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Effects of Mineral Composition of Different Wood Wastes in Ibadan on Proximate Composition of *Lentinus Squarrosulus* (Mont.)

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ABSTRACT: *Lentinus squarrosulu* (Mont.) is one of the cultivated indigenous edible mushrooms that are available in Nigeria. Recently, there has been growing crave to crop wild edible mushroom species that have potential economic values. Mushrooms can be an alternative source of protein especially for commoners in the society. Hence, the objective of this paper is to evaluate the effect of mineral composition of five wood wastes-*Triplochiton scleroxylon*, *Cordia milleni*, *Vitellaria paradoxa*, *Pouteria altissima* and *Anogeissus leiocarpa* different wood wastes on *L. squarrosulus* (Edible Mushroom) cultivation for their consequences on the growth, yield and proximate analysis. Data obtained reveal Carbon/Nitrogen ratio of 11.59, composition of Magnesium (0.035 mg), Potassium (0.053 mEq/l), Manganese (0.0013 mg), Copper (0.00050 g/m3), Iron (0.00275 mol/L), Phosphorus (0.027 mmol/L), Organic carbon (32.10 mg/L C), Organic matter (55.3 t/ha) and total nitrogen (2.77 mg/L) contributed greatly to the high crude protein, fats and ash contents of mushroom cultivated on *T. Scleroxylon.* However, insignificant contents of sodium (0.2 mg), Calcium (0.2 mmol/L) and Magnesium (0.013 mg) in *Pouteria altissima* led to the general inadequate performance of *L. squarrosulus* in yields. The percentage fresh mean weight of *L. squarrosulus* ranged from 9.13 g – 19.00 g. The highest value was produced by *T. scleroxylon followed by P. altissima, V. paradoxa, C. milleni while A. leiocarpa* gave the least.

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Lentinus squarrossulus is a wild edible mushroom belonging to Polyporaceae family. Wild types commonly develop from decomposing deciduous trees in tropical rainforest like Nigeria. It has been valued for its antimicrobial, antioxidants, hypocholestemic, and anticancer properties (Ugbogu, *et. al.*, 2019). The genus *Lentinus* are numerous in the tropics and can survive a wide temperature range. Many of its fruiting bodies are edible except those with very hard and leather like texture (Karunarathna, *et. al.*, 2011). *L. squarrosulus* (Mont.), *Lentinus-tuber-regium* (Fr.) Fr. *Lentinus polychrous*, *Lentinus sajor-caju* (Fr.) Fr., *Lentinus giganteus* Berk and *Lentinus strigosus* Fr. are some of the famous examples. It is highly treasured by the local indwellers of Africa and Asia for its medicinal gains, meaty texture and taste. It is used traditionally in treating ailments like ulcer, infertility in humans, aneamia and in lowering the risk of chronic sicknesses (Okigbo and Nwatu, 2015; Lau and Abdullah, 2017). De Leon *et al.*, (2017), reported that *L. squarrosulus* is among the 22 domesticated mushrooms out of about 200 species that exist. Lately, there has been a rising concern to cultivate wild mushroom species that are believed to have possible

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commercial values (Lau and Abdullah, 2017). Ayaz, *et al*., (2011), accounted that mushrooms are more nourishing than vegetables and this can be compared to egg, meat and milk. Virtually all the lignocellulose material such as wastes from wood industry, textile, agriculture, forestry, and horticulture can be employed in mushroom domestication (Jeznabadi, *et. al*., 2017). The generated wastes from various spheres of the wood industry are becoming alarming every day. The wastes can be reused for cultivating mushroom and hence, getting rid the environment of pollution and thereby ensuring a safety environment. Mushrooms have been earlier reported to absorb and pile up several chemical substances from its cultured substrates (Gupta, *et. al*., 2019). Nevertheless, this efficacy is species dependent and by the elemental bioavailability (Kalac, 2016). Mushrooms enriched with essential elements may importantly improve its pharmaceutical and nutritional value. Although, several works have been carried out on the proximate analysis of *L. squarrossul*us (Nwanze, *et. al.,* 2006), to show its high protein content, low fats, minerals, dietary fibres, and caloric value, there is a need to do more work on the analysis of indigenous edible mushrooms cultivated on indigenous wood species. Thus, the objective of this work is to evaluate the effects of mineral composition of five wood wastes in Ibadan on proximate composition of (edible mushroom) *lentinus squarrosulus* (mont.).

