



## Original Research

# Influence of Seasonal Variation and Substrate Type on the Nutritional Composition of *Pleurotus ostreatus* and *Pleurotus eryngii* Cultivated in Port Harcourt, Nigeria

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## ABSTRACT

The cultivation of *Pleurotus* species in Port Harcourt has been affected by the nature of wood sawdust utilised and the prevailing season. Notwithstanding, *Pleurotus* cultivation is of great economic value as it provides jobs, income to growers and valuable nutrients to consumers within Port Harcourt. However, there is a dearth of information on the impact of substrate materials and prevailing seasons on the nutrient quality of cultivated *Pleurotus* species in Port Harcourt. It is on this basis that this research was carried out to evaluate the effect of seasonal variation and substrate types on the nutrient quality of *Pleurotus ostreatus* and *Pleurotus eryngii* grown in Port Harcourt, Nigeria. The 600 g of *Xylopia aethiopica* (softwood sawdust, SW) and 600 g *Mitragyna ciliata* (hardwood sawdust, HW) were supplemented with 100 g of rice bran and 1g of *Rhizophora racemosa* wood ash for the cultivation of *Pleurotus ostreatus* (P1) and *P. eryngii* (P2) within the dry (D) and wet (R) seasons. A completely randomised design was adopted for this study to avoid experimental bias. A total of eight treatments (P1SWD, P1HWD, P2SWD, P2HWD, P1SWR, P1HWR, P2SWR and P2HWR) in accordance with the interaction of substrate type, *Pleurotus* species and season were established and experimented in four replications. The Association of Official Analytical Chemists (AOAC) method was utilised for the determination of proximate, mineral and vitamin compositions of the cultivated *Pleurotus* species. Data obtained were subjected to ANOVA and Duncan statistical tests at  $p \leq 0.05$ . Proximate investigation revealed moisture, ash, lipid, fibre, carbohydrate and protein to be present in both species. However, highest values of moisture ( $46.13 \pm 1\%$ ), ash ( $2.43 \pm 0.05\%$ ), lipid ( $3.83 \pm 0.28\%$ ) and fibre ( $1.43 \pm 0.05\%$ ) were recorded within the wet season for P2SWR, P2HWR, P2HWR and P1SWR, respectively. Carbohydrate and protein were highest within the dry season for P1HWD ( $25.5 \pm 0.1\%$ ) and P1SWD ( $41.51 \pm 0.07\%$ ), respectively. Calcium, iron, magnesium, phosphorus, potassium and sodium were the minerals present in both species. Highest values of calcium ( $315 \pm 1 \text{ mg } 100 \text{ g}^{-1}$ ), magnesium ( $305.65 \pm 0.57 \text{ mg } 100 \text{ g}^{-1}$ ), potassium ( $131.0 \pm 1 \text{ mg } 100 \text{ g}^{-1}$ ) and sodium ( $70.67 \pm 1.15 \text{ mg } 100 \text{ g}^{-1}$ ) were recorded within the wet season for P1HWR, P2HWR, P2SWR and P2HWR respectively. Iron and phosphorus were highest in the dry season for P2SWD ( $4.06 \pm 0.11 \text{ mg } 100 \text{ g}^{-1}$ ) and P2HWD ( $504.67 \pm 1.52 \text{ mg } 100 \text{ g}^{-1}$ ), respectively. Vitamin A and thiamine were the only vitamins considered. The dry season had the highest Vitamin A and thiamine concentrations for P1HWD ( $10.33 \pm 0.57 \text{ mg } 100 \text{ g}^{-1}$ ) and P2SWD ( $0.78 \pm 0.03 \text{ mg } 100 \text{ g}^{-1}$ ), respectively. The values obtained for both species of *Pleurotus* under the various treatments differed significantly at  $p \leq 0.05$ . Generally, the wet season and hardwood sawdust substrate promoted higher nutrient quality in *Pleurotus*.

