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Evaluation of the Nutritional Status of Two Edible Mushroom Species in Ekiti State, Nigeria

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Abstract
Studies on the nutritional composition of two edible mushroom species namely *Pleurotus sajo-caju* Fr. and *Lentinus squarosulus* Mont. in Ekiti State, Nigeria were carried out. Standard analytical methods were used to obtain the proximate and mineral composition of the mushrooms. Results of proximate analysis showed that *P. sajo-caju* contained 6.61% of moisture, 1.11% of fat, 4.17% of ash, 26.25% of protein, 0.17% of crude fiber and 61.70% of carbohydrate while *L. squarrosulus* contained 9.77% of moisture, 2.41% of fat, 4.30% of ash, 16.67% of protein, 0.26% of crude fiber and 66.61% of carbohydrate. The percentage of fat and crude fiber was generally low. Results of mineral analysis revealed high concentrations of potassium (577.42mg/100g in *P. sajo-caju* and 789.67mg/100g in *L. squarrosulus*) and calcium (165.15mg/100g in *P-sajo-caju* and 285.15mg/100g in *L. squarosulus*). Other minerals were present in appreciable amounts, the least being manganese (1.26mg/100g) in *P. sajo-caju* and copper (0.90mg/100g) in *L. squarrosulus.* However, lead and nickel were below detection limits in the two mushroom species. These results show that these mushrooms are good sources of proximate components and minerals needed for maintenance of good health.
Keywords: proximate composition, mineral composition, mushroom, Ekiti state.

1. Introduction

Mushrooms are fungi and belong to the family Basidiomycetes. They are made up of hypha which form interwoven web of tissue known as mycelium in the substrate upon which the fungus feeds. Ingold (1993) reported that most often, their mycelia are buried in the tissue of a tree trunk, on a fallen log of wood or in the nourishing substrates. Though man has been hunting for wild mushrooms since antiquity (Cooke, 1977), they still remain one of the world's greatest untapped resources of nutritious food (Kayode *et al.,* 2015). Edible mushrooms have potentials to contribute enormously to food value of our habitual diet as they may contribute enormously to the supply of both macro and micro-nutrients in our diet. Nutritive value of mushrooms is attributed to their high content of essential amino acids, vitamins, minerals and low lipid (Jiskani, 2001). All essential amino acids are present as well as water- soluble vitamins and all the essential minerals (Buigut, 2002). Mushrooms are good sources of vitamins like riboflavin, biotin and thiamine (Chang and Buswell, 1996). The fruiting bodies of mushrooms are characterized by high level of well assimilated mineral elements. Major mineral constituents in mushrooms are potassium, phosphorus, sodium and calcium while copper zinc and iron form parts of minor constituents (Chang, 1991). The protein value of mushrooms is twice as that of asparagus and potatoes, four times that of tomatoes and carrots and six times that of oranges (Jiskani, 2001). Bano (1976) suggested that the food value of mushrooms lies between meat and vegetables. Gruen and Wong (1982) indicated that edible mushrooms are highly nutritional and compare favorably with meat, egg and milk. With all the nutritional qualities of edible mushrooms, it is interesting to remark that they are also relatively much cheaper than many of the known food items that contain similar nutrients. Despite the nutritional importance of edible mushrooms, the nutritional values of some tropical edible mushrooms consumed in Ekiti State, Nigeria have not been determined. This situation infers that people eat edible mushrooms in this area without knowing their nutritional values. This justification infers this study whose aim is to determine the nutritional values of two species of edible mushrooms in Ekiti State, Nigeria in order to encourage their possible husbandry.

2. Materials and methods

2.1 Collection of mushrooms

The fully matured mushroom species (*L. squarrosulus*) was collected from a farmland in Igede Ekiti while *P. sajo-caju* was collected from the Afe Babalola University, Ado Ekiti. The mushrooms were cleaned and washed many times, sliced and air dried, powdered in a blender and kept in air tight containers prior to analysis.

