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NUTRITIONAL VALUE OF *PLEUROTUS (FLABELLATUS) DJAMOR (R-22)* CULTIVATED ON SAWDUSTS OF DIFFERENT WOODS

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Abstract

The sawdust of different woods were investigated for the cultivation of exotic strain of *Pleurotus (flabellatus) djamor (R-22)* to find out the efficiency of different nutrients including protein, fat, crude fiber, ash, dry matter and moisture. Among all type of nutrients, protein, fat, crude fiber, ash, dry matter and moisture of *Pleurotus ostreatus* on sawdust of different woods were observed. Protein was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (21.89), (21.64), (21.34), (21.16), (21.03) and (20.75) % respectively. Fat was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (0.80), (0.53), (0.41), (0.33), (0.24) and (0.11)% respectively. Crude fiber was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (8.92), (8.45), (8.17), (7.96), (7.70) and (7.32) % respectively. Ash was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (7.65), (6.75), (6.47), (6.39), (6.33) and (6.23%) respectively. Dry matter was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (6.47), (6.27), (6.13), (6.01), (5.87) and (5.67) % respectively. Moisture was observed on control treatment (cotton waste, kikar, mango, mixed sawdust, simbal and kail (84.55), (81.20), (79.85), (76.26), (74.35) and (71.14) % respectively. Oyster mushroom showed relatively more contents on control treatment cotton waste as compared to other substrates. The maximum protein, fat, crude fiber, ash, dry matter and moisture contents in *Pleurotus (flabellatus) djamor (R-22)* was obtained on Kikar sawdust .The lowest contents was obtained on kail sawdust.

Introduction

Pleurotus species, commonly known as Oyster mushrooms are edible fungi cultivated worldwide especially in south east Asia, India, Europe and Africa. The Oyster mushroom (*Pleurotus ostreatus*) is an edible mushroom having excellent flavour and taste. Mushrooms are the source of extra ordinary power and virility and are used in the preparation of many continental dishes and have medicinal properties like anticancerous, anticholesteral, antitumorous. The genus is characterized by its high protein content (30–40% on dry weight basis) (Sharma &Madan 1993). Mushrooms have been used as food and medicine in many parts of the world since time immemorial. Although mushrooms are often grouped with vegetables and fruits, they are actually fungi. They are macro-fungi which belong either to Basidiomycetes or Ascomycetes and they are very distinct from plants, animals and bacteria (Mushigeni & Chang, 2001). Bioconversion of lignocellulosic residues through cultivation of *Pleurotus* species offers the opportunity to utilize renewable resources in the production of edible, protein-rich food that will sustain food security for people in developing countries (Sanchez *et al.*, 2002). Cultivation viable processes for the bioconversion of lignocellulosic wastes (Bano *et al*., 1993; Cohen *et al*., 2002). The technology can also limit air pollution associated with burning agriculture wastes as well as to decrease rodents, pests and deleterious fungal inoculum populations of edible mushrooms. It is evidently clear that the growing interest in the cultivation of mushrooms can help in solving many problems of global importance such as protein shortage as well as improving the health and well being of people, considering that mushrooms are valuable health foods which are low in calories and provide essential minerals (Weinheim, 2006). It contains high amount of proteins, fibers, vitamins, minerals and low amount of calorie and cholesterol (Pathak *et al.*, 1998). It enables us to obtain substrate materials at low prices or even for free and to conserve our surroundings by recycling wastes(Khan *et al*., 2012) Mushrooms are useful against diabetes, ulcer and lung diseases (Quimio,1976). Mushrooms contains about (85-95)% water, (3)% protein, (4)% carbohydrates, (0.1% fats, (1)% minerals and vitamins (Tewari, 1986). It has high nutritive and medicinal value and contributes to a healthy diet because of its rich source of vitamins, minerals and proteins (Shah *et al.*, 2004). Mushrooms with their flavour, texture, nutritional value and high productivity per unit area have been identified as an excellent food source to alleviate malnutrition in developing countries (Eswaran & Ramabadran, 2000). Consequently, considering the significance of mushrooms as a rich source of protein and its role in degrading the sawdusts, this study is concerned with the assessment of appropriate sawdusts of different woods for cultivation of *Pleurotus (flabellatus) djamor (R-22)* to fulfill this gap to provide sufficient nutrients by finding nutritional status.