MATERIALS AND METHODS

Five wood wastes: *C. milleni*, *T. scleroxylon*, *V. paradoxa*, *A. leiocarpa* and *P. altissima* were collected within Ibadan metropolis. Analysis of the different wood wastes was carried out to know the constituent elements. C/N ratio was determined by dividing percentage carbon by percentage nitrogen constituents of each wood wastes.

Substrate preparation: The substrates were mixed separately with 1% agricultural lime ($CaCO_3$) and 5% wheat bran respectively to enhance the growth of the mushroom. Each substrate (400g) was packed into a 28.0 cm x 15.8 cm transparent polythene bag. The experiment was completely randomized with five treatments and eight replications. The substrate bags were then sterilized at 121ºC in an autoclave for one hour, left to cool and later inoculated with *Lentinus squarrossulus* spawn. The inoculated substrates were then transported into the incubation room for mycelia growth. The linear mycelia growth was evaluated every week for three weeks.

Cropping and Harvesting: Mushroom bags were transferred to the fruiting room immediately after full mycelia ramification. The tip of the polythene bags was cut opened after spawn run and were arranged on the shelves, exposed to 80-90% humid condition and were being sprayed with water on a regular basis. Primordial formation was noticed between 3-5 days after opening of the bags. Matured mushrooms were harvested continually until the fifth flush. The individual treatment was replicated five times (Olasupo *et al*., 2020). *Lentinus squarrossulus* was analyzed for food composition according to the Association of Official Analytical Chemists (AOAC, 2000). The percentages of Ash, carbohydrate, dry matter, moisture, crude fibre, crude protein and fats were determined.

Data collection: Mycelia Running Rate of substrate in the bag (cm) for each substrate was taken after the mycelia colonies cross the shoulder of the bag. Linear length was taken at different sides of the bag (Sarker, 2004), with ruler and recorded for three weeks. MRR = L/N (cm/day).

$$MRR = \frac{L}{M}\ (cm/day)$$

L = Average length of mycelium running for different places (cm), N = Number of days

Then, the percentage mean mycelia growth of *L. squarrosulus* exhibited by different wood wastes on a weekly basis was determined. Fruiting bodies parameters like pileus diameter (cm), stipe length (cm), stipe thickness (mm) were collected. The stipe length and pileus diameter were evaluated with meter rule while the stipe thickness was assessed with Vernier caliper. The fresh weight (g) of each fruiting body was determined by a digital weighing balance and documented after each harvest. Average fresh weight was then determined by dividing the total weight of fruiting body per bag by the total number of fruiting body per bag. Harvesting proceeded until all the nutrients in each substrate were depleted.

Statistical analysis: The collected data means were analyzed in a completely randomized design (CRD) using analysis of variance (ANOVA) with Statistical Analysis Software (SAS) 9.0. Means were separated by Duncan at 5% significant level ($p \leq 0.05$).

RESULTS AND DISCUSSION

Effects of mineral composition of sawdust on the proximate analysis of Lentinus squarrosulus: The elemental composition of the different wood wastes collected during this study in Ibadan urban centres are presented in Table 1. The rate of decomposition is determined by Carbon to Nitrogen ratio. It is more favoured when it is low and less favoured when it is high (Mohanty, *et al*., 2013). The C/N ratio obtained in table 1 was not significantly different from one another. Higher composition of Mg (0.035), K (0.053), Fe (0.00275), P (0.027), Olasupo *et al*., (2020), and Organic carbon (32.10), Organic matter (55.3) and total nitrogen (2.77) relative to other elements in table 1, suggested that these elements contributed greatly to the high crude protein, fats and ash contents of the cultivated mushroom on *T. scleroxylon*. Considerable amounts of Ca (2.18), Na (2.18) and Zn (0.0025) in relation to the other elements indicated that these elements have a consequential impression on the high crude fiber of the mushroom cultivated on *A. leiocarpa* in Figure 1. Nevertheless, *V. paradoxa* was able to produce *L. squarrosulus* with a reasonable amount of carbohydrate compared to other substrates. *P. altissima* produced *L. squarrosulus* with substantial amount of moisture contents due to its moderate amount of Organic carbon (31.70), Organic matter (54.7) and total nitrogen (2.74). *Cordia milleni* was able to produce *L. squarrosulus* with significant amount of dry matter due to its controlled amount of Na (0.83), Ca (0.83) and K (0.046) compared to other substrates. However, insignificant contents of Na (0.2), Ca (0.2) and Mg (0.013) in *P. altissima* resulted into the overall poor performance of *L. squarrosulus* in terms of yield obtained from it. Hence, *P. altissima* would not be a suitable substrate for the cultivation of *L. squarrosulus.* The mycelia growth of *L. squarrosulus* shown by the different wood wastes monitored for three weeks in Table 2 depicted that *V. paradoxa* was leading in the rate of ramification followed by *P. altissima*, *A. leiocarpa*, *C. milleni* and *T. scleroxylon* respectively. The heaviest fresh mean weight of *L. squarrosulus* obtained from this study in Table 3 was observed in *T. scleroxylon* followed by *P. altissima*, *V. paradoxa*, *C. milleni* and *P. altissima* with 19.00 kg, 17.53 kg, 16.20 kg, 13.67 kg and 9.13 kg respectively.

