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Proximate And Mineral Compositions Of Pleurotus Pulmonarius And P. Sajor-Caju Cultivated On Agro Wastes

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Abstract: ***Pleurotus pulmonarius and Pleurotus sajor-caju were cultivated on Pycanthus angolensis and Spondia mombim sawdusts supplemented with 0, 5, 10, 15 and 20% Palm kernel Cake (PKC), Oil palm fibre (OPF), Rice Bran (RB), Wheat bran (WB), and Corn cobs (CC) to determine the effect of these agro wastes on yield, proximate and mineral contents of the harvested dried mushrooms. The highest yield in terms of fresh weight was obtained from P. Pulmonarius (40.67g±0.11) as compared to P. Pulmonarius having the lowest yield of 10.08g±0.07. The proximate analysis revealed a maximum protein content of 27.38%±0.01, a maximum fat content of 3.82% ±0.00. The ash and fibre content ranged between 4.25%±0.02 - 10.57%±0.02 and 5.71%±0.02 - 1.5%±0.03 respectively. The mineral composition of the harvested fruiting bodies varied from 0.23mg/100g±0.01 – 13.15mg/100g±0.07, 0.04mg/100g±0.01 – 10.74mg/100g±0.12 and 0.21mg/100g±0.01 – 12.75mg/100g±0.02 for Ca, Mg and Fe respectively.***

Keywords: ***Pleurotus pulmonarius, Pleurotus sajor-caju, Proximate, Pycanthus angolensis, Spondia mombim, supplement, substrates.***

I. INTRODUCTION

The cultivation of edible mushrooms has evolved in time and has become an activity of economic importance in the present days and the majorly produced species are of the genera *Agaricus, Pleurotus* and *Lentinula*. Their world production has increased, especially *Pleurotus* spp. due to their ability to grow on different residues, such as sawdust and agro industrial waste, a characteristic that made production economically viable. Such characteristics are relevant as regards production, but mushrooms are also important regarding their nutritional aspect. The type of substrate, the environmental conditions and the fungus species used in cultivation all have a large influence on the chemical composition of fruiting bodies.

Mushrooms are a valuable source of dietary fiber; 100g serving of mushrooms contains 2.5g dietary fiber. It is also rich in essential minerals and trace elements (Rahman, *et al.*, 2012). Oyster Mushrooms are valuable health foods, which are low in calories, high in vegetable proteins, zinc, chitin, fiber and vitamins C, D and B-complex (Cağlarırmak, 2007).

The high nutritional and medicinal values of the fruiting bodies of mushrooms have been variously reported in literature. These reports indicated that mushrooms are especially rich in dietary protein and contain appreciable amounts of carbohydrate, fats, vitamins, fibre and minerals

(Ahmed *et al*., 2013; Manjunathan *et al*., 2011; Oyetayo, 2011; Fakoya *et al*., 2014).

Pleurotus is an efficient lignin- degrading mushroom and can grow well on different types of lignocellulolosic materials. Cultivation of this Mushroom is very simple and low cost production technology, which gives consistent growth with high biological efficiency. Different species of *Pleurotus* can grow well in variable temperature conditions; hence they are ideally suited for cultivation throughout the year in various regions and in countries like Nigeria.

This study aims at formulating new growth substrates for mushroom cultivation as well as investigating the effects of the substrates on the growth, yield proximate and mineral composition of *P. pulmonarius* and *P. sajor-caju* in order to better manage cultivation for future application in the growth of edible mushrooms.

II. MATERIALS AND METHODS

SAMPLE COLLECTION

Sawdust of *Pycnanthus angolensis* and *Spondias mombin* were collected from saw mills in Akure metropolis. Supplements used were corn cobs (CC), oil palm fibre (OPF), wheat chaff (WC), rice bran (RB) and palm kernel cake (PKC) were collected from oil mills and agro processing units in Akure, Ondo state. Calcium carbonate ($CaCO_3$) was bought from a local laboratory reagents retailer in Akure, Ondo state. *Pleurotus pulmonarius* and *P. sajor-caju* were obtained from the culture collection unit of edible mushrooms in the Forestry Research Institute of Nigeria, Ibadan, Oyo state, Nigeria and subsequently sub cultured on Potato Dextrose Agar (PDA) plates and incubated at room temperature (28^{o}C) for 7 days.

