International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2023; 11(3): 07-10

Received: 04-01-2023
Accepted: 11-02-2023

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Nutritive value of oyster mushroom (*Pleurotus eous*) grown on different substrates and their combinations

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Abstract
A study was undertaken to ascertain the effect of different substrates and their combinations on the yield of oyster mushroom (*Pleurotus eous*) at Department of Plant Pathology, College of Agriculture, Nagpur, during 2012-2013. The *Pleurotus eous* was cultivated on different agro wastes *viz*., wheat straw, paddy straw, soybean straw, tur straw alone and in different combinations. The highest carbohydrate percentage was found in fruiting bodies harvested from whet straw 50% + paddy straw 50% (42.97 per cent). The highest protein percentage was found in fruiting bodies harvested from soybean straw (35.10 per cent). Substrate soybean straw showed highest fat percentage (2.22 per cent). Reducing sugar content of *P. eous* found highest on paddy straw (2.81 per cent).

Keywords: *Pleurotus* mushroom, straw, spawn, Oyster, Pilus

Introduction
The oyster mushroom (*Pleurotus* spp.) is also called as 'dhingri' or abalone. This group got a common name 'oyster mushrooms' because of the tongue shaped pileus with an eccentric lateral stipe (Balakrishnan and Nair, 1995) [2].
Pleurotus eous was first reported from India in 1850. After that its occurrence has been recorded from Mysore on dead wood of *Ficas bengalensis*, where it was successfully grown on rice straw supplemented with horsegram powder in wooden trays. This is conspicuous species because of its bright pink sporocarp (Bahukhandi, 1990) [1].
The mushrooms are naturally grown in fields, forests, on manure_heaps, water channels and hilly areas, mostly during or just after rains (Bhatti *et al.* 2007)**.** One of the most charming point would be that mushrooms are grown on agricultural wastes. It enables us to acquire substrate materials at low prices or even for free and to conserve our environment by recycling waste. Most of all, oyster mushroom (*Pleurotus* spp.) can utilize various kinds of substrate materials than any other mushroom (Poppe 2004) [6].
Mushrooms are ideal for consumption by patients of hypertension and diabetics. Other mushrooms are known to have medicinal properties for example bracket mushroom (*Ganoderma lucidum*) has been used for disease management of patients with HIV and AIDS. Their immunodulatory and anti-tumor activities of polysaccharide – protein complex from mycelial cultures gives those valued medicinal properties (Earnshaw *et al.* 2012) [4].

Materials and Methods
Chemical used for analysis of nutritive value
The chemical used for analysis of nutritive value were BSA stock solution, sodium carbonate, NaOH solution, copper sulphate, sodium potassium tartrate, Folin-ciocalteau reagent, dinitrosalicylic acid, crystalline phenol, sodium sulphite, phenol (reagent grade), sulphuric acid, standard glucose and petroleum ether.

Equipment required for chemical analysis
Colorimeter to take the optical density for the protein analysis, Soxhlet extraction apparatus complete with allihn condenser, soxhlet extractor, round bottom short neck receiver flask for fat analysis, water bath machine for reducing sugar and carbohydrate analysis. Burette, pipette, conical flask (250 ml) were available from Department of Soil Science and Agriculture Chemistry and Department of Animal Husbandry and Dairy science, College of Agriculture, Nagpur.

Method for chemical analysis of *Pleurotus eous*

Determination of carbohydrate

Determination of carbohydrate by Phenol Sulphuric Acid Method.

Procedure

1. Weigh 100 mg of the sample into a boiling tube.
2. Hydrolyse by keeping it in a boiling water bath for three hours with 5 ml of 2.5 N HCL and cool to room temperature.
3. Neutralise it with solid sodium carbonate until the effervescence ceases.
4. Make up the volume to 100 ml and centrifuge.
5. Pipette out 0.2, 0.4, 0.6, 0.8, and 1 ml of the working standard into a series of test tubes.
6. Pipette out 0.1 and 0.2 ml of the sample solution in two separate test tubes. Make up the volume in each tube to 1 ml with water.
7. Set a blank with 1 ml of water.
8. Add 1 ml of phenol solution to each tube.
9. Add 5 ml of 96% sulphuric acid to tube and shake well.
10. After 10 min shake the contents in the tubes and place in a water bath at 25-30°C for 20 min.
11. Read the colour at 490 nm.
12. Calculate the amount of carbohydrate present in the sample solution using the standard graph.