**Keywords:** *Pleurotus*, seasonal variation, substrate type, nutrient quality.

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## INTRODUCTION

Oyster mushrooms are found across different regions in the world, including temperate and tropical forests.

Notwithstanding, they act as primary decomposers of wood as they can degrade both deciduous and non-deciduous dead trees, a situation that informed the name white rot fungus. The oyster mushroom grows in various places; however, most of them are seen in dead and decaying woods, expressing their whole saprophytic nature. Just like other fungal organisms, *Pleurotus* species also utilise the extracellular digestion processes through the secretion of digestive enzymes on the substrate material (Lewinsohn et al., 2000).

Several other authors have also reported the influence of abiotic factors on the cultivation of mushrooms as well as

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other plants (Santoyo et al., 2017; Uddin et al., 2011). Sardar et al. (2017) reported the influence of temperature and pH levels on the growth of different wild and exotic *Pleurotus* species. Furthermore, Chitra et al. (2018) reported that temperature and relative humidity play a significant role in the yield of Oyster mushrooms. Early research has shown *Pleurotus* species to be cherished as a result of the vital nutrients and antinutrients they contain. Studies have confirmed the genus to contain several proximate nutrients, including carbohydrates, fibre, lipid, ash, protein, moisture and energy, important components to development and growth (Ahmed et al., 2016). Literature has further revealed the genus to possess essential minerals such as calcium, phosphorus, potassium, magnesium, iron, sodium and many more that are required in different metabolic processes. Different vitamins have also been associated with the *Pleurotus* genus, viz: vitamins A, B, C and thiamine, and they play several roles in human well-being. Antinutrients (saponin, flavonoid, tannin, oxalate, glycosides, polyphenol and lignite) have been implicated by previous authors to be present in *Pleurotus*, and their availability supports the immune system to fight invading pathogens in humans (Elkanah et al., 2022).

Literature has emphasised the great importance of *Pleurotus* to society as it does not only serve as food for man but provides other ecosystem services as well. Due to their saprophytic nature, they are considered white rot fungi as they can degrade and decompose materials (Wendiro et al., 2019). This is achieved through the release of digestive enzymes that can break down cellulose, lignin and other components of organic materials. The process of this action not only provides their nutrient but also makes these nutrients available in the environment for other organisms (Uddin et al., 2011).

## MATERIALS AND METHODS

### Sample collection

Softwood and hardwood sawdust from *Xylopia aethiopica* and *Mitragyna ciliata*, respectively and *Rhizophora racemosa* were obtained from Timber Market Mile II Diobu, Port Harcourt. Homogeneous sawdust was collected directly from the saw machine, while *Rhizophora* wood was burned to obtain ash. Spawns of *Pleurotus ostreatus*, *P. eryngii*, and rice bran were procured from Dilomat Farms, Rivers State University, where all samples were assembled for analysis.

### Cultivation studies

The various substrate materials were mixed as follows with four replications.

Sawdust = 600 g, Rice bran = 100 g and Wood ash = 1 g

A total of eight treatments were applied in accordance with the interaction of the season, nature of wood and the *Pleurotus* species as follows: P1SWD, P1HWD, P2SWD, P2HWD, P1SWR, P1HWR, P2SWR and P2HWR.

Where:

P1= *Pleurotus ostreatus*

P2= *Pleurotus eryngii*

SW = Softwood  
HW = Hardwood  
D= dry season  
R= rainy season

The periods adopted for this study were in accordance with the season duration documented by SC (2021). April to October (rainy season) and November to March (dry season). The cultivation methods described by Chinda and Chinda (2007), composting, bagging, sterilisation, inoculation, incubation, cropping and harvesting, were employed in this research. Each treatment was allowed to compost for 34 days, with compost turned weekly. Dry season composting was conducted from 1<sup>st</sup> December 2021 to 3<sup>rd</sup> January 2022, while wet season composting took place from 29<sup>th</sup> April to 1<sup>st</sup> June 2022. Three spoons of fully colonised spawn (each spoon weighing 12.01±0.95 g) were inoculated into the bags. The inoculated bags were weighed and transferred to the incubation room, where they were arranged and monitored for growth. Incubation was carried out at 25±3°C for 33 days.