SPAWN PREPARATION

Sorghum grains were used to prepare the mother spawn. Sorghum grains were boiled in water bath for 10-15 minutes in the ratio of 1:1 (Sorghum grains: water) and mixed with 4% (w/w) $CaCO_3$ Sorghum grains were then packed (250g) in polythene bags (of 200 x 300 mm. size) and sterilized in an autoclave at 121ºC for 30 min. After sterilization, the bags were inoculated under aseptic conditions with actively growing mycelium of the *P. ostreatus* and *P. sajor caju* from Potato Dextrose Agar (PDA) plates and incubated (at 27±2 ºC) for mycelial growth without any light for 10-15 days until the mycelium fully covered the grains (Sánchez, 2010).

SUBSTRATE PREPARATION

The sawdust of *Pycnanthus angolensis* and *Spondias mombin* were soaked in water, excess water squeezed out. $CaCO_3$ (1%) and the various additives were thoroughly mixed with the sawdust at 0, 5, 10, 15 and 20%. 200g of each mixture was put in polythene bags, sterilised in an autoclave for 2 hours at 121^{0}C, allowed to cool and inoculated with the spawn under aseptic conditions. Incubation followed in the dark. Varying percentages of substrate formulations were prepared.

DETERMINATION OF PROXIMATE COMPOSITION

Protein, fat, fibre, ash and total carbohydrate were determined with the procedure recommended by AOAC (2006)

MINERAL ASSAY

The analyses of macronutrients (Ca and Mg) and micronutrients (Fe) were carried out in accordance to AOAC, 2006. Samples were weighed (0.5g), digested with nitricperhydrol acid mixture and solubilized. Ca, Mg and Fe contents were determined by means of atomic absorption spectrophotometry, all previously calibrated with standard solutions for each element.

STATISTICAL ANALYSIS

The results obtained were statistically analysed using analysis of variance (ANOVA), and tests of significance carried out by Duncan's multiple range test at $P \leq 0.05$.

III. RESULTS AND DISCUSSION

PROXIMATE AND MINERAL COMPOSITIONS OF SAWDUST AND SUPPLEMENTS

Table 1 show the proximate and mineral compositions of saw dusts and supplements used in cultivating the *Pleurotus* mushrooms. Palm kernel cake has the highest protein content of 19.11%±0.66 while corncob has the lowest protein content of 5.51%±0.00. Oil palm fibre and rice bran have fat contents of 22.01%±0.55 and 5.39%±0.00 respectively. Moisture content of palm kernel cake was lowest (3.29%±0.01) while 15.34%±0.01 was obtained in corn cobs. The mineral composition of the saw dusts used indicates that *P. angolensis* sawdust has the highest Ca value of 2780 mg/100g±0.02 before use for mushroom cultivation while Mg and Fe of *S. mombim* were 29.96mg/100g±0.11 and 7.96mg/100g±0.33 respectively.

MUSHROOM YIELD AND BIOLOGICAL EFFICIENCY

The total yield was estimated on the basis of 200 g substrate by measuring the fresh weight of the harvested mushrooms. The results presented in Table 2 indicates the total yield of *P. Pulmonarius* and *P. sajor-caju* with the highest yield in terms of fresh weight of *P. Pulmonarius* as 40.67g±0.11 cultivated on sawdusts of *P. angolensis* and *S. mombin* supplemented with 20% Corn Cobs as compared to *P. Pulmonarius* having the lowest value of 10.08g±0.07 cultivated on sawdusts of *P. angolensis* and *S. mombin* supplemented with 5% Wheat Chaff. A maximum biological efficiency of 45.75%±0.17 and a minimum value of 9.29%±0.07 were obtained for *P. Pulmonarius*. Therefore, it could be suggested that the cultivation substrate for *P. Pulmonarius* which had the best yield contained a better formulation than others which produced low yield of mushroom fresh weight.