2.2 Proximate analysis

The mushroom species were analyzed for food composition according to the Association of Official Analytical Chemists (AOAC, 1995). These include the determination of crude protein, crude fat, moisture content, ash, crude fiber, carbohydrate and minerals. The minerals include potassium, sodium, calcium, magnesium, manganese, iron, nickel, zinc, lead and copper. Values for iron, copper and manganese were read on Atomic Absorption Spectrophotometer after standardizing with respective elements. The percentage of all the fractions (crude protein, crude fat, minerals and ash) were added together and subtracted from 100 to obtain the total

carbohydrate percentage while the nitrogen free extract (dry weight) was calculated as the percentage of the total carbohydrate and crude fiber.

3. Results

Table 1 shows the scientific names, local names, families and habitats of the mushroom. The results of the proximate composition of the two mushroom species are presented in Table 2. Results revealed that the moisture content, fat content, ash, protein content, crude fiber and carbohydrate content of *P. sajo-caju* were 6.61%, 1.11%, 4.17%, 26.25%, 0.17% and 61.70% respectively while that of *L. squarrosulus* were 9.77%, 2.41%, 4.30%, 16.67%, 0.26% and 66.61% respectively. The moisture content, fat and crude fiber contents were higher in *L. squarrosulus* while the carbohydrate and ash contents of both mushrooms are comparable. The moisture, fat, ash and crude fibers of the two mushrooms were low while proteins and carbohydrates were of high concentrations. Results in Table 3 show values of the macro mineral compositions of the mushrooms. The concentrations (mg/100g) of sodium, potassium, magnesium and calcium in *P. sajo-caju* were 45.79, 577.42, 39.86 and 165.15 respectively while that of *L. squarrosulus* were 75.89, 789.67, 36.20 and 281.15 respectively. Results revealed that all the macro minerals were of higher concentrations in *L. squarrosulus* than *P. sajo caju* except magnesium whose values were comparable. The most abundant macro mineral in the two mushrooms was potassium while the least was magnesium. Table 4 shows the micro mineral composition of the mushrooms. The concentrations (mg/100g) of manganese, iron, zinc and copper in *P. sajo-caju* were 1.26, 13.80, 7.69 and 2.40 respectively while that of *L. squarosulus* were 4.17, 25.15, 6.39 and 0.90 respectively. The concentrations of manganese and iron were higher in *L. squarrosulus*; copper concentration was higher in *P. sajo-caju* while the concentrations of zinc in the mushrooms were comparable. The micro mineral with the highest content in the two mushrooms was iron while the least was manganese in *P. sajo-caju* and copper in *L. squarrosulus*. However, the concentrations of lead and nickel in the mushrooms were below detectable limits.

Table 1: Scientific names, local names, families and habitat of the mushroom species

S/N	Scientific name	Local name	Family	Habitat
1.	*P. sajo-caju*	Owu oyibo	Pleurotaceae	Saw dust
2.	*L. squarrosulus*	Osun awo	Polyporaceae	Tree trunk

Table 2: Proximate composition (%) of *P. sajo-caju* and *L. squarrosulus*

Parameters	%Composition	
	P. sajo-caju	*L. squarrosulus*
Moisture	6.61 ± 0.10	9.77 ± 0.01
Crude fat	1.11 ± 0.16	2.41 ± 0.00
Ash	4.17 ± 0.00	4.30 ± 0.14
Protein	26.25 ± 0.16	16.07 ± 0.18
Crude fiber	0.17 ± 0.18	0.26 ± 0.00
Carbohydrates	61.70 ± 1.01	66.61 ± 1.21

Values are means of three replicates

Table 3: Macro mineral composition (mg/100g) of *P. sajo caju* and *L. squarosulus*

Macro minerals	*P. sajo caju*	*L. squarrosulus*
Sodium	45.79 ± 0.50	75.89 ± 2.62
Potassium	577.42 ± 1.31	789.67 ± 1.11
Magnesium	39.86 ± 0.17	36.20 ± 0.80
Calcium	165.15 ± 1.77	285.15 ± 2.53

Values are means of three replicates

Table 4: Micro mineral composition (mg/100g) of *P. sajo caju* and *L. squarrosulus*

Micro minerals	*P. sajo caju*	*L. squarrosulus*
Manganese	1.26 ± 0.15	4.17 ± 2.62
Iron	13.80 ± 0.53	25.15 ± 0.60
Nickel	ND	ND
Zinc	7.69 ± 0.67	6.39 ± 0.11
Lead	ND	ND
Copper	2.40 ± 0.35	0.90 ± 0.10