Table 1: Elemental analysis of different wood wastes collected in Ibadan urban centres.

Sample	Na %	Ca %	Mg %	K %	Mn %	Cu %	Fe %	Zn %	P %	O.C %	O.M %	T.N %	C/N
Cordia milleni	0.83	0.83	0.019	0.046	0.0004	0.00033	0.00025	0.0018	0.005	30.3	52.2	2.61	11.61
Triplochiton scleroxylon	0.54	0.54	0.035	0.053	0.0013	0.0005	0.00275	0.0023	0.027	32.1	55.3	2.77	11.59
Vitellaria paradoxa	0.78	0.78	0.027	0.025	0.0008	0.00033	0.00025	0.0023	0.017	24.3	41.9	2.1	11.57
Anogeissus leiocarpa	2.18	2.18	0.016	0.031	0.0004	0.00033	0.00075	0.0025	0.008	23.3	40.2	2.01	11.59
Pouteria altissima	0.2	0.2	0.013	0.038	0.0003	0.0003	0.00025	0.0022	0.018	31.7	54.7	2.74	11.57

Table 2 Mean mycelia growth (%) of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre on a weekly basis

Substrate	Week 1	Week 2	Week 3
Triplochyton scleroxylon	33.86	55.26	100
Cordia milleni	39.64	77.12	100
Vitellaria paradoxa	52.97	92.26	100
Pouteria altissima	45.57	87.34	100
Anogeissus leiocarpa	20.48	87.95	100

Mean of five replicates.

Table 3: Growth parameters of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre

Growth parameters	*T. scleroxylon*	*C. milleni*	*V. paradoxa*	*P. altissima*	*A. leiocarpa*
Fresh mean weight (g)	19.00^{a}	13.67^{b}	16.20^{ab}	17.53^{ab}	9.13^{c}
Mean Pileus diameter (cm)	4.64^{a}	4.38^{a}	3.89^{ab}	4.64^{a}	3.03^{b}
Mean stipe length (cm)	4.02^{a}	3.63^{a}	3.811^{a}	3.78^{a}	3.69^{a}
Mean stipe thickness (mm)	0.06^{a}	0.05^{a}	0.05^{a}	0.09^{a}	0.04^{a}

abc = mean value with different superscripts are statistically different at p≤0.05

Table 4: ANOVA table of mean fresh weight (kg) of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre

Source	Sum of DF	Squares	Mean Square	F Value	Pr > F
Model	4	299.9822222	74.9955556	7.36	0.0008
Error	20	203.7333333	10.1866667		

Table 5: ANOVA table of mean pileus diameter (cm) of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre

Source	Sum of DF	Squares	Mean Square	F Value	Pr > F
Model	4	9.20525956	2.30131489	4.58	0.0087
Error	20	10.05799556	0.50289978		

Table 6: ANOVA table of mean stipe length (cm) of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre

Source	Sum of DF	Squares	Mean Square	F Value	Pr > F
Model	4	0.44414489	0.11103622	0.91	0.4770

Error	20	2.44001333	0.12200067		

Table 7: ANOVA table of mean stipe length (mm) of *L. squarrosulus* domesticated on different wood wastes in Ibadan urban centre