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PROXIMATE AND MINERAL COMPOSITIONS OF HARVESTED MUSHROOMS

Tables 3 and 4 shows the Proximate and mineral compositions of dried *P. pulmonarius* and *P. sajor-caju* cultivated on saw dust combinations with different supplement levels. The protein content estimated in dry powder of both *Pleurotus* species cultivated indicated that *P. sajor-caju* cultivated on sawdusts of *P. angolensis* and *S. mombin* supplemented with 15% Rice bran has highest percentage of protein content of 27.38%±0.01 while *P. sajor-caju* cultivated on sawdusts of *P. angolensis* and *S. mombin* supplemented with 20% wheat chaff has lowest percentage of protein content of 18.26%±0.02. The fat content indicates that *P. pulmonarius* has the highest percentage of fat content of 3.82%±0.00 when cultivated on sawdusts of *P. angolensis* and *S. mombin* supplemented with 15% oil palm fibre. This is probably due to the high fat content of the oil palm fibre used as supplement. The crude fiber has a range of 5.71%±0.02 - 11.25%±0.03, while the ash content ranged from 4.25%±0.02 to 10.57%±0.02. The proximate compositions recorded in this research were similar as reported in earlier studies of Singh *et al.* (2003); Bonatti *et al.* (2004); Patil and Dakore, (2007); Patil *et al.* (2008) and Fakoya *et al*., (2014).

Minerals such as P, Ca, K, Fe and Mg are naturally present in all of the materials used in the preparation of the cultivation substrate which in turn reflected in the mushrooms cultivated on them. The minerals tested for in the harvested mushrooms had values ranging from 0.23±0.01 to 13.15mg/100g±0.07, 0.04±0.01 to 10.74mg/100g±0.12 and 0.21±0.01 to 12.75mg/100g±0.02 for Ca, Mg and Fe respectively. Manimozhi and Kaviyarasan, 2013 reported similar values for the mineral elements tested for. Ceci Sales *et* al., 2009 reported minimum values of 0.34mg/100g, 2.12mg/100g and 115mg/100g for Ca, Mg and Fe respectively for *P. ostreatus* while Arun and Anita, 2010 reported values of 35.03mg/100g, 195mg/100g and 18.76mg/100g for Ca, Mg and Fe respectively for *P. sajor-caju.* Recent evidence has shown that mushrooms can absorb metal ions in high concentrations (Bystrzejewska-Piotrowska *et al*., 2008, Gonen Tasdemir *et al.*, 2008). Therefore, mushrooms in this study exhibited prefential differences in absorbing mineral elements from the substrates used in cultivating them but generally, most of the mushrooms studied had good amount of Ca, Mg and Fe.

	Moisture	Fat	Fibre	Ash	Protein	Carbohydrate	Ca (mg/100g)	Mg (mg/100g)	Fe (mg/100g)
PA	4.92± 0.00	5.65±0.01	41.57±0.00	2.49±0.2	4.48±0.03	40.89±0.11	2780±0.02	8.77±0.11	2.83± 0.33
SM	6.35±0.02	4.87±0.23	38.90± 0.33	2.25±0.11	4.40± 0.00	43.23±0.23	73.68±0.00	29.96±0.01	7.96±0.33
RB	7.09±0.00	5.39±0.00	33.54±0.25	14.61±0.55	11.04±0.66	28.34±0.01	63.33±0.02	70.00±0.22	98.33±0.05
WC	11.37±0.30	4.27±0.22	3.61±0.05	3.50±0.02	17.93±0.33	59.32±0.55	150±0.15	40.22± 0.01	34.33±0.11
PKC	3.29±0.01	7.84±0.25	17.41±0.01	4.17±0.00	19.11±0.66	48.18±0.05	75.55±0.20	21.00±0.11	3.23±0.33
OPF	5.33±0.11	22.01±0.55	19.06±0.05	13.00±0.01	11.98±0.05	28.62±0.25	15.55±0.00	2.00±0.11	1.50±0.15
CC	15.34±0.01	5.01±0.15	41.07±0.05	0.47±0.05	5.51±0.00	32.60±0.01	8.33±0.23	2.83±0.15	25.00±0.23

KEY: PA – Pycanthus angolensis sawdust, SM – Spondias mombim sawdust, RB- Rice Bran, WC- Wheat Chaff, PKC- Palm Kernel Cake, OPF- Oil palm Fibre, CC- Corn Cobs.
Values are means of triplicates ± SD.

