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EVALUATION OF NUTRIENT QUALITY IN PLEUROTUS OSTREATUS CULTIVATED ON COMPOSTED AGRO-WASTESAQUACULTURE IN NIGERIA

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Abstract: Study on the nutrient quality assessment of Pleurotus ostreatus grown on agrowastes composted for five months was carried out in Department of Plant Science and biotechnology and Dilomat Farms and Services Limited all in Rivers State University. Substrate materials such as sawdust, Rhizophora wood ash and Rice bran were composted for five months to grow Pleurotus ostreatus. The Association of Analytical Chemists (AOAC) method was adapted for the determination of antinutrient and nutrient components. Proximate evaluation revealed the presence of moisture (33.36 + 0.05) ash (0.96 + 0.04) lipid, fiber, carbohydrates, protein. Mineral and vitamin investigation showed high values of calcium (276.67 + 1.23) iron, magnesium, phosphorus, potassium, sodium and thiamine (0.77 + 0.06). Anti-nutrient investigation revealed the availability of glycoside, oxalate, saponin, tannin, polyphenol, flavonoid and lignant. Generally, P. Ostreatus grown on five months composted soil had improved nutrient quality.

Keywords: Pleurotus ostreatus, Agrowaste, nutrient quality and composting

INTRODUCTION

Pleurotus ostreatus (Jacq.) P. Kumm. within the Pleurotaceae family, is an edible fungus that grows naturally on dead and decaying wood logs, decomposing leaves, and trunks in temperate and tropical forests worldwide. The fruiting bodies of *P. ostreatus*, also known as oyster mushrooms, have a unique shell form (Wojewoda, 2003).

Oyster mushroom cultivation started as a test project in 1917 in Germany by Flack on tree stumps and wood logs, then Block, Tsao, and Hau completed the growing invention in the USA (Laborde, 1995). In order to distinguish P. ostreatus from other species in the genus, it is occasionally referred to as the grey oyster mushroom or the tree oyster mushroom as the term "oyster mushroom" is also used to refer to other species within the Pleurotus genus (Laborde, 1995).

While oyster mushrooms are among the more commonly sought-after wild mushrooms, little was known about their nutritional makeup and composition in contrast to vegetables and medicinal mushrooms (Kalac, 2012). Because culinary mushrooms are only thought of as a delicacy and are rarely consumed in industrialized nations, researchers are not very interested in them. But things have started to shift noticeably; compared to ten or fifteen years ago, the number of original papers published annually on culinary mushrooms is currently several times higher (Kalac, 2012). Their fleshy fruiting bodies, which are thought to be a functional food with numerous health benefits (Cheung et al., 2008), or their fermented residues, which could be used as animal feed after mushroom cultivation (Brenneman *et al*., 1994), could be the cause of this. Their substrate can also be used as fertilizer and soil conditioner for the growth of plants (Brenneman *et al*., 1994). Furthermore, various Pleurotus species have been reported to be commercially cultivated due to their rich nutrient contents and medicinal qualities, short life cycle, reproducibility in the recycling of specific agricultural and industrial wastes, and low resource and technological requirements (Yildiz *et al*., 2002; Agbagwa *et al*., 2020a&b). P. ostreatus has also been reported to possess antibacterial (Karaman *et al*. 2010), antidiabetic (Krishna and Usha, 2009) and antiviral (Ei-Fakharany et al. 2010), anti-oxidative (Jedinak and Sliva, 2008), antihypercholesterolic (Alam et al., 2009) and anticancer (Martin and Brophy, 2010) properties.

The production of mushrooms has been reported by as the second most important commercial microbial technology next to yeast (Pathak *et al*. 2009). According to nutritional studies, it has a distinct flavor and aromatic qualities and is high in protein, fiber, carbs, minerals, and vitamins (Herndez *et al*., 2003; Kalmis *et al*., 2008). Bioactive compounds with promising biological effects, including terpenoids, steroids, phenols, alkaloids, lectins, and nucleotides, have been identified and isolated from the fruit body, mycelium, and culture broth of various Pleurotus mushrooms, according to numerous investigations conducted across the globe (Lindequist *et al*., 2015).

A variety of food and agricultural wastes, including wood shavings, cereal straws, sawdust, vegetable biomass, waste from the food and paper industries, rubber tree, and others, are used in the commercial cultivation of Pleurotus ostreatus (Noorhalieza *et al*., 2018; Agbagwa *et al*., 2020c). Nonetheless, there is dearth of information on the effect of substrate composting time on the nutrient quality of cultivated P. ostreatus. It is on this basis this research was carried out to evaluate the influence of substrate composting time on the nutrient composition of *P.* ostreatus grown in Port Harcourt.

Materials and Methods

Sample Collection

Sawdust and woods from Rhizophora racemosa were obtained from Timber market Mile II Diobu. The R. racemosa woods were immediately chunked and burnt for ash collection. Rice bran and healthy spawns of Pleurotus ostreatus were bought from Dilomat Farms and Services Limited, Rivers State University. All experimental materials were transported to the Rivers State University Dilomat Farms for further studies.

Cultivation Studies

The cultivation methods outlined by Chinda and Chinda (2007) and completely randomized design (CRD) were adopted for this research to avoid experimental bias. The substrate materials viz: rice bran, wood ash and sawdust were compounded and replicated five times.