### Nutrient analysis

The Nutrient compositions, including proximate components (moisture, ash, fibre, lipid, protein and carbohydrate), minerals (calcium, magnesium, phosphorus, potassium, sodium and iron) and vitamins (vitamin A and thiamine), were evaluated using atomic absorption spectrophotometer as described by AOAC (2005).

### Statistical analysis

Data obtained were subjected to analysis of variance (ANOVA) in a CRD at a 5% significance level. Mean separation was by Duncan multiple range test (DMRT) at a 5% level of significance.

## RESULTS

### Effect of season and substrate type on proximate composition of the mushroom

The result of the effect of season and substrate type on the proximate composition of cultivated mushrooms, presented in Table 1, showed the availability of moisture, ash, lipid, fibre, carbohydrate and protein in all assessed treatments. For moisture, higher contents were recorded in the wet season compared to the dry season. P1SWD recorded the highest moisture (35.26±0.11) during the dry season, while P2SWR had the highest value (46.13±1) during the wet season. Softwood supported higher moisture content for both species of *Pleurotus*. For ash, the wet season supported higher ash contents compared to those in the dry season. P2HWD had the highest ash value in the dry season (0.63±0.05). Hardwood favoured higher ash content for P1 and P2. At the same time, P2HWR recorded the highest value (2.43±0.05) during the wet season. For lipids, both species performed better during the wet season. However, P2SWD had the highest value (3.05±0.05) during the dry season, while P2HWR recorded the highest value (3.83±0.28) for the wet season. Softwood supported higher performance of both *Pleurotus* species compared to hardwood substrate. For fibre, the wet season recorded higher values than the dry season.

**Table 1:** Effect of season and substrate type on proximate composition of mushroom (%).

| Treatment | Moisture                | Ash                     | Lipid                  | Fiber                  | CHO                     | Protein                 |
|-----------|-------------------------|-------------------------|------------------------|------------------------|-------------------------|-------------------------|
| P1SWD     | 35.26±0.11 <sup>d</sup> | 0.50±0.10 <sup>de</sup> | 2.75±0.05 <sup>c</sup> | 0.16±0.01 <sup>e</sup> | 20.13±0.05 <sup>d</sup> | 41.51±0.07 <sup>a</sup> |
| P1HWD     | 31.73±0.25 <sup>f</sup> | 0.46±0.05 <sup>e</sup>  | 2.60±0.10 <sup>c</sup> | 0.11±0.01 <sup>e</sup> | 25.20±0.10 <sup>a</sup> | 40.10±0.40 <sup>b</sup> |
| P2SWD     | 33.76±0.25 <sup>e</sup> | 0.30±0.10 <sup>f</sup>  | 3.05±0.05 <sup>b</sup> | 0.27±0.02 <sup>d</sup> | 22.53±0.15 <sup>b</sup> | 40.41±0.07 <sup>b</sup> |
| P2HWD     | 33.33±1.52 <sup>e</sup> | 0.63±0.05 <sup>d</sup>  | 2.60±0.10 <sup>c</sup> | 0.12±0.01 <sup>e</sup> | 25.13±0.05 <sup>a</sup> | 38.52±0.10 <sup>c</sup> |
| P1SWR     | 37.33±0.15 <sup>c</sup> | 1.07±0.06 <sup>c</sup>  | 3.11±0.10 <sup>b</sup> | 1.14±0.05 <sup>c</sup> | 20.00±0.70 <sup>d</sup> | 38.40±0.17 <sup>c</sup> |
| P1HWR     | 36.60±0.36 <sup>c</sup> | 1.30±0.10 <sup>b</sup>  | 3.66±0.15 <sup>a</sup> | 1.43±0.05 <sup>a</sup> | 21.53±0.45 <sup>c</sup> | 36.26±0.30 <sup>d</sup> |
| P2SWR     | 46.13±1.00 <sup>a</sup> | 1.30±0.10 <sup>b</sup>  | 3.60±0.10 <sup>a</sup> | 1.30±0.10 <sup>b</sup> | 9.11±0.34 <sup>f</sup>  | 40.03±0.20 <sup>b</sup> |
| P2HWR     | 43.36±0.77 <sup>b</sup> | 2.43±0.05 <sup>a</sup>  | 3.83±0.28 <sup>a</sup> | 1.18±0.05 <sup>c</sup> | 12.32±0.58 <sup>e</sup> | 36.53±0.49 <sup>d</sup> |