Table 1: Proximate and Mineral Compositions of Sawdusts and supplements

Substrates	*P. pulmonarius* 1st Flush (g)	2nd Flush (g)	Total Yield(g)	B.E (%)	*P. sajorcaju* 1st Flush (g)	2nd Flush (g)	Total Yield (g)	B.E (%)
P: S (50:50)	12.67	9.34	22.01 ±0.02^b	24.59 ±0.02	14.43	7.21	21.62 ±0.047	22.45 ±0.22^b
P: S: 5% OPF	0.00	0.00	0.00	0.00	7.80	5.61	13.28 ±0.25^a	15.28±0.06^a
P: S: 10% OPF	22.54	0.00	22.51 ±0.06^c	25.16 ±0.05^c	15.11	10.24	25.40 ±0.14^c	27.25 ±0.12^c
P: S: 15% OPF	20.52	10.31	30.82 ±0.06^a	35.43 ±0.04^a	16.27	12.48	28.78 ±0.09^a	35.57 ±0.24^a
P: S: 20% OPF	17.24	8.94	26.20 ±0.02^d	29.50 ±0.45^d	18.50	9.50	28.01 ±0.02^d	28.25 ±0.06^d
P: S: 5% PKC	19.20	10.98	30.13 ±0.11^b	30.24 ±0.07^b	20.98	13.43	34.42 ±0.02^a	38.82 ±0.08^a
P: S: 10% PKC	21.37	11.11	32.46 ±0.02^c	38.21 ±0.03^c	18.21	7.09	25.41 ±0.10^b	29.75 ±0.16^b
P: S: 15% PKC	22.81	11.35	34.18 ±0.03^d	40.33 ±0.18^d	19.00	10.04	29.04 ±0.04^c	35.66 ±0.11^d
P: S: 20% PKC	25.33	12.32	37.66 ±0.11^a	43.66 ±0.19^a	21.84	11.98	33.81 ±0.02^d	31.80 ±0.05^c
P: S: 5% RB	12.54	7.32	19.81 ±0.04^a	17.25 ±0.06^a	9.21	3.22	12.51 ±0.12	10.44 ±0.10^a
P: S: 10% RB	15.92	10.21	26.17 ±0.04^c	30.04 ±0.06^d	14.19	7.77	21.91 ±0.11^c	22.30 ±0.29^b
P: S: 15% RB	14.08	7.87	21.94 ±0.05^b	26.05 ±0.05^c	13.04	9.74	22.77 ±0.01^d	25.70 ±0.29^c
P: S: 20% RB	19.33	9.21	28.52 ±0.04^d	30.20 ±0.03^d	15.57	10.49	26.04 ±0.04^a	29.13±0.11^d
P: S: 5% WC	5.92	4.20	10.08 ±0.07^a	9.29 ±0.07^a	18.50	0.00	18.47 ±0.10^c	22.20 ±0.11^d
P: S: 10% WC	7.21	5.80	13.07 ±0.03^b	14.69 ±0.27^b	12.22	5.22	17.51 ±0.11^b	19.14 ±0.03^b
P: S: 15% WC	10.50	7.90	18.50 ±0.14^d	22.34 ±0.12^d	12.93	7.71	20.66 ±0.03^d	19.47 ±0.01^c
P: S:20% WC	12.22	4.70	16.93 ±0.05^c	20.54 ±0.18^c	10.85	5.35	16.12 ±0.11^a	15.17 ±0.06^a
P: S: 5% CC	25.78	12.22	38.25 ±0.25^a	42.88 ±0.07^a	15.98	10.31	26.26 ±0.06^a	28.81 ±0.13^c
P: S: 10% CC	23.81	10.87	34.60 ±0.12^c	38.87 ±0.33^c	19.11	9.93	29.040 ±0.04^c	28.30 ±0.13^b
P: S: 15% CC	20.39	11.55	31.71 ±0.30^b	35.41 ±0. 22^b	21.22	8.35	29.66 ±0.10^d	35.41 ±0.22^d
P: S: 20% CC	27.42	13.33	40.67 ±0.11^a	45.75 ±0.17^a	23.40	13.23	36.69 ±0.07^a	41.03±0.03^a

KEY: P: S- P. angolensis: S.mombim, OPF- oil palm fibre, PKC- palm kernel cake, RB- rice bran, WC- wheat chaff, CC- corn cobs, B.E - Biological efficiency
Values are means of triplicates ± SD. Values in the same column carrying the same superscript are not significantly different according to Duncan's multiple range test at ($p \leq 0.05$)

