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Yield, Biological Efficiency and Nutritional Value of *Pleurotus sajor-caju* Cultivated on Floral and Agro-waste

Agarwal S, Vaseem H, Kushwaha A, Gupta K.K, Maurya S, Chaturvedi V.K, Pathak R.K and Singh M.P*

Centre of Biotechnology, University of Allahabad, India

Abstract

The oyster mushroom, *Pleurotus sajor-caju*, was cultivated on different percentages of paddy straw and floral waste. The yield, biological efficiency and moisture content of the mushroom were found to be maximum on 100% Paddy Straw (PS). The proximate compositions of fruiting bodies of mushrooms in terms of protein, total sugar, reducing sugar, non-reducing sugar, total lipid, energy, ash, crude fber, total cholesterol and triglyceride were determined. The proximate composition ranged differently, for protein (13.76-23.63 g/100g), total sugar (40.12-47.05 g/100g), reducing sugar (6.23-11.07 g/100g), non-reducing sugar (30.74-40.58 g/100g), total lipid (3.31-8.75 g/100g), energy value (285.61-333.13 kcal/100g), ash (5.70-10.33 g/100g), crude fber (10.42-21.41 g/100g), total cholesterol (1201.04-1559 mg/dl) and total triglyceride (60.13-776.08 mg/dl).

K : *Pleurotus sajor-caju*; Agro-waste; Floral waste; Nutritional analysis

A : PS: Paddy straw; FW: Flower waste

I

Malnutrition is one of the biggest problems in India and other developing countries and people who suffer are mainly poorer, children and pregnant women. One such solution to this problem is the cultivation of mushroom. Edible mushrooms are good sources of energy. They are low in starch and lipids but rich in proteins. Due to high amount of proteins they can be used to bridge the protein malnutrition gap. Compared with vegetables they are high in protein and have a good balance of vitamins and minerals. They contain little fat and digestible carbohydrate, making them suitable for low calorie diets [1]. Mushroom proteins contain all the essential amino acids needed in the human diet and are especially rich in lysine and leucine which are lacking in most staple cereal foods [2,3] and hence making them useful for vegetarian people. *Pleurotus* species are rich source of proteins, minerals (Ca, P, Fe, K and Na) and vitamin C, B complex (thiamine, riboflavin, folic acid and niacin) [4]. They are very effective in reducing the total plasma cholesterol and triglyceride level [5] and contain high potassium to sodium ratio, which makes mushrooms an ideal food for patients suffering from hypertension and heart diseases. Mushrooms are low in total fat content and have a high proportion of polyunsaturated fatty acids (72% to 85%) relative to total fat content, mainly due to linoleic acid. The high content of linoleic acids is one of the reasons why mushrooms are considered a health food [6,3]. Mushroom cultivation has many advantages like they are easy to cultivate, has high nutritional value and they can be easily grown on different agricultural wastes like palm wastes, cotton wastes, cereal straw, sugarcane bagasse, paper wastes, plant leaves, cotton coir, etc. Mushroom mycelia (vegetative phase) are important in the ecosystem because they are able to biodegrade the substratum and therefore use the wastes of agricultural production [7].

In religious countries like India, devotees offer large amount of flowers to God, which ultimately produces an ample amount of flower waste which are then disposed to water bodies or dumped on the land to decay which causes severe environmental problems such as water, soil pollution etc. This might lead to outbreak of serve endemic diseases as the garbage attracts pests. During rainy season, the condition becomes worse with mosquitoes and files breeding on the waste. Also there is a serious issue of the leachate production from the flower waste, which ultimately if mixed with river water or well will cause health issue. So, to avoid this it is necessary to dispose these flower wastes properly or to be treated to reduce this problem. Marigold flower petals have many advantages for human beings, mainly related to their antioxidant activity. Marigold extracts are the source of lutein esters or lutein which can be used in various pharmaceutical products. These high levels of lutein concentration seem to be safe and can be associated with a low risk for developing cardiovascular diseases, several types of cancers, cataracts, etc [8].

Keeping in view, the problems of pollution and malnutrition, the cultivation of saprophytic edible mushrooms may be the only currently solution for recycling of lignocellulose organic waste that combines the production of protein rich food with the reduction of environmental pollution. The present study determines the nutritional content of the oyster mushroom, *Pleurotus sajor-caju,* of different flushes cultivated alone on paddy straw and in different percentages of paddy straw and floral wastes.

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In the present study, the oyster mushroom, *Pleurotus sajor-caju* was grown on paddy straw and in different combinations of paddy straw and floral waste - 100% paddy straw, 80% paddy straw + 20% flower waste and 60% paddy straw + 40% flower waste. The pure cultures of *P. sajor-caju* was procured from Directorate of Mushroom Research (DMR), Solan (HP), India and maintained on malt extract agar medium at temperature 25 ± 2°C and pH 6-6.5 and sub-cultured at periodic interval of three weeks.

C

The agricultural waste i.e. paddy straw was collected from different

***Corresponding author:** Singh M.P, Centre of Biotechnology, University of Allahabad- 211002 (UP), India, E-mail: mpsingh.16@gmail.com

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agricultural fields and floral waste was collected from different temples of Allahabad, the floral waste mainly contained of marigold flowers. After collection and removal of foreign particles the floral waste was spread in an open area to sundry for 20 to 30 days. After complete drying, the floral waste was autoclaved at 121°C, 15 psi for 20 minutes.