\*Means with the same superscripts across the column are not significantly different ( $p \leq 0.05$ ). CHO= Carbohydrate, P1SWD= *P. ostreatus* + softwood + dry season, P1HWD= *P. ostreatus* + hardwood + dry season, P2SWD= *P. eryngii* + softwood + dry season, P2HWD= *P. eryngii* + softwood + dry season, P1SWR= *P. ostreatus* + softwood + wet season, P1HWR= *P. ostreatus* + hardwood + wet season, P2SWR= *P. eryngii* + softwood + wet season, P2HWR= *P. eryngii* + hardwood + dry season.

However, P2SWD recorded the highest value (0.27±0.02), whereas P1HWR had the highest fibre value (1.43±0.05) during the wet season. Softwood encouraged better performance of P1 and P2 than hardwood. For carbohydrates, the dry season supported higher carbohydrate contents than those recorded during the wet season. Nevertheless, P1HWD had the highest value (25.20±0.10) for the dry season, while P1HWR recorded the highest value (21.53±0.45) for the wet season. Hardwood favoured higher carbohydrate contents for both P1 and P2. For protein, the dry season encouraged higher values of protein compared to their equivalents of the wet season. Notwithstanding, P1SWD recorded the highest value (41.51±0.07) during the dry seasons, whereas P2SWR had the highest value (40.03±0.20) during the wet season. Softwood supported higher protein content in P1 and P2 compared to the hardwood substrates.

Generally, wet season and hardwood recorded the best performance of both species. P1 and P2 had equal proximate nutrient potential. However, there was a significant difference in the effect of season and substrate type on the proximate composition of both cultivated *Pleurotus* species at  $P \leq 0.05$ .

#### Effect of season and substrate type on mineral composition of mushrooms

The result of the effect of season and substrate type on the mineral composition of both cultivated mushrooms presented in Table 2 showed better values of calcium during the wet season

than in the dry season. Meanwhile, P2SWD recorded the highest calcium value (246±1) during the dry season as against the 315±1 value observed for P1HWR, the highest value during the dry season. Hardwood favoured higher calcium values for both *Pleurotus* species. For Iron, higher values were seen for the wet season compared to those of the dry season. P2SWD had the highest value (4.06±0.11) during the dry season, while P1HWR recorded the highest value (4.04±0.06) during the wet season. Softwood supported higher values for both species of *Pleurotus*. For magnesium, the wet season had higher values than those recorded during the dry season. However, P2HWD had the highest magnesium value (249±1) during the dry season, while P2HWR recorded the highest value (305.67±0.57) for the wet season. Hardwood favoured higher values for both *Pleurotus* species than softwood. For phosphorus, higher values were observed for the dry season compared to the wet season. However, P2HWD recorded the highest value (504.67±1.52) during the dry season, whereas P1HWR had the highest value (413±2.64) for the wet season. Hardwood supported higher phosphorus values for both species of *Pleurotus*. For potassium, higher values were seen during the wet season compared to those of the dry season. Nonetheless, P2SWD had the highest value (126±1) during the dry season, while P2SWR recorded the highest value (131±1) for the wet season. Softwood favoured better potassium content for both *Pleurotus* species. For sodium, higher values were recorded during the wet season than in the dry season. P2SWD had the highest value (69±1) during the dry season, while P2HWR recorded the highest sodium value (70.76±1.15) during the wet season. Notwithstanding, softwood

