may be attributed to inherent biological differences as well as type or composition of the growing substrate (Maggioni et al 1970).

It can also be observed from the results that all the mushroom samples contained crude protein, ash and crude fibre in amounts that surpasses those contained in some legumes (except groundnuts and soyabeans) grown in West Africa, (Ologhogbo, 1980; Aletor and Aladetimi, 1989). Interestingly the fat contents were low with values ranging from 3.6% to 7.81% (dmb) as shown on Table 1. This implies that mushrooms can function effectively in low fat diet such as those required by patients with cardiovascular diseases, obesity etc (Gropper *et al*., 2009).

The results of the mineral contents show that the highest mineral element *detected* was Iron while Calcium was the lowest. *Termitomyces sp, and Russula sp,* and *Pleutorus tuber regium* contained 2,093. 3ppm, 1830.0ppm and 2001,6ppm of Iron respectively (Table 3), although reports by Crisan and Sands (1978) show that mushrooms are low in iron. The appreciable levels of iron in these local species studies suggest that these mushrooms may be useful in treatment of anemia. Mushrooms have also been used in the past to cure anemia (Gender, 1986, Bahl 1985).

High values were also obtained for phosphorus (220-1940ppm), sodium (494-1069ppm). This indicates that these mushroom species are good sources of these mineral elements and may provide more than 50% of the recommended daily allowance for these elements. The values were also higher than those reported for cowpea species but lower than the values reported for fish, snails and meat, (Imevbore 1992; Aletor and Aladetimi, 1989.

The vitamin C contents of samples of mushroom are presented in Table 3. Vitamin C was detectable at levels ranging from 0.01% to 0.04%. Generally the result shows that the mushroom evaluated are not dependable source of Vitamin C, however they can also make important contribution to the diet.

Anti – nutrient factors

The values for anti – nutrient factors were generally low in all the samples studied as shown on Table 4. The phytate values ranged from 0.09 to 0.25mg/100g, Hydrocyanides (0.04 – 1.00mg/100g) and tannin (0.11 – 1.02mg/100g). This showed that the toxic effect of these substances may not be experienced by the consumer since there is further destruction of these substances during cooking.

Similar values (0.1 to 0.36mg/100g) have been reported for phytates in some mushrooms, (Aletor 1995). However these values are not higher than those reported for cowpea and soyabean by Ologhogbo,(1980). Phytates chelate mineral elements such as Ca, Mg,Fe and Zn which renders the elements unavailable for absorption, (Forbes and Erdman 1983). Phytates and Tannins also inhibit the activities of digestive enzymes: amylase, pepsin and pancreatin, (Griffiths, 1979; Huisman, 1991)

Table 1:Moisture Content of Fresh Mushroom Samples stored for 3 days

Mushroom	First day	Second Day	Third Day
Termitomyces sp	87.0%	62.5%(28.81%loss)	40.2%(53.79%loss)
Russula sp	90.2%	66.3%(26.64%loss)	35%(61.19%loss)
Pleutorus tuber – regium	60.7%	55.5%(9.22%loss)	50.1%(17.46loss)

Table 2: Proximate Composition Mushroom Samples (% dry mass basis)

Mushroom	Crude Protein	Fat	Ash	Crude Fibre	Carbohydrate
Termitomyces sp	41.7	7.8	12.2	5	33.3
Russulasp	30.3	5.6	16.0	17.9	30.2
Pleutorustuber – regium	15.4	3.6	12.5	13.5	55.0

Table 3: Mineral and Vitamin C Content of Mushroom Sample (%dmb)

Mushroom	Ca(%)	K(%)	Mg(%)	Na(ppm)	Mn(ppm)	Fe(ppm)	Cu (ppm)	Zn (ppm)	P(ppm)	Vit. C
Termitomyces sp	0.0039	0.471	0.02	127	3.233	272.129	2.2288	11.115	252.2	0.04
Russula sp	0.0009	0.304	0.0098	48.412	2.644	179.34	0.895	8.536	159.74	0.01
Pleutorus tuber – regium	0.00	0.216	0.031	420.117	8.437	786.62	2.452	8.567.	86.46	0.01
RDA*	800mg	--	300mg	--	--	18mg	--	15mg	800mg	

Table 4: Anti – nutrients (mg/100g) Content of Mushroom Samples

Mushroom	Hydrocyanic acid	Tannin	Phytate
Termitomyces sp	0.13	0.13	0.0117
Russula sp	0.0019	0.0411	0.0735
Pleutorus tuber – regium	0.0157	0.04323	0.098

*RDA-Recommended Daily Allowance (Onyeka, 2013)

CONCLUSION

Results on the proximate composition, mineral and anti-nutrient content of the edible species of mushrooms clearly indicate the potentials for their use as sources of good quality food. Using these proximate, mineral and antinutritional analytical values as approximate indices of nutritional quality, it would appear that these mushrooms (*Termitomyces sp, Russula sp, and Pleteurotus tuber – regium.* fall between most legumes and meat. From the present analytical information, it is conceivable that a number of these edible mushrooms hold tremendous promise in narrowing the protein and mineral supply deficits prevalent in several developing countries of Africa. To date, virtually all of these mushrooms are harvested in the wild, with no efforts at their husbandry. Consequently, for their full nutritional potentials to be realized, intensive efforts must be geared towards the husbandry and popularization of these nutritious species.

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