H

The paddy straw was completely dipped in water. The substrate was allowed to stay in water for overnight. After that excessive water was drained out. After draining, the paddy straw was again completely dipped in hot water (temperature 70°C to 80°C) for an hour. Then excess water was drained out.

Spawn is referred as the vegetative mycelium of the fungus, which is grown on cereal grains. Wheat grains were washed and then half boiled. After that water from wheat grains was drained out. This was followed by mixing of $CaCO_3$ and $CaSO_4$ in 3:1 ratio.

The wheat grains were now half filled in bottles and plugged by cotton. The half-filled bottles were autoclaved at the temperature 121°C and pressure 15 psi for 30 minutes then left for overnight followed by inocule p01u7v ociverwi.1(u)1s tes. icu14(p)-56letedB0CD1(i)-9(c)-5(u14(p)-56)4(lef)9(o)12(ra)19 r (temperatut.rer fletey 4(d p)12(r)13(e)-5d9(inin-5(

S. No	Substrates	Total Yield (g/bag)	Biological effciency (%)	Moisture Content (%)
1	100% PS	233.42 ± 3.37[a]	93.37 ± 1.35[a]	84.16 ± 2.11[a]
2	80% PS+20% FW	162.10 ± 4.04[b]	64.84 ± 1.62[b]	83.50 ± 1.05[a]
3	60% PS+40% FW	141.19 ± 3.20[c]	56.47 ± 1.28[c]	78.46 ± 0.88[b]

Results show mean ± SEM of 3 trials.
Values in the same column that do not share a common superscript are signifcantly different at P<0.05
(One-way ANOVA, then Duncan post hoc Comparison).

Table 1: Yield, biological effciency and moisture content of *Pleurotus sajor-caju* cultivated on different combinations of foral and agro-waste.

Substrates	Flushes	Protein (g/100g)	TS (g/100g)	RS (g/100g)	NRS (g/100g)	Lipid (g/100g)	Energy (kcal/100g)
100% PS	I[st]	13.76 ± 0.12[c]	44.27 ± 1.56[b]	11.07 ± 0.21[a]	33.19 ± 1.42[c]	8.02 ± 0.01[b]	304.35 ± 6.68[b]
80% PS+20% FW		17.76 ± 0.43[b]	45.82 ± 0.95[a]	10.68 ± 0.07[a]	35.14 ± 0.88[b]	8.75 ± 0.01[a]	333.13 ± 5.46[a]
60% PS+40% FW		22.13 ± 0.41[a]	47.05 ± 2.21[b]	8.77 ± 0.45[b]	38.28 ± 2.28[a]	5.46 ± 0.17[c]	325.88 ± 6.38[a]
100% PS	II[nd]	16.26 ± 0.19[c]	41.53 ± 0.70[a]	10.47 ± 0.38[a]	31.03 ± 0.38[a]	7.54 ± 0.09[a]	298.94 ± 3.59[a]
80% PS+20% FW		21.4 ± 0.35[b]	41.27 ± 1.63[a]	10.52 ± 0.43[a]	30.74 ± 2.04[a]	7.77 ± 0.45[a]	320.64 ± 4.26[a]
60% PS+40% FW		23.63 ± 0.58[a]	46.81 ± 2.64[a]	6.23 ± 0.11[b]	40.58 ± 2.62[a]	3.31 ± 0.07[b]	311.64 ± 9.56[a]
100% PS	III[rd]	16.3 ± 0.85	40.77 ± 0.30	9.62 ± 0.21	31.14 ± 0.21	6.40 ± 0.20	285.91 ± 6.01
80% PS+20% FW		23.16 ± 0.13	40.12 ± 0.49	8.15 ± 0.40	31.96 ± 0.27	6.57 ± 0.29	312.28 ± 4.19
100% PS	IV[th]	16.53 ± 0.27	40.76 ± 0.21	7.4 ± 0.18	33.36 ± 0.16	6.27 ± 0.27	285.61 ± 3.85

PS: Paddy Straw, FW: Flower Waste, TS: Total Sugar, RS: Reducing Sugar, NRS: Non-reducing Sugar
Results show mean ± SEM of 3 trials.
Values in the same column (in fushes) that do not share a common superscript are signifcantly different at P<0.05 (One way ANOVA then Duncan post hoc. comparison) (In III[rd] and IV[th] fush post hoc cannot be applied because only two or one groups was to be compared).

Table 2: Nutritional content of *Pleurotus sajor-caju* cultivated on different combinations of foral and agro-waste (in different fushes).

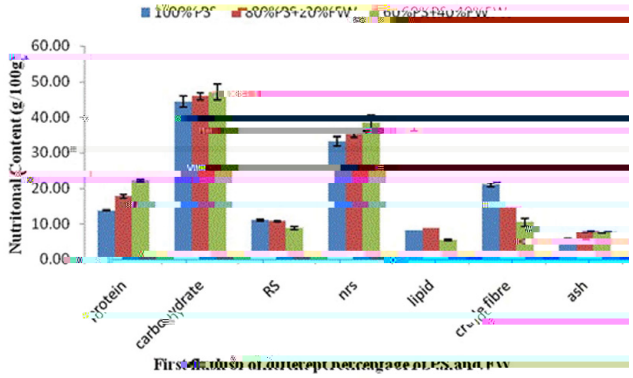

Figure 1: Protein, Total Sugar, Reducing Sugar (RS), Non-Reducing Sugar (NRS), Total Lipid, Crude M' otal Su " ₦ otal _ A m p. V M Su ŋ ' otal q fut ' ' M D M