Values are means of triplicates
ND – Not detected

4. Discussion

The results of the proximate analysis of the two species of edible mushroom revealed that the mushrooms are richly endowed with proximate contents and minerals. This agrees with the finding of previous researchers (Ezeibekwe *et al*., 2009; Jiskani, 2001; Chang and Buswell 1996) that edible mushrooms have high nutritional attributes. The carbohydrate contents of *P. sajo caju* and *L. squarrosulus* were higher than that reported by Eze *et al*. (2014) for some mushrooms commonly consumed in Nigeria like *Auricularia auricular* (42.82%) and *Termitomyces mammiformis* (37.64%). However, results compare favourably with values in other edible mushrooms such as *Plerotus tuber-regium* (60.93%) by Eze *et al.* (2014) and *Cheimonophyllum candidissimus* (62.06%) by Okwulehie and Ogoke (2013). The crude fiber contents obtained were lower than the values reported for *Termitomyces spp* (5.0%), *Russula sp* (17.9%) and *Plerotus tuber-regium* (13.5%) (Ijioma *et al.,* 2015). Crude fiber contents (%) of 8.49, 4.52, 2.51 and 1.06 were reported for *C. candidissimus*, *Pleurotus sp., Russula sp.,* and *Auricularia sp.* by Okwulehie and Ogoke (2013) which are higher than the values obtained in this study. The value of the crude fat observed in *P. sajo caju* compares favourably with values reported in *Auricularia auricular* (1.12%), *Lactarium triviralis* (1.26%), *Termitomyces mammiformis* (1.19%) and *Schizophyllum commune* (1.18%) while that of *L. squarrosulus* observed in this study compares favourably with 2.35% in *Russula vesca* (Eze *et al.,* 2015). However, the values obtained for crude fat in the two mushrooms in this study are lower than the values reported for *Termitomyces spp* (7.80%), *Russula spp* (5.60%) and *P. tuber-regium* (3.60%) (Ijioma, 2015). The values are also lower than that reported for *P. sajo caju* (6.65%) by Kayode *et al*. (2013). However, the values obtained for crude fat in this study are higher than values obtained for fats in *Pleurotus spp* (0.19%) and *Auricularia spp* (0.32%) (Okwulehie and Ogoke, 2013). The low fat contents observed in this study implies that the mushrooms can function effectively in low fat diet such as those required by patients with cardiovascular diseases and obesity (Gropper *et al*., 2009). The result of protein content of *P. sajo caju* and *L. squarrosulus* were 26.25% and 16.67% respectively. Both values were higher than the values obtained in the caps of *P. tuber regium* (13.8%, 14.6% and 13%) by Akindahunsi and Oyetayo (2006), Kadiri and Fasidi (1990) and Mlodecki *et al*. (1974) respectively. The value was also higher than (8.9%) reported for *Auricularia auricular by* Aletor (1995). However, the value of the protein content observed in this study was lower compared to some edible mushrooms like *T. mammiformis* (37%), and *L. triviralis* (32%) (Adejumo and Adesanya, 2004). The protein value obtained in *P. sajo caju* in this study compares favourably with that of *A. auricular* (25.37%) and *L. trivivalis* (22.83%) while that of *L. squarrosulus* compares favourably with *P. tuber-regium* (17.47%) (Eze *et al*., 2015). The value obtained for the protein content of *L. squarrosulus* in this study was lower than that reported for *L. squarrosulus* (26.23%) by Eze *et al.* (2015). This may be attributed to a number of factors such as composition of the substratum, size of the pileus and harvest time (Bano and Rajarathnam, 1982). The value of moisture observed in *P. sajo caju* fell below values obtained for *C. candidissimus* (10.13%) and *A. auricular* (12.06%) by Okwulehie and Ogoke (2013) but compares favourably with the values reported for the cap and stalk of *P. tuber-regium* (Akindahunsi and Oyetayo, 2006) and 7.00% reported for *P. sajo caju* by Kayode *et al* (2013) while that of *L. squarrosulus* compared favourably with values obtained for *Pleurotus sp.* and *Radula sp.* (Okwulehie and Ogoke, 2013). The low moisture content observed in this study suggests that the mushrooms will be less susceptible to microbial contamination (Uraili and Izuagbe, 1990). Ash contents of the two mushrooms were comparable to values reported for edible mushrooms by Eze *et al.* (2015) but were lower than the values reported by (Okwulelie and Ogoke, 2013) for other edible mushrooms. The knowledge of the ash content gives an indication of the mineral composition of the mushrooms. The importance of minerals in our diet cannot be over-emphasized given their roles in metabolic reactions, rigid bone formation and osmoregulation among others (WHO, 1996). The present study revealed that edible mushrooms are rich sources of mineral elements. This conforms to the reports of several researchers (Adejumo and Awosanya 2004; Ola and Oboh, 2001; Kadiri and Fasidi, 1990). The most abundant mineral in the two mushrooms was potassium. This agrees with initial reports of Kadiri and Fasidi (1990) and Ola and Oboh (2001) who found the highest mineral to be potassium in all the edible mushrooms analyzed. The potassium content were higher than the values found in several other edible mushrooms (Eze *et al*., 2015; Okwulelie and Ogoke, 2013) but comparable with values reported by Kayode *et al.* (2013) for *P. sajo caju*. The importance of potassium in controlling high blood pressure in the body cannot be over-emphasized (Yusuf *et al*, 2007). The calcium content of the mushrooms in this study was also high. Calcium is necessary for sustaining strong bones, muscular contraction and relaxation, blood clotting and absorption of vitamins B_{12} (Mensal *et al*., 2008). The iron contents of these mushrooms are high when compared with those of green vegetables (Oko, 2012; Abdurahman, 2012) which are usually recommended for anemic convalescence. Thus, the mushrooms can help in boosting the blood level in anemic conditions. Generally, variations in the mineral proportions of mushrooms vary according to the species, age, diameter of fruiting bodies and the type of substratum (Demibras, 2001).

