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EFFECT OF AGRO-WASTE COMPOST MATURITY ON THE NUTRITIONAL COMPOSITION OF PLEUROTUS OSTREATUS

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DOI: <https://doi.org/10.5281/zenodo.17130670>

Abstract: This study was conducted in the Department of Botany Laboratory, Nnamdi Azikiwe University, Akwa, Anambra State, to evaluate the nutritional and antinutritional composition of *Pleurotus ostreatus* cultivated on composted agro-waste substrates. Substrates, including sawdust, Rhizophora wood ash, and rice bran, were composted for five months prior to mushroom cultivation. Nutrient and antinutrient contents were determined using standard methods of the Association of Analytical Chemists (AOAC). Proximate analysis revealed significant levels of moisture ($33.36 \pm 0.05\%$), ash ($0.96 \pm 0.04\%$), lipids, fiber, carbohydrates, and protein. Mineral and vitamin analyses showed elevated calcium content (276.67 ± 1.23 mg/100g), along with appreciable amounts of iron, magnesium, phosphorus, potassium, sodium, and thiamine (0.77 ± 0.06 mg/100g). Antinutritional screening detected glycosides, oxalates, saponins, tannins, polyphenols, flavonoids, and lignans. The results indicate that *P. ostreatus* cultivated on five-month composted agro-waste substrates exhibits enhanced nutritional quality, highlighting its potential as a functional food.

Keywords: *Pleurotus ostreatus*, agro-waste, composting, nutritional quality, antinutrients

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

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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 Department of Botany Laboratory, Nnamdi Azikiwe University, Akwa, Anambra State

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 ± 2.25 g) 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

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were incubated at 25 ± 3 °C 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 \pm 0.05
Ash	0.96 \pm 0.04
Lipid	4.23 \pm 0.20
Fibre	1.21 \pm 0.01
Carbohydrate	19.8 \pm 0.62
Protein	41.38 \pm 0.13

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

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

Table 3: Antinutrient Composition of Cultivated *P. ostreatus*.

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

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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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