Source	Sum of DF	Squares	Mean Square	F Value	Pr > F
Model	4	0.00808711	0.00202178	0.96	0.4491
Error	20	0.04197333	0.00209867		

Table 8: Proximate composition of *L. squarrossulus* domesticated on different wood wastes in Ibadan urban centre

Wood wastes	Crude protein (%)	Ash (%)	Fat (%)	Crude fibre (%)	Moisture (%)	Dry matter (%)	Carbohydrate (%)
Triplochiton scleroxylon	18.30	5.17	2.65	14.69	10.00	90.00	51.88
Cordia milleni	21.20	6.18	3.20	13.04	11.10	88.90	45.28
Vitellaria paradoxa	18.20	2.38	3.10	10.80	10.50	89.50	55.02
Pouteria altissima	19.30	4.32	2.25	16.10	10.80	89.20	47.23
Anogeissus leiocarpa	17.50	2.50	2.80	11.30	11.30	88.70	54.60

The mean percentage of mycelia growth of L. squarrossulus domesticated on different wood wastes in Ibadan urban centre on weekly basis: The reality that *V. paradoxa* was the fastest while *C. milleni* was the slowest in table 2, could be due to varying wood waste density as a result of the wood attributes (Fuwape, *et al*., 2014; Olasupo *et al*., 2019). However, they all reached their full ramification stage on week 3. This indicated that any of the substrate could be used to cultivate *L. squarrosulus*. Although, *V. paradoxa* would be most preferable.

Effect of different wood wastes on the growth parameters of L. squarrossulus: The fresh mean weight (9.13 kg – 19.00 kg) of *L. squarrosulus* obtained from this study in table 3 is greater than the result (1.98 – 7.26), provided by Osibe and Chiejina, (2015). The pileus diameter value (3.03 cm – 4.64 cm) obtained was similar to the report (3.01 – 5.76), given by Chiejina and Osibe, (2015), but higher than the findings of Nwanze, *et al*., (2005), who reported a range of 1.07 cm – 4.37cm

Moisture contents (%): The percentage proximate composition of *L. squarrossulus* as shown in Table 8 revealed that moisture content of the mushroom produced by *A. leiocarpa* gave the highest percentage (11.30) while *T. scleroxylon* (10.00) gave the least. The implication of this factor is for the shelf life of the mushroom. The *L. squarrossulus* with the least moisture content indicated that it can be easily sundried, smoked and stored soon after harvest. The value obtained in this experiment is very low when compared to the values (12.28 – 13.33) documented by Chiejina and Osibe, (2015), but can be likened to (9.88 – 10.67) described by Nwoko, *et al.*, (2018). More so, it was greater than the value (6.87 - 8.75%) obtained when *P. ostreatus* was cultivated on the same substrates (Olasupo, *et. al*., 2020).

Crude protein (%): The values of crude protein obtained in this work ranged from 17.50% – 21.20% with *C. milleni* having the highest value while *A. leiocarpa* having the least value. Although, it is a bit lower but can still be compared to the account (16.31 – 28.40%) given by Nwoko, *et. al*., (2018). It is however lower than (17.40% – 35.05%) obtained on *P. ostreatus* cultivated on the same substrates reported by Olasupo, *et. al.,* (2020). The variations in the crude protein value could be due to strains/species of the mushroom, time of harvest, size of the pileus and nitrogen constituents of the growth substrates (Bernas, *et. al*., 2006).

Crude fiblre (%): It was reported in this work that the crude fibre value was from 10.80 – 16.10% with *P. altissima* giving the highest while *V. paradoxa* giving the least. This is greater than the account (4.58 – 5.40%) given by Chiejina and Osibe (2015). Nevertheless, it can be compared to 11.21 – 14.63% attested by Joshua, *et. al*., (2018). The crude fibre got from this study was greater than (7.90% – 8.70%), produced by the same wood wastes for cultivation of *P. ostreatus.* Uptake of food with low fibre content is good for normal growth and development of infants as well as weaning children (Salamat, *et al*., 2018). However, in adults it promotes absorption of food which is desirable for patients suffering from cancer, heart related diseases and diabetes because it brings down cholesterol level in the blood (Ugbogu and Amadi, 2014). More so, it is suitable for cleansing and proper maintenance of intestinal tract motility (Mukhopadhyay and Guha, 2015).