Substrate composition per bag= 700g sawdust + 100g rice bran + 1g wood ash The setup were allowed to compost for 150 days (5 months: February to June, 2022) and each compost was turned on a weekly basis. A weighed quantity (36.05±2.25g) of spawn was inoculated into the bags. The inoculated bags were weighed and taken to the incubation room where they were arranged and monitored for growth. The bags were incubated at 25±3 0C for 38 days. The colonized bags were immediately cropped and watered for three days before the bags were cut open. Mature mushrooms were harvested by hand picking three days after sprouting.

Determination of nutrients and antinutrients of cultivated *Pleurotus ostreatus*

Samples of harvested Pleurotus ostreatus were sent to the Food Science and Technology Laboratory for the determination of nutrient composition. The methods of AOAC, (2005) were adopted for the analysis.

Statistical analysis

Data obtained were subjected to mean and standard deviation analysis with the aid of SPSS software version 22.

RESULTS AND DISCUSSION

Table 1 proximate composition of Cultivated *P. ostreatus*

Parameters	Composition (%)
Moisture	33.36±0.05
Ash	0.96±0.04
Lipid	4.23±0.20
Fibre	1.21±0.01
Carbohydrate	19.8±0.62
Protein	41.38±0.13

Table 2 Mineral and vitamin composition of Cultivated *P. ostreatus*.

Parameters	Composition (mg/100g)
Calcium	276.67±1.23
Iron	4.05±0.04
	223.33±3.09
Magnesium	223±3.09
Phosphorus	418±1.63
Potassium	127±0.82
Sodium	69.33±1.25
Thiamine	0.77±0.06

Table 3: Antinutrient Composition of Cult vated *P. ostreatus*.

Parameters	Composition (%)
Glycoside	0.001±0.00
Oxalate	0.004±0.00
Saponin	0.23+0.00
Tannin	0.001±0.00
Polyphenol	5.6±0.08
Flavonoid	1.83±0.06
Lignant	3.6±0.08

Result from proximate composition of P. ostreatus of the present study has shown the presence of moisture, ash, lipid, fiber, protein and carbohydrate. Early researchers have also implicated the availability of these same component in Pleurotus as well as other edible mushroom (Iqbal et al., 2016) reported similar parameters but higher values for protein, carbohydrate, lipids and ash. The proximate composition of the current study is higher than those reported by sharmila et al. (2015) for P. ostreatus grown on different substrates. The report is Agbagwa et al. (2020a) also reported lower proximate composition values for P. ostreatus with an exception for moisture.

The mineral investigation of the present study also recorded the availability of calcium, iron, magnesium, phosphorus, potassium, sodium and thiamin in high concentrations.

Result for the mineral composition of the current study disagreed with the report of Oyetayo and Ariyo (2013) as they reported lower mineral contents. Duru et al. (2018) also reported lower values of all tested mineral elements of the present study. The high mineral values of the present study compared to previous studies could be as a result of wood ash adoption for the cultivation process as Mandre (2006) implicated wood ash to support increase metabolic processes, enzymatic reaction, biosynthesis and assimilation of minerals. Notwithstanding, Agbagwa et al. (2020b) also cultivated P. ostreatus using wood ash but the mineral values reported were still lower than those recorded in the current study.

This could be due to the composting period of their substrate which lasted for a period of one month compared to the five months of composting period of the present study. Literature has shown that mushroom grow on dead and decayed substance (Bowman and free, 2006); an indication that the level of nutrient assimilation is dependent on the degradation level of the substrate utilized.

Thiamin was the only vitamin observed for P. ostreatus of the present study. Early researchers have also shown the availability of thiamin in P. ostreatus as well as other sister member of the Genus (Iqbal et al., 2016, Nwoko et al., 2018). The thiamin values of the present study is in line with the findings of Duru et al. (2018) and Agbagwa et al. (2020b).

A variety of anti-nutrients such as glycosides, oxalate, saponin, tannin, polyphenol, flavonoid and lignant were seen for the cultivated P. ostreatus in the present study. Literatures have also implicated same anti-nutrients in P. ostreatus and other edible Mushrooms (Adebayo and Oloke, 2017). The anti-nutrients recorded in the current study agree with the reports of Nwoko et al. (2017) and Agbagwa et al. (2020b).

Generally, the nutrient composition of the cultivated P. ostreatus cannot be overlooked as these nutrients play a major role in the daily and healthy living of many and other animals (Marten et al., 2017). Minerals play a major role in different metabolic, biochemical and physiological processes. For instance, iron is a component haemoglobin, calcium supports the body frame work (Idu and Onyibe, 2017). The absence of vitamin B1 (Thiamin) in humans could result to beriberi (Piska et al., 2017). The activities of these anti- nutrients have been associated with anti- microbial, antioxidants, anti-lipidemic and anti viral properties (Oyekanmi et al., 2011; Lavi et al, 2006; Iqbal et al., 2018).

CONCLUSION

Pleurotus Ostreatus contains quite a number of nutrient and anti-nutrient. The present study has further shown that increase in composting time could also cause an increase in the nutrients quality.

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