Calculation

Absorbance corresponds to 0.1 ml of the test = x mg of glucose

100 ml of the sample solution contains

$$= \frac{x}{0.1} \times 100 \text{ mg of glucose}$$

= % of carbohydrate

3.2.5.2 Determination of protein

Protein content was determined by a Lowry's method (Lowry *et al.* 1951) [13].

Reagents

a. 2% Na2CO3 in 0.1 NaOH
b. 1% NaK Tartrate in H_2O
c. 0.5% CuSO4.5 H_2O
d. 48 ml of A, 1ml of B, 1 ml C
e. Phenol reagent - 1 part Folin-phenol [2N]: 1 part water
BSA Standard - 1 mg/ml

Procedure

1. Set up eleven sets of three test tubes in the rack.
2. Add BSA [0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 µl] to these test tubes.
3. Add 2 ml of solution D to each test tube.
4. Incubate for 10 min. at room temperature.
5. Add 0.2 ml of dilute Folin-phenol solution to each tube.
6. Vortex each tube immediately.
7. Incubate at room temperature for 30 min.
8. Determine absorbance of each sample at 600 nm.
9. Plot absorbance *vs.* mg protein to obtain standard curve.

Determination of fat

Fat were determined gravimetrically after continuous extraction of the dried sample with petroleum ether, this method is called as Soxhlet method (A.O.A.C., 7.045, 1975).

Procedure

1. Weigh 1 gm dried mushroom powder sample.
2. Prepare a small packet of sample with Whatman No.1 filter paper thimble.
3. Take weight of empty dry extraction flask.
4. Plug the bottom of thimble by putting cotton.
5. Connect the rubber tube, water tap to condenser. See that water supply the condenser is constantly flowing.
6. Put the packet of sample in thimble and pour organic solvent to 2/3 capacity of thimble. Take extraction flask containing 2/3 organic solvent.
7. Connect these extraction flask and thimble to the condenser unit with heating coil.
8. Put on heating switch and start water supply to the condenser.
9. Continue heating slowly till 6-8 siphoning collected in extraction flask.
10. Take out extraction flask from the extraction unit.
11. Evaporate excess ether.
12. Keep the flask in the oven and evaporate remaining spirit.
13. Cool to the room temperature and weigh it accurately.

Calculation

$$\text{Fat per cent} = \frac{\text{Wt. of flask after extraction - Wt. of flask before extraction}}{\text{Wt. of sample taken}} \times 100$$

Determination of reducing sugar

Reducing sugar were determined by Dinitrosalicylic acid (DNS) method (Miller G.L. 1972) [10].

Procedure

1. Weigh 100 mg of the sample and extract the sugars with hot 80% ethanol (5 ml each time)
2. Collect supernatant and evaporate it by keeping it on a water bath at 80 °C.
3. Add 100 ml water and dissolve the sugars.
4. Pipette out 0.5 to 3 ml of the extract in test tubes and equalize the volume to 3 ml with water in all the tubes.
5. Add 3 ml of DNS reagent.
6. Heat the content in boiling water bath for 5 min.
7. When the contents of the tubes are still warm, add 1 ml of 40% Rochelle salt solution.
8. Cool and read the intensity of dark red color at 510 nm.
9. Run a series of standards using glucose (0-500 µg) and plot a graph.

Results and Discussion

Nutritive value of oyster mushroom (*Pleurotus eous*)

Nutritive value of oyster mushroom (*Pleurotus eous*) on dry weight basis i.e. carbohydrate, protein, fat, reducing sugar are represented in table1. It revealed from the table, carbohydrate content of *Pleurotus eous* was highest when grown on wheat straw 50% + paddy straw 50% (42.97 per cent) followed by wheat straw i.e. (41.62 per cent) and paddy straw (41.05 percent). The lowest content of carbohydrate was obtained in

fruiting body grown on wheat straw 25% + paddy straw 25% + soybean straw 25% + tur straw 25% i.e. (34.51 per cent). The carbohydrate content in fruiting bodies on dry weight basis was obtained is ranging from 34.51 to 42.97 per cent.