Conclusion

This study has clearly shown that the edible mushrooms (*P. sajo caju* and *L. squarrosulus*) have tremendous

potentials in supplementing the protein and mineral deficiency prevalent in developing countries like Nigeria. It is hereby recommended that government should encourage the husbandry and popularization of edible mushrooms.

References

Abdurahman, F.I., Tijani, M.A. & Osuyi, U.O. (2012). Proximate content and chemical composition of *Ocimum viridis* leaf an *Ocimum grattisium* leaf. *IRJP*, 2(3):347-354.

Adejumo, T. O. & Awosanya, O. B. (2004). Proximate and mineral composition of four edible mushroom species from South western Nigeria. *African Journal of Biotechnology* 4(10):1084-1088.

Akindahunsi, A. A. & Oyetayo, F. L. Nutrient and antinutrient distribution of edible mushroom, *Pleurotus tuber-regium (*fries) singer. *ELSEVIER LWT. 2006;* 39: 548-553.

Aletor, V.A. (1995). Compositional studies of edible tropical series of Mushrooms. *Food Chemistry.* 54: 265-26.

AOAC (1995). Official Methods of Analysis 16th Ed., Association of Official Analytical Chemists, Washington, D.C.

Bano, Z. (1976). Nutritive value of Indian mushrooms and medicinal practices. *Eco. Bot.,* 31:367-371.

Bano, Z. & Rajarathanam, S. (1982). *Pleurotus* mushrooms as a nutritious food. In: Tropical mushrooms-Biological nature and cultivation methods, (Chang, S.T., Quimio, T.H. eds.). The Chinese University Press, HongKong. Pp363 - 382.

Buigut, S.K. (2002). Mushroom production in sustainable small-scale farming system- opportunities and constraints: a survey of Uasin Gishu district. In: Proceedings of the Horticulture seminar on sustainable horticultural production in the tropics at Jomo Kenyatta University of Agriculture and Technology, Juja, Kenya, 3rd-6th October, 2001.Eds. Wesonga, J.M., Losenge, T.Ndung'C.K., Fricke, A. Hau, B., Stutzel, H. (2002). Pp 1-5.