**Table 2:** Effect of season and substrate type on mineral composition of mushrooms (mg 100 g<sup>-1</sup>).

| Treatment | Ca                       | Fe                     | Mg                       | P                         | K                         | Na                       |
|-----------|--------------------------|------------------------|--------------------------|---------------------------|---------------------------|--------------------------|
| P1SWD     | 218.67±0.57 <sup>f</sup> | 3.03±0.05 <sup>d</sup> | 213.67±3.21 <sup>g</sup> | 428.33±7.63 <sup>c</sup>  | 121.00±1.00 <sup>d</sup>  | 63.33±0.57 <sup>d</sup>  |
| P1HWD     | 231.67±1.5 <sup>d</sup>  | 0.40±0.00 <sup>e</sup> | 241.33±1.52 <sup>d</sup> | 500.33±0.57 <sup>a</sup>  | 123.00±2.00 <sup>cd</sup> | 49.67±1.52 <sup>e</sup>  |
| P2SWD     | 246.00±1.00 <sup>c</sup> | 4.06±0.11 <sup>a</sup> | 225.00±5.00 <sup>f</sup> | 438.33±7.63 <sup>b</sup>  | 126.00±1.00 <sup>b</sup>  | 69.00±1.00 <sup>ab</sup> |
| P2HWD     | 224.67±0.57 <sup>e</sup> | 0.44±0.00 <sup>e</sup> | 249.00±1.00 <sup>c</sup> | 504.67±1.52 <sup>a</sup>  | 125.00±1.00 <sup>bc</sup> | 45.33±1.52 <sup>f</sup>  |
| P1SWR     | 305.00±3.00 <sup>b</sup> | 3.53±0.05 <sup>b</sup> | 216.33±1.52 <sup>g</sup> | 411.67±1.15 <sup>d</sup>  | 124.00±1.00 <sup>bc</sup> | 67.00±1.00 <sup>c</sup>  |
| P1HWR     | 315.00±1.00 <sup>a</sup> | 4.04±0.06 <sup>a</sup> | 232.00±1.00 <sup>e</sup> | 413.00±2.64 <sup>d</sup>  | 121.00±1.00 <sup>d</sup>  | 64.33±0.57 <sup>d</sup>  |
| P2SWR     | 200.67±0.57 <sup>h</sup> | 3.60±0.10 <sup>b</sup> | 301.00±1.00 <sup>b</sup> | 370.00±10.00 <sup>f</sup> | 131.00±1.00 <sup>a</sup>  | 68.33±0.57 <sup>bc</sup> |
| P2HWR     | 211.00±1.00 <sup>g</sup> | 3.36±0.15 <sup>c</sup> | 305.67±0.57 <sup>a</sup> | 400.33±0.57 <sup>e</sup>  | 129.33±0.57 <sup>a</sup>  | 70.67±1.15 <sup>a</sup>  |

\*Means with the same superscripts across the column are not significantly different ( $p \leq 0.05$ ). CHO= Carbohydrate, P1SWD= *P. ostreatus* + softwood + dry season, P1HWD= *P. ostreatus* + hardwood + dry season, P2SWD= *P. eryngii* + softwood + dry season, P2HWD= *P. eryngii* + softwood + dry season, P1SWR= *P. ostreatus* + softwood + wet season, P1HWR= *P. ostreatus* + hardwood + wet season, P2SWR= *P. eryngii* + softwood + wet season, P2HWR= *P. eryngii* + hardwood + dry season.