Material and Methods

Chemical analysis of oyster mushroom: According to the method described by (Anon., 1984). The spawn of exotic strain *Pleurotus (flabellatus) djamor (R-22)* cultivated on sawdust of Kikar, Mango, Simbal and Kail were analyzed for chemical composition. The percentage of protein, fat, fiber, ash, moisture and dry matter contents were analyzed in *P. (flabellatus) djamor (R-22).*The respective analytical procedure is briefly given below.

a. Level of protein contents in mushroom: The protein contents on sawdust of Kikar (*Acacia nilotica*), Mango (*Magnifera indica*) Simbal (*Bombax cieba*) and Kail (*Pinus wallichiana)* was calculated out by multiplying nitrogen contents of mushroom. An oven dried samples were taken for the protein determination. (2) gm of sample and (5)g (copper sulphate + potassium sulphate was taken. Then the samples were placed in the glassware by adding (30ml $H_2SO_{4)}$ and putted in the heater for digestion of the sample for (5-6) hrs. Then, (250)ml solution of each sample putted in the Soxlet apparatus, (10ml boric acid and 10 ml N_2OH) were taken in the beaker and putted under the apparatus and heated with flame. Then the color turned from pink to green.

$$\text{Protein content \%} = \frac{(N \times 14.007 \times (Vs - Vb) \times 6.25 \times 50)}{W \times 1000} \times 100$$

where
N = Normality (0.01) of standard HCl acid;
Vs = Volume of standard HCl acid used to titrate a sample;
Vb = Volume of standard HCl acid used to titrate a blank.
W = Weight (g) of dry sample used.

b. Level of crude fat in mushroom: An oven dried samples were transferred in asbestos thimble. The thimble mouth was plugged with fat free absorption cotton. The thimble was placed in the glass jacket and (150 ml) diethyl ether was taken in the receiving flask of Sox let apparatus. The apparatus was placed at (60^{o}C) by heating the assembly maintained. For about (8 hours) the extraction was continued. Then removed the thimble and solution was transferred in the beaker and allowed to evaporate under hood, the extract was completely dried in the oven at (150^{o}C) for thirty minutes. Therefore, recorded the weight of the extract after cooling the beaker in the desiccator. The extract percentage was calculated by the following formula:

$$\text{Crude fat (\%)} = \frac{\text{Weight of ether extract}}{\text{Weight of sample}} \times 100$$

c. Level of crude fiber determination: Fat free sample was taken for crude fiber determination. Two gram of sample was heated at simmering temperature (about 80^{o}C) with 200 ml sulphuric acid solution kept about half an hour. The boiling medium volume was kept constant by frequent addition of hot water. The beaker was converted in a cooling device i.e., 500 ml round bottom flask. By adding 500 ml cold water, the boiling stopped. Under vacuumed condition, the content filtered immediately. The residues were washed for five times with (100 ml) hot water and then digested. The sample was filtered until become neutral and with the help of the acetone, the residues were washed properly and then transferred to an ashing crucible. It was dried in constant weight in an oven and weigh. For ignition crucible was placed in the muffle furnace at (65^{o}C). With the help of the following formula the ash and crude fiber was calculated:

$$\text{Crude fiber (\%)} = a-(b/w) \times 100$$

where,
a = Dry weight after digestion
b = Weight of ash
w = Weighting of sample

d. Level of ash contents in mushroom: Samples of mushroom were taken from each substrate and ash contents were determined. Two gram of oven dried sample was taken in a china crucible (i.e., china crucible was cleaned and previously weighted. It was ignited on a flame and crucible was placed in a muffle furnace at (550+- 50+-)^{o}C for three hours. Afterwords,crucible was cooled in desiccator and then weighted. Then ash contents were calculated by using the following formula:

$$\text{Ash\%} = \frac{W2 - W3}{\text{Wt. of sample}} \times 100$$

where,
W1 = wt of crucible
W2 = wt of crucible + material

The total ash was determined using the furnace gravimetric method (Anon., 1995) and the weight of ash obtained in percentage as follows:

$$\text{Ash \%} \frac{A-B}{W} \times 100$$

where,
A = weight of crucible after ignition sample
B = weight of empty crucible
C = weight of sample

e. Level of moisture contents determination: The moisture contents of *Pleurotus (flabellatus) djamor R-22* cultivated on sawdust of Kikar, Mango, Simbal and Kail was calculated by using this formula:

$$\text{Moisture content (\%)} = \frac{\text{Weight of fresh sample} - \text{weight of dry sample}}{\text{Weight of fresh sample}} \times 100$$

f. Dry matter:

$$\text{D.M} = W1/W2 \times 100$$

where,
W1 = weight of the sample before drying
W2 = weight of the sample after drying