Fats (%): Fats in the mushroom are known for its hypocholestrolemic and unsaturated fatty acid properties (Abugri, *et. al*., 2016). The percentage of fats in this study was from 2.25% – 3.20%. *C. milleni* gave the highest percentage followed by *V. paradoxa* while *P. altissima* gave the least. It can be compared to 3.1 - 3.8% reported by Olasupo, *et. al.,* (2020) when *P. ostreatus* was cultivated on the same substrates. This is low if compared to the account (7.89%) submitted by Joshua, *et. al*., (2018). Nevertheless, it is higher than the report (0.89%) described by Sylvester, *et al*., (2014). Low fats/lipids contents in a diet is suited for cardiovascular disease and obesity management (Smith and Groff, 2009). Notwithstanding, dietary fats increases food palatability by absorbing and holding back its flavor (Anita, *et al*., 2006).

Ash contents (%): Ash contents is the entire amount of mineral constituents in the mushroom (Ulziijargal and Mau, 2011). Percentage ash contents in this study ranged from 2.38 – 6.18%. *C. milleni* produced the highest value followed by *T. scleroxylon* while *V. paradoxa* produced the least. This is low when compared to 18.43% and 7.84% reported by Joshua *et al*., (2018) and Duru *et al*., (2018) respectively. Nevertheless, it is higher than 1.14% documented by Sylvester *et al*., (2014).

Carbohydrates (%): The percentage carbohydrates value of *L. squarrossulus* obtained in this study ranged from 45.28% – 55.02%. This corroborates 48.84% and 56.37% reported by Das, *et al*., (2017) and Adebiyi, *et. al*., (2018), respectively. This is greater than the account (25.03 -26.18%) given by Joshua, *et al*., (2018). High carbohydrates contents of mushroom can be locally used for binding and bulking or thickening of soup (Adebiyi, *et. al*., 2018). Carbohydrates supply an adequate energy especially for breakfast and weaning food formulas (Kassegn, 2018).

Dry matter %: The dry matter percentage value of *L. squarrossulus* obtained from this work ranged from 88.70% – 90.00%. *V. paradoxa* gave rise to the highest value followed by *A. leiocarpa* while *C. milleni* gave rise to the least. This is lower than the report (97.25%) given by Nwanze, *et. al*., (2006). However, it can be compared favourably to 88.76 - 91.22%, examined by Jonathan, *et. al*., 2011.

Conclusion: This study demonstrated the effects of mineral composition of indigenous wood wastes in Ibadan metropolis on the yield and proximate constituents of an indigenous mushroom (*L. squarrossulus*). The mycelia growth of *L. squarrossulus* showed that any of the substrates could be adopted for ramification. Although, *T. scleroxylon* gave the highest yield as compared to other wood wastes. To obtain a better yield, I would recommend that the size of the bag should be increased and be cultivated on other substrates.

REFERENCES

Abugri, D.A., McElhenney, W.H. and Willian, K.R. (2016). Fatty acid profiling in selected cultivated edible and wild medicinal mushrooms in Southern United States. *Journal of experimental food chemistry*. 2:1

Adebiyi, A.O., Tedela, P.O. and Alabi, O.O. (2018). An inter-species comparative study on the distribution of nutrients in selected edible mushrooms in Ekiti State, Nigeria. Haya: *The Saudi Journal of Life Sciences.* 3(6): 469-473.

Anita, B.S., Akpan, E.J., Okon, P.A. and Umoren, I.U. (2006). Nutritive and anti-nutritive evaluation of sweet potatoes (*Ipomea batatas*) leaves. *Pak. J. Nutr.* 5(2):166-168.

AOAC, 2000. Official Methods of Analysis International 17th edition. Association of Official Analytical Chemists. Washington DC.

Ayaz, F.A., Chuang, L.T., Torun, H., Colak, A., Sesli, E., Presley, J., Smith, B.R. and Glew, R.H (2011). Fatty acid and amino acid compositions of selected wild edible mushrooms consumed in Turkey. *Int. J. Food Sci. Nutri.* 62:328-335.