**Table 3:** Effect of season and substrate type on vitamin composition of mushrooms (mg 100 g<sup>-1</sup>).

| Treatment | Vitamin A               | Thiamine                |
|-----------|-------------------------|-------------------------|
| P1SWD     | 0.00±0.00 <sup>b</sup>  | 0.63±0.01 <sup>cd</sup> |
| P1HWD     | 10.33±0.57 <sup>a</sup> | 0.02±0.01 <sup>f</sup>  |
| P2SWD     | 0.00±0.00 <sup>b</sup>  | 0.78±0.03 <sup>a</sup>  |
| P2HWD     | 0.00±0.00 <sup>b</sup>  | 0.02±0.00 <sup>f</sup>  |
| P1SWR     | 0.00±0.00 <sup>b</sup>  | 0.65±0.02 <sup>bc</sup> |
| P1HWR     | 0.00±0.00 <sup>b</sup>  | 0.61±0.01 <sup>d</sup>  |
| P2SWR     | 0.13±0.01 <sup>b</sup>  | 0.56±0.01 <sup>e</sup>  |
| P2HWR     | 0.14±0.01 <sup>b</sup>  | 0.67±0.01 <sup>b</sup>  |

\*Means with the same superscripts across the column are not significantly different ( $p \leq 0.05$ ). CHO= Carbohydrate, P1SWD= *P. ostreatus* + softwood + dry season, P1HWD= *P. ostreatus* + hardwood + dry season, P2SWD= *P. eryngii* + softwood + dry season, P2HWD= *P. eryngii* + softwood + dry season, P1SWR= *P. ostreatus* + softwood + wet season, P1HWR= *P. ostreatus* + hardwood + wet season, P2SWR= *P. eryngii* + softwood + wet season, P2HWR= *P. eryngii* + hardwood + dry season.

favoured better sodium content for both *Pleurotus* species. Generally, wet season and hardwood supported the best performance of both species, while P2 had higher mineral nutrients than P1. However, there is a significant difference in the effect of season and substrate type on the mineral composition of both cultivated *Pleurotus* species at  $p \leq 0.05$ .

#### Effect of season and substrate type on vitamin composition of the mushroom

The results of season and substrate type on vitamin composition of harvested mushrooms represented in Table 3 showed the occurrence of two vitamins (A and thiamine). However, Vitamin A was detected only in treatments P1HWD, P2SWR, and P2HWR, whereas thiamine was present in all treatments, though at varying concentrations. The highest vitamin A content, 10.33±0.57, was observed for P1HWD. Thiamine was present in all tested treatments; however, higher thiamine values were recorded in the wet season than in the dry season. P2SWD recorded the highest thiamine value (0.78±0.03) during the dry season, while P2HWR recorded the highest value (0.67±0.01) during the wet season. Softwood supported higher Thiamine in both species of *Pleurotus*.

Generally, hardwood and wet season favoured the best vitamin content, while P2 performed better than P1 in terms of vitamin composition. There is a significant difference in the effect of season and substrate type on the vitamin composition of both cultivated species at  $p \leq 0.05$ .

#### DISCUSSION

The present study has revealed that both species had similar performance in terms of proximate composition. However, these performances were recorded during the wet season and on the hardwood substrates. However, the higher content of moisture during the wet season could be due to the result of the prevailing weather conditions, as more rainfall, lower temperature, and higher relative humidity could lead to lower levels of

evaporation (Rukhiran et al., 2023; SC, 2021).

Studies have revealed that the *Pleurotus* genus is a good source of nutrients and that the occurrences of these nutrients vary from species to species (Ritota and Manzi, 2019). Early researchers have also implicated the same proximate compositions to be present in *Pleurotus* species, including *P. ostreatus* and *P. eryngii* (Sobowale et al., 2018; Oyetayo and Ariyo, 2013). The protein and carbohydrate contents of the present study are higher than those reported by Das et al. (2015) for *P. flabellatus*, *P. ostreatus*, *P. palmonarias* and *P. floridanus* grown at non-sterilized rice straw at warm temperatures. Zahid et al. (2010) reported lower proximate values for *P. eryngii* and *P. ostreatus* compared to those recorded in the present study. The research of Ahmed et al. (2016) on *P. ostreatus* and *P. eryngii* differs from the present study as they reported lower protein and higher moisture values than those presented in the current study. Notwithstanding, Sifat et al. (2020) reported similar moisture, proteins and carbohydrate values for both *P. ostreatus* and *P. eryngii*, agreeing with the proximate values presented in the current study, *Pleurotus* mushrooms have not just served as a source of livelihood to rural people but also a source of nutrient as it produces energy (carbohydrate and lipid) amino acids (protein) and proper digestion (fibre) (Ahmed et al., 2016; Adebayo and Oloke, 2017).