Wheat straw (41.62 per cent), Paddy straw (41.05 per cent), tur straw (40.76 per cent), soybean straw (40.56 per cent) and wheat straw 50% + tur straw 50% (39.43 per cent) did not vary statistically for carbohydrate content. The similar results were reported by Patil *et al.* (2010) [5] and Yehia (2012) [12] for carbohydrate content on dry weight basis.

The protein content in fruiting bodies of mushroom presented in table. It has been reported that not only the protein content of the substrate but also nature of protein in the substrate influences the protein content of the fruiting bodies (Patil *et al.* 2010) [5].

The present results showed that the protein content of *Pleurotus eous* significantly higher when grown on soybean straw i.e. (35.10 per cent) followed by Paddy straw (31.17 per cent). The lowest protein content was obtained from fruiting bodies grown on wheat straw 25% + paddy straw 25% + soybean straw 25% + tur straw 25% i.e. (28.07 per cent). The protein content in fruiting bodies on dry weight basis was ranging from 28.07 per cent to 35.10 per cent.

The similar results were reported by Patil (2009) [11], Ingle and Ramteke (2010) [14] and Patil *et al.* (2010) [5]. Patil *et al.* (2010) [5] reported that *Pleurotus ostreatus* grown on soybean straw showed higher content of protein i.e. 24.66 per cent.

The fat content of oyster mushroom (*Pleurotus eous*) is presented in table. It revealed that the fat content of *Pleurotus eous* was higher when grown on soybean straw i.e. (2.22 per cent) followed by wheat straw i. e. (2.14 per cent) and paddy straw i.e. 2.09 per cent. The lowest fat content was obtained from fruiting bodies grown on wheat straw 50% + paddy straw 50% i.e. (1.08 per cent). The fat content in fruiting bodies ranging from 1.08 percent to 2.22 per cent.

The similar results were reported by Patil *et al.* (2010) [5] that the fat percent in dry fruiting bodies harvested from soybean straw (2.82 per cent) was higher than other substrates.

The reducing sugar content of oyster mushroom (*Pleurotus eous*) is presented in table. It revealed that the reducing sugar content of *Pleurotus eous* was higher when grown on paddy straw i.e. (2.81per cent) followed by wheat straw i.e. (2.44 per cent) and soybean straw i.e. (2.35 per cent). The lowest reducing sugar content was obtained from fruiting bodies grown on wheat straw 25% + paddy straw 25% + soybean straw 25% + tur straw 25% (1.36 per cent). The reducing sugar content in fruiting bodies ranging from 1.36 percent to 2.81 per cent.

Table 1: Effect of different substrates on nutritive content of *P. eous.*

Treatments	Carbohydrate (%)	Protein (%)	Fat (%)	Reducing sugar (%)
	Mean	Mean	Mean	Mean
T_1 - Wheat straw	41.62	30.39	2.14 (1.46)	2.44 (1.55)
T_2 - Paddy straw	41.05	31.17	2.09 (1.44)	2.81 (1.67)
T_3 - Soybean straw	40.56	35.10	2.22 (1.49)	2.35 (1.52)
T_4 - Tur straw	40.76	30.46	1.41 (1.18)	1.97 (1.39)
T_5 - Wheat straw 50% + Tur straw 50%	39.43	30.11	1.22 (1.09)	1.46 (1.20)
T_6 - Wheat straw 50% + Paddy straw 50%	42.97	29.00	1.08 (1.04)	1.99 (1.40)
T_7 - Wheat straw 50% + Soybean straw 25% + Tur straw 25%	38.12	28.81	1.22 (1.10)	1.93 (1.38)
T_8 - Wheat straw 25% + Paddy straw 25% + Soybean straw 25% + Tur straw 25%	34.51	28.07	1.15 (1.07)	1.36 (1.16)
F Test	Sig.	Sig.	Sig.	Sig.
SE ± (m)	1.57	1.15	0.04	0.07
CD at 5%	4.71	3.46	0.15	0.21

Fig. in parenthesis are square root value.

The similar results were reported by Mandhare *et al.* (2007) [8] and Mandhare *et al.* (2008) [9] that the reducing sugar percent in dry fruiting bodies of *Pleurotus eous* harvested from paddy straw was higher than wheat straw.

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