Bernas, E., Jawarska, G. and Lisiewska. Z. (2006). Edible mushrooms as a source of valuable nutritive constituents. *Acta Sci. Pol. Technol. Ailments.* (5):5-20

Chiejina, V.N. and Osibe, D.A. (2015). Oil palm fruit fibre promotes the yield and quality of *Lentinus squarrosulus* (Mont.) Singer an edible Nigerian mushroom. *African journal of Biotechnology.* Vol. 14(14): 1195-1200.

Das, A.R., Saha, A.K., and Das, P. (2017). Proximate composition and antimicrobial activity of three wild edible mushrooms consumed by ethnic inhabitants of Tripura in Northeast India. *Studies in Fungi.* 2(1):17-25.

De Leon, A.M., Guinto, L.J.Z.G., De Ramos, P.D.V. and Kalaw, S.P. (2017). Enriched cultivation of *Lentinus squarrosulus* (Mont.) Singer: a newly domesticated wild edible mushrooms consumed in the Philipines. *Mycosphere.* 8:615-629.

Duru, M., Nwadike, C., Exekwe, A Nwaogwugwu, C., Egboagwu, I., Odika, P., Njoku, S. and Chuckudoruo, C. (2018). Evaluation of nutritional, anti-nutritional and some biochemical studies on *Pleurotus squarrosulus* (Mont.) Singer using rats. *African Journal of Biochemistry Research.* 12(2):7-27.

Fuwape, J.A., Nurudeen, T.A. and Ogunmolu, M.O. (2014). Growth and nutritional properties of *Pleurotus sajor-caju* cultivated on sawdust of an exotic and indigenous tree species. *Journal of plant & Agricultural Research*. Vol. 1:1-5.

Gupta, S., Summuna, B. Gupta, M. Annepu, S.K. (2019). Edible Mushrooms: Cultivation, Bioactive Molecules, and Health Benefit. *Bioactive Molecules in food.* Pp 1815-1847.

Jeznabadi, E.K., Jafarpour, M., Eghbalsaied, S. and Pessaraki, M. (2017). Effects of various substrates and supplements on king oyster (*Pleurotus eryngii*). *Compost Sci., Util.* 25:S1-S10.

Jonathan, S.G., Amos-Tautua, B.M.W. and Olawuyi, O.J. (2011). Food values, heavy metal accumulation, aflatoxin contamination and detection of exo-polysaccharrides in *Lentinus squarrosulus* Berk, a Nigerian mushroom. *African Journal of Agricultural Research.* Vol. 6(13): 3007-3012.

Joshua, V.I., Falemora, B.C., Aina, O.O. and Courson, T.R. (2018). Morphological characterization and proximate analysis of three edible mushrooms in Plateau and Kogi States, Nigeria. *World Journal of Microbiology.* Vol. 4(2): 139-145.

Kalac, P. (2016). Edible mushrooms chemical composition and nutritional value. Elsevier, Amsterdam (ISBN 9780128044551).

Karunarathna, S.C., Yang, Z.L., Zhao, R., Vellinga, E.C, Bahkali, A.H.,Chukeatirote, E and Hyde, K.D. (2011). Three new species of *Lentinus* from northern Thailand. *Mycological process.* 10:389-398.

Kassegn, H. (2018). Determination of proximate composition and bioactive compounds of the Abyssinian purple wheat. *Cogent Food & Agriculture.* 4:1-9.

Lau, B.F. and Abdullah, N. (2017). Bioprospecting of *Pleurotus squarrosulus* (Mont.) an underutilized wild edible mushroom, as a potential source of functional ingredients: a review. *Trends Food Sci. Technol.* 61: 116-131.

Liang, C.H., Wu, C.Y., Lu, P.L., Kuo, Y.C. and Liang, Z.C. (2016). Biological efficiency and nutritional value of the culinary-medicinal mushroom *Auriculata* cultivated on sawdust basal substrate supplemented with different proportions of grass plants. *Saudi J. Biol. Sci.* https://doi.org/10.1016/j.sjbs.2016.10.017.

Mohanty, M., Nishant K. S. and Menzies, N.W. (2013). How important is the quality of organic amendments in relation to mineral N availability in soils? Agricultural Research. 2: 99-110.

Mukhopadhyay, R., and Guha, A.K. (2015). A comprehensive analysis of the nutritional quality of edible mushroom *Pleurotus sajor-caju* grown in deproteinized whey medium. *LWT-Food Science and Technology.* 61: 339-345.