Table 2: Yield of P. pulmonarius and P. sajor caju cultivated on P. angolensis and S.mombim sawdust combinations and supplements Levels

Substrate	Fat (%)	Fibre (%)	Ash (%)	Protein (%)	Carbohydrate (%)	Ca (mg/100g)	Mg (mg/100g)	Fe (mg/100g)
P: S (50:50)	1.85 ±0.03^b	5.71 ±0.02^b	7.49 ±0.02^d	26.50±0.10^a	58.44 ±0.01^a	9.77 ±0.01^a	1.33 ±0.01^b	9.92 ±0.02^a
P:S:5% OPF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P:S:10% OPF	3.25 ±0.01^d	11.25 ±0.03^a	5.12±0.02^b	24.83 ±0.04^c	55.53 ±0.01^c	3.11 ±0.01^d	5.16 ±0.06^a	7.46 ±0.02^c
P:S:15% OPF	3.82 ±0.00^a	10.06 ±0.03^d	7.06 ±0.03^c	22.22 ±0.00^b	56.76 ±0.02^d	1.33 ±0.00^b	4.33 ±0.01^c	8.34 ±0.01^d
P:S:20% OPF	2.12 ±0.02^c	9.33 ±0.01^c	10.57 ±0.02^a	26.33 ±0.01^d	51.65 ±0.01^b	2.45 ±0.01^c	4.43 ±0.01^d	2.16 ±0.04^b
P:S:5% PKC	2.82±0.01^f	6.46 ±0.02^b	7.58 ±0.08^c	26.45 ±0.01^a	56.74 ±0.05^c	2.99 ±0.01^c	1.24 ±0.01^c	1.31 ±0.03^b
P:S:10% PKC	2.56 ±0.02^d	8.48 ±0.06^d	8.41 ±0.02^d	25.92 ±0.12^d	54.57 ±0.02^b	13.15 ±0.07^a	3.44 ±0.01^d	4.53 ±0.01^c
P:S:15% PKC	1.78 ±0.01^c	8.06 ±0.03^c	7.39 ±0.03^b	25.45 ±0.05^c	57.39±0.04^d	8.87 ±0.06^d	10.05 ±0.04^a	11.63 ±0.01^d
P:S:20% PKC	1.30 ±0.01^b	8.92±0.01^a	8.36 ±0.02^d	19.24 ±0.02^b	62.21 ±0.01^a	2.13 ±0.01^b	0.23 ±0.01^b	12.75 ±0.02^a
P:S:5% RB	1.55 ±0.02^c	7.70 ±0.06^d	4.25 ±0.02^b	21.26 ±0.06^b	64.32 ±0.01^a	10.23 ±0.01^a	2.14 ±0.01^b	2.94±0.01^c
P:S:10% RB	1.95 ±0.01^d	7.20 ±0.10^c	8.32 ±0.01^d	24.63 ±0.01^c	57.89 ±0.11^b	9.26 ±0.06^d	4.30 ±0.10^c	7.49 ±0.01^a
P:S:15% RB	1.94 ±0.01^d	7.04 ±0.01^b	7.22 ±0.03^c	24.61 ±0.01^c	59.16 ±0.02^d	4.26 ±0.05^b	9.22 ±0.01^d	2.34 ±0.01^b
P:S:20% RB	1.38 ±0.02^b	7.25 ±0.05^c	7.91 ±0.02^d	24.90 ±0.01^d	58.60 ±0.01^c	8.96 ±0.01^c	10.74 ±0.12^a	3.52 ±0.07^d
P:S:5% WC	2.73 ±0.06^d	9.44 ±0.02^c	6.12 ±0.04^b	24.03 ±0.06^c	57.77 ±0.06^a	2.62 ±0.06^c	1.09±0.01^b	10.99 ±0.01^c
P:S:10% WC	1.88±0.02^c	9.85 ±0.03^d	9.82 ±0.01^a	25.13 ±0.06^d	53.35 ±0.02^b	2.25 ±0.01^b	1.33 ±0.01^c	12.34 ±0.00^a
P:S:15% WC	1.79 ±0.01^b	8.82±0.02^b	8.99 ±0.02^d	25.93 ±0.01^a	54.45 ±0.02^c	8.84 ±0.06^d	2.06 ±0.05^d	5.65 ±0.02^b
P:S:20% WC	2.77 ±0.01^d	9.42±0.03^c	8.26 ±0.06^c	23.12 ±0.02^b	56.48 ±0.02^d	9.46 ±0.01^a	5.54 ±0.01^a	12.22 ±0.01^d
P:S:5% CC	1.75 ±0.04^d	8.82 ±0.02^a	8.15 ±0.05^c	25.12 ±0.02^b	56.17 ±0.01^c	12.17 ±0.01^a	0.09 ±0.01^b	1.63 ±0.01^b
P:S:10% CC	1.52 ±0.01^c	8.35 ±0.02^d	8.75 ±0.02^d	25.96 ±0.01^c	55.43 ±0.03^b	1.03 ±0.02^b	0.96 ±0.01^c	2.83 ±0.01^c
P:S:15% CC	1.02 ±0.02^b	6.43 ±0.02^b	9.52 ±0.06^a	26.80 ±0.01^a	56.25 ±0.05^d	7.32 ±0.01^d	7.11 ±0.01^d	5.06 ±0.02^d
P:S:20% CC	2.32 ±0.01^a	7.67 ±0.02^c	7.07 ±0.07^b	26.54 ±0.02^d	56.39 ±0.01^a	2.49 ±0.01^c	7.21 ±0.01^a	8.55 ±0.01^a