Chang, S.T. (1991). Cultivated mushrooms, In: Handbook of Applied Mycology, pp3:221-240.

Chang, S.T. & Buswell, J.A. (1996). Mushroom Nutriceutical. *World J. Microbial*., 12:473- 475.

Cooke, R.C. (1977). Fungi, Man and his Environment, Largman, London. Pp 144.

Demibras, A. (2001). Concentrations of 21 metals in 18 species of mushrooms growing in the east Black Sea region. *Food Chemistry*, 75:453-457.

Eze, C.S., Amadi, J.E. & Emeka, A.N. (2014). Survey and proximate analysis of edible mushrooms in Enugu State, Nigeria. *Annals of Experimental Biology*, 2(3):52-57.

Ezeibekwe, I. O., Ogbonnaya, C. I. & Osuala, O. M. Proximate analysis and mineral composition of edible mushrooms in parts of South eastern, Nigeria. *Report and Opinion.*2009; 1(4): 32-36.

Gropper, S.S., Smith, J. L. & Groff, J.L. (2009). Advanced Nutrition and Human Metabolism. 5th edition, Australian Wardsworth Cengage Learning.

Gruen, V.E.C. & Wong, H.X. (1982). Immunodulatory and antitumour activities of a polysaccharide-peptide complex from a mycelia culture of *Trichoderma sp. Sciences,* 57:269-281.

Ijioma, B. C., Ihediohanma, N. C., Onuegbu, N.C. & Okafor, D. C. (2015). Nutritional composition and some antinutritional factors of three edible mushroom species in South eastern Nigeria. *European Journal of Food, Science and Technology* 3(2):57-63.

Ingold, C.T. (1993). The biology of fungi, 6th revised edition Chapman and Hall. Pp197-206. Iowa Conservation Education Council, 1994.

Jiskani, M. M. (2001). Energy potential of mushrooms. The DAWN economic and business review, Oct. 15-21. P. IV.

Kadiri, M., & Fasidi, O. I. (1990). Variations in chemical composition of *Chlorophyllum molybditis* (Mayerex. Fr.) masses and *Pleurotus tuber-regium* (Fries) during fruitbody development. *Nigerian Journal of Science,* 24: 86-89.

Kayode, R. M. O., Olakulehin T. F., Annongu A. A., Sola-Ojo F. E., Oyeyinka S. A & Kayode, B. I (2013). Evaluation of the nutritional composition and phytochemical screening of an exotic and wild species of oyster mushrooms (*Pleurotus sajorcaju). Nigerian Journal Agricultural, Food and Environment.*2013; 9 (3): 48-53.

Mensah, J.K., Okoli, R. I. & Ohaju-Obodo, J. O. (2008). Phytochemical, medicinal and nutritional properties of some green leafy vegetables. *African Journal of Biotechnology*, 25(12): 758.

Mlodecki, H., Latosa, W., & Maty, S.J. (1974). Hygienic evaluation of *Hybridum imbricatum* I-values for amino acids, mineral and fats. *Nutrition Abstract Review,* 44 Abs 2184.

Oko, A.O. (2012). Nutritional and phytochemical composition of leaves of *Mucuna poggei. Journal of Biology and Life Science*, 3(1):232-242.

Okwulehie, I. C. & Ogoke, J. A. (2013). Bioactive, nutritional and heavy metal constituents of some edible mushrooms found in Abia state of Nigeria. *International Journal of Applied Microbiology and Biotechnology Research,* 1: 7-15.

Ola, F.L. & Oboh, G. (2001). Nutrient distribution and zinc bioavailability. Estimation in some tropical edible mushrooms. *Nahrrung,* 45, 67-68.

Uraih, N. & Izuagbe, y. (1990). Public Health, Food and Industrial Microbiology, Benin, Uniben Press, Nigeria.

WHO (1996). World Health Organization Technical Series. Trace elements in human nutrition and health. World Health Organization, Geneva. pp 199-205.

Yusuf, A.A., Mofia, B.M. & Ahmed, A.B. (2007). Proximate and Mineral Composition of *Tamarindus indica* Linn. 1753 seeds. *Science World Journal*,2: 1-4.