Nwanze, P.I., Jatto, W. Oranusi, S. and Josiah, S.J. (2006). Proximate analysis of *Lentinus squarrosulus* (Mont.) Singer and *Psathyrella atroumbonata* Pegler. *African Journal of Biotechnology.* 5(4): 366-368.

Nwanze, P.I., Khan, A.U., Ameh, J.B. and Umoh, V.J. (2005). The effect of the interaction of various spawn grains with different culture medium on carpophore dry weight and stipe and pileus diameter of *Lentinus squarrosulus* (Mont.) Singer. *African Journal of Biotechnology.* 4(7): 615 – 619.

Nwoko, M.C., Ehumadu, C.R. and Ukpai, K.U. (2018). Proximate and bioactive compounds of young and mature fruit bodies of *Lentinus squarrosulus* (Mont.) Singer collected from two log substrates in Umudike, Abia State, Nigeria. *Opn. Acc. Tox. & Research.* 1(1): 9-12.

Okigbo, R.N. and Nwatu, C.M. (2015). Ethnostudy and usage of edible and medicinal mushrooms in some parts of Anambra State, Nigeria. *Nat. Resour.* 6:79-89.

Olasupo, O.O., Asonibare, A.O., Ekpo, E.N. and Adegboyega, D.A. (2020). Comparative studies on proximate analysis of *Pleurotus ostreatus* (Jacq.) P.Kumm. cultivated on four indigenous wood wastes. Proceedings of the 42nd Annual Conference of Forestry Association of Nigeria. “Forestry Development of Nigeria: Fifty years of Interventions and advocacy” held at Forestry Research Institute of Nigeria, Ibadan, 23rd – 28th November, 2020. Pp. 363 – 369.

Olasupo, O. O., Adegboyega, D. A., Asonibare, A. O. and Haastrup, N. O. (2020). Relative performance of *Pleurotus florida* (Fr.) P. Kumm cultivated on different indigenous wood wastes. *Journal of Forestry Research and Management.* 17(1): 136-143.

Olasupo, O. O., Asonibare, A. O., and Nurudeen, T. A. (2019). Relative performance of oyster mushroom (*Pleurotus florida*) cultivated on different indigenous wood wastes. *Journal of Agricultural Research and Natural Resources.* 3(2): 34-55.

Osibe, D.A. and Chiejina, V.N. (2015). Assessment of palm press fibre and sawdust-based substrate formulas for efficient carpophore production of *Lentinus squarrosulus* (Mont.) Singer. *Mycobiology*. 43(4): 467-474

Roy, A.., Borthakur, M., Saha, A.K., Joshi, S.R. and Das, P. (2015). Growth of mycelial biomass and fruit body cultivation of *Lentinus squarrosulus* collected from home garden of Tripura in Northeast India. *Journal of Applied Biology and Biotechnology*. 3(4): 17-19.

Sarker, N.C. (2004). Oyster mushroom (*Pleuotus ostreatus*) production technology suitable for Bangladesh and its nutritional and postharvest behavior (Ph.D Thesis). Bangabandhu Sheikh MujiburRaham. Agricultural University Gazipur.

Smith, J.L., and Groff, J.L. (2009). Advanced nutrition and human metabolism. 5th edition, Australian Wardsworth Cengage Learning. 600pp.

Sylvester, E.C., Ezejiofor, A.J. and Nnedinma, E.A (2014). Survey and proximate analysis of edible mushrooms in Enugu State, Nigeria. *Annals of Experimental Biology.* 2(3): 52-57.

Ugbogu, A.E. and Amadi, B.A. (2014). Biochemical composition of month beans (*V. aconitifolia*) and pigeon pea (*C. cajan*). *Intraspecific Journal of Nutrition and Food Science.* 1(1): 1-8.

Ugbogu, E.A., Akubugwo, I.E., Ude, V.C., Gilbert, J. and Ekeanyanwu, B. (2019). Toxicological evaluation of phytochemical characterized aqueous extract of wild dried *Lentinus squarrosulus* (Mont.) mushroom in rats. *Toxicol. Res.* 35(2): 181-190.

Ulziijargal, E. and Mau, J.L. (2011). Nutrient compositions of culinary medicinal mushroom fruiting bodies and mycelia. *International Journal of Medicinal Mushrooms.* 13(4):343-349.