KEY: P: S- P. angolensis: S.mombim, OPF- oil palm fibre, PKC- palm kernel cake, RB- rice bran, WC- wheat chaff, CC- corn cobs. Values are means of triplicates ± SD. Values in the same column carrying the same superscript are not significantly different according to Duncan's multiple range test at ($p \leq 0.05$).

Table 3: Proximate and mineral Composition of dried Pleurotus pulmonarius cultivated on saw dust combinations with different supplement Levels

Substrate	Fat (%)	Fibre (%)	Ash (%)	Protein (%)	Carbohydrate (%)	Ca (mg/100g)	Mg (mg/100g)	Fe (mg/100g)
P: S (50:50)	1.66 ±0.01	9.34 ±0.01^{abc}	6.03 ±0.01	24.03 ±0.01	58.93 ±0.04	2.17 ±0.06^b	1.01 ±0.01^b	0.98 ±0.01
P:S:5% OPF	1.44 ±0.01^c	7.22 ±0.01^a	7.22 ±0.01^b	21.65 ±0.01^b	62.52 ±0.04^d	2.12 ±0.01^a	3.23 ±0.01^c	0.34 ±0.01^b
P:S:10% OPF	1.00 ±0.00^a	8.37 ±0.03^c	7.76±0.01^c	22.45 ±0.03^c	60.35 ±0.02^c	0.23 ±0.01^a	6.22 ±0.01^d	7.13 ±0.01^a
P:S:15% OPF	1.39 ±0.01^b	7.19 ±0.01^a	8.34 ±0.01^d	20.12 ±0.02^a	62.93 ±0.04^a	1.08 ±0.06^b	0.04 ±0.01^a	2.12 ±0.01^d
P:S:20% OPF	1.87 ±0.01^a	8.33 ±0.03^b	9.04 ±0.02^a	23.47 ±0.01^d	57.30 ±0.01^b	1.57 ±0.01^c	3.23 ±0.01^c	0.21 ±0.01^a
P:S:5% PKC	2.01±0.01^d	9.34 ±0.01^c	10.46 ±0.07^d	27.34 ±0.01^a	50.86 ±0.01^a	0.87 ±0.01^a	0.43 ±0.01^b	3.13 ±0.01^d
P:S:10% PKC	1.82 ±0.01^c	9.33 ±0.01^c	9.57 ±0.01^b	25.41 ±0.02^c	53.83 ±0.04^c	2.22 ±0.00^c	0.33 ±0.01^a	2.32 ±0.02^c
P:S:15% PKC	1.29 ±0.01^a	9.14 ±0.00^b	10.23 ±0.01^c	22.54 ±0.04^a	56.75±0.05^d	3.33 ±0.01^d	1.29 ±0.01^d	0.23 ±0.01^a
P:S:20% PKC	2.47 ±0.01^a	9.00±0.01^a	10.45 ±0.01^d	26.17 ±0.01^d	51.89 ±0.02^b	10.23 ±0.01^a	3.24 ±0.01^a	9.34 ±0.01^a
P:S:5% RB	0.52 ±0.07^b	7.70 ±0.01^c	5.24 ±0.01^a	22.22 ±0.01^a	64.32 ±0.01^a	0.23 ±0.01^a	2.82 ±0.01^d	2.96±0.03^c
P:S:10% RB	0.97 ±0.01^c	7.95 ±0.06^d	7.32 ±0.01^d	24.35 ±0.01^c	59.36 ±0.01^c	2.22 ±0.01^b	0.30 ±0.01^a	2.49 ±0.01^b
P:S:15% RB	1.09 ±0.01^d	6.98 ±0.07^a	6.13 ±0.06^c	27.38 ±0.01^a	58.47 ±0.02^a	12.30 ±0.06^d	3.01 ±0.01^a	3.01 ±0.01^d
P:S:20% RB	0.36 ±0.04^a	7.13 ±0.06^b	7.29 ±0.01^d	25.44 ±0.10^d	59.75 ±0.01^d	4.96 ±0.01^c	0.88 ±0.01^b	3.55 ±0.01^a