The current study has shown the availability of vitamin A and thiamine in both *P. ostreatus* and *P. eryngii*. However, vitamin A occurred in limited amounts in treatments P1HWD, P2SWR and P2HWR compared to thiamine, which was recorded across all tested treatments. Literature has also shown the unavailability of vitamin A in some cultivated treatments of *P. ostreatus* (Agbagwa et al., 2020a). The presence of vitamins A, B, C, D, E and K in *P. ostreatus*. However, they reported lower vitamin A and thiamine contents than those presented in this study. Nwoko et al. (2018) indicated lower thiamine values for *P. pulmonarius* than their equivalents recorded for *P. ostreatus* and *P. eryngii* in the current study. Similarly, thiamine values for *P. pulmonarius* were compared with those recorded in the present study. The availability of these vitamins further makes *Pleurotus* mushroom highly valued, as vitamin A plays an important role in eye vision, and the absence of thiamine (B1) has been associated with beriberi ailment (Guzman, 2000).

The present study revealed higher mineral contents during the wet season and on hardwood treatments. However, *P. eryngii* had higher mineral contents than *P. ostreatus*. The high values recorded could be a direct impact of the utilised agro-waste materials as the material employed for the cultivation recorded high contents of the same mineral elements. Furthermore, the high rate of assimilation of the mineral elements by both species of *Pleurotus* could be related to the wood ash material used, as Mandre (2006) revealed that wood ash influenced the rate of mineral uptake.

The findings of the present study disagree with the mineral report of Agbagwa et al. (2020b) for *P. ostreatus* grown on sawdust, wood ash and cassava bran, as they reported lower mineral values for the same elements considered in the current study. Ahmed et al. (2016) also reported lower mineral values for *P. ostreatus* and *P. eryngii* than those recorded in this study.

Akyüz et al. (2022) further revealed lower mineral values for *P. pulmonarius* grown on coir fibre, palm husk, sawdust and rice straw.

Furthermore, Manzi et al. (1999) reported higher potassium values for *P. eryngii* than those recorded in the present study. Adebayo et al. (2014) implicated the same mineral elements in *P. ostreatus*, *P. palmonarius*, *P. sapidus* and *P. cornucopiae* grown on sawdust. They reported lower values compared to those recorded in the current study. The present study confirms the claims of previous literature about the *Pleurotus* genus being a good source of mineral elements Adebayo and Oloke (2017). Early researchers have implicated the mineral elements recorded in this study to support healthy living; as calcium contributes to strengthening bones, iron remains an important component of blood, phosphorus is important in the formation of nucleotides while magnesium and potassium support physiological, biochemical and metabolic processes (Ritota and Manzi, 2019; Bisht et al., 2022).

## CONCLUSION

*Pleurotus ostreatus* and *P. eryngii* grown on different substrate types and seasons possess vital proximate, mineral and vitamin nutrients. The concentration of these nutrients in *Pleurotus* could be influenced by the nature of the wood sawdust and the prevailing season. The wet season and hardwood sawdust promoted higher nutrient quality in *Pleurotus*.

## DECLARATION OF COMPETING INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## AUTHOR CONTRIBUTION STATEMENT

Agbagwa Samuel Sunday, Chuku Edith Chisa, Wekhe Emenike Onyinye, Okhifo Anthony: Conducted the study, evaluated the data and wrote up this report.

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## ETHICAL STATEMENT

Not applicable.

## AVAILABILITY OF DATA AND MATERIAL

Not applicable.

## INFORMED CONSENT

Not applicable.

## CONSENT FOR PUBLICATION

The authors have submitted consent for publication of this article in the 'Journal of Horticulture Sciences and Technology'.

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Zero Hunger, Good Health and Well-being, Responsible Consumption and Production, and Climate Action.

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