P:S:5% WC	0.99 ±0.01^c	9.54 ±0.03^b	9.31 ±0.02^d	22.05 ±0.06^d	58.18 ±0.07^a	2.97 ±0.01^d	0.46±0.01^a	1.64 ±0.01^c
P:S:10% WC	0.21±0.02^a	8.87 ±0.01^a	9.11 ±0.01^b	20.20 ±0.02^c	61.64 ±0.02^c	0.73 ±0.01^a	1.13 ±0.01^d	0.86 ±0.01^a
P:S:15% WC	0.39 ±0.01^b	8.30±0.01^a	9.56 ±0.03^a	19.28 ±0.07^b	62.42 ±0.01^d	8.34 ±0.01^a	0.75 ±0.02^b	6.77 ±0.01^a
P:S:20% WC	1.29 ±0.01^d	8.29±0.01^a	9.25 ±0.00^c	18.26 ±0.02^a	63.28 ±0.57^a	0.24 ±0.02^b	1.23 ±0.02^a	2.75 ±0.01^d
P:S:5% CC	2.37 ±0.02^a	6.47 ±0.02^a	7.48 ±0.01^b	26.45 ±0.00^d	57.22 ±0.01^d	7.99 ±0.01^a	1.01 ±0.01^b	1.94 ±0.01^d
P:S:10% CC	1.96 ±0.02^d	8.38 ±0.01^c	7.95 ±0.06^c	25.05 ±0.01^b	56.62 ±0.00^c	2.87 ±0.02^d	3.23 ±0.01^d	1.63 ±0.01^c
P:S:15% CC	1.33 ±0.02^a	7.47 ±0.01^b	9.54 ±0.04^a	26.86 ±0.02^a	54.83 ±0.01^a	2.34 ±0.01^c	0.09 ±0.06^a	1.29 ±0.01^b
P:S:20% CC	1.58 ±0.01^b	8.46 ±0.02^d	8.84 ±0.01^d	25.98 ±0.01^c	55.17 ±0.02^b	1.11 ±0.01^a	3.13 ±0.01^c	3.82 ±0.02^a

KEY: P: S- P. angolensis: S.mombim, OPF- oil palm fibre,

PKC- palm kernel cake, RB- rice bran, WC- wheat chaff, CC- corn cobs.
Values are means of triplicates ± SD. Values in the same column carrying the same superscript are not significantly different according to Duncan's multiple range test at ($p \leq 0.05$).

Table 4: Proximate and mineral Composition of dried Pleurotus sajor caju cultivated on saw dust combinations with different supplements Levels

IV. CONCLUSION

In conclusion, it has been found that the lignocellulosic substrates examined can be successfully used for the cultivation of mushroom. This study particularly shows that *Pleurortus pulmunarus* and *Pleurortus saorcaju* grow well on nearly all of these substrate formulations and that the proximate and mineral compositions of the mushrooms were greatly influenced by the substrate used during cultivation which produced mushrooms rich in Calcium (Ca), Magnesium (Mg) and Iron (Fe) important to human nutrition and health.

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