Results and Discussions: The data regarding protein, fat, crude fiber, ash, dry matter and moisture contents in *Pleurotus ostreatus* on saw dust of different woods presented in Table 1 that Protein was observed on control treatment (cotton waste) which was (21.89)% and

similarly (21.64), (21.34), (21.16), (21.03) and (20.75)% was observed on Kikar, Mango, mixed sawdust, Simbal and Kail, respectively. The maximum protein was obtained on Kikar (21.64%).The lowest protein was obtained on Kail sawdust (20.75%). Oyster mushroom showed relatively more protein contents on control treatment (cotton waste) as compared to other substrates.Fat was observed on control treatment (cotton waste) which was 0.80% and similarly (0.53), (0.41), (0.33), (0.24) and (0.11)% was observed on Kikar, Mango, mixed sawdust, Simbal and Kail respectively. Oyster mushroom showed relatively more crude fat on control treatment Cotton waste as compared to other substrates. The maximum fat was obtained on Kikar (0.53%).The lowest fat was obtained on Kail sawdust (0.11%).Crude fiber was observed on control treatment (cotton waste) which was 8.92% and similarly was observed (8.45), (8.17), (7.96), (7.70) and (7.32)% on Kikar, Mango, mixed sawdust, Simbal & Kail respectively. Oyster mushroom showed relatively more crude fiber contents in control treatment (cotton waste) as compared to other substrates. The maximum crude fiber was obtained on kikar (8.45%).The lowest Crude fiber was obtained on Kail sawdust (7.32%).Ash was observed on control treatment (cotton waste) which was (7.65)% and similarly was observed (6.75), (6.47), (6.39), (6.33) and (6.23)% on Kikar, Mango, mixed sawdust, Simbal & Kail respectively. Oyster mushroom showed relatively more ash contents in control treatment (cotton waste) as compared to other substrates. The maximum ash was obtained on Kikar (6.75%). The lowest ash was obtained in kail saw dust (6.23%). Dry matter was observed on control treatment (cotton waste) which was (6.47)% and similarly was observed (6.27), (6.13), (6.01),(5.87) and (5.67)% on Kikar, Mango, mixed sawdust, Simbal & Kail respectively. Oyster mushroom showed relatively more dry matter in control treatment Cotton waste as compared to other substrates. The maximum dry matter was obtained on Kikar (6.27%). The lowest dry matter was obtained on Kail sawdust (5.67%).Moisture was observed in control treatment (cotton waste) which was (84.55)% and similarly was observed (81.20), (79.85), (76.26), (74.35) and (71.14)% in Kikar, Mango, mixed sawdust, Simbal & Kail, respectively. Oyster mushroom showed relatively more moisture content in control treatment Cotton waste as compared to other substrates. The maximum moisture was obtained on Kikar (84.55%). The lowest moisture was obtained on Kail sawdust (71.14%). Ahmed *et al.*, (2009) determined the effect of agro waste on moisture content, crude protein, fat, crude fiber and ash content. Soybean straw showed maximum crude protein (23.50%) content and ash content (8%). Maximum moisture (92.45%) and crude fiber content (8.10%) in the fruiting bodies were recorded on Paddy straw cultivation. Molin (1996) also studied that the mushrooms are rich in protein contents.Chang & Mshigeni (2001) found that mushrooms are low in total fat content. Peter (1991) found that mushroom a food of high quality, flavor and nutrition value have high content of protein, low content of fat and high content of fibers. Dundar *et al*., (2009) reported that mushrooms were analyzed for protein, ash, fat, dietary fiber and moisture. The moisture in LFB comprised 79.90% of total weight, whereas the base, which was usually discarded, comprised 15.47%.The base was high in carbohydrate (77.33% dry weight) and low in crude protein contents (9.12%). However, SFB contained the highest amounts of ash and crude fiber (7.21 and (9.15)%, respective).protein, and their protein contents ranged from (10 to 35)% of dry weight (Anon., (1984) found that analysis for moisture, crude protein, crude fat, crude fiber and ash was performed in accordance with the official Methods of Analysis of the Association of Official Analytical Chemist from the mycelium of mushrooms. Ponurugan *et al.*, (2007) found the moisture content and dry matter in hard wood saw dust (90.13)% and (9.87)% respectively. Anon, (1995) reported that the fruiting bodies of mushrooms were collected after the first productive flow and dried in an oven at (60°C) to constant weight and kept under refrigeration at (4°C). The samples of mushrooms were analyzed for chemical composition such as, Moisture, dietary fiber and ash contents were determined.

Table 1. Level of protein, fat, crude fiber, ash, moisture contents and dry matter in *Pleurotus (flabellatus) djamor (R-22)* cultivated on sawdust of different woods.

Substrates	Protein, fat, crude fiber, ash, dry matter and moisture contents in *Pleurotus (flabellatus) djamor (R-22)*					
	Protein %	Fat %	Crude fiber %	Ash %	Dry matter %	Moisture content %
Control (Cotton waste)	21.89a	0.80a	8.92a	7.65a	6.47a	84.55a
Sawdust (Simbal) *Bombax cieba*	21.03e	0.24dc	7.70e	6.33d	5.87e	74.35d
Sawdust (Mango) (*Magnifera indica*)	21.34c	0.41b	8.17c	6.47c	6.13c	79.85b
Sawdust (Kail) (*Pinus wallichiana)*	20.75f	0.11e	7.32f	6.23e	5.67f	71.14e
Sawdust (Kikar) *Acacia nilotica*	21.64b	0.53b	8.45b	6.75b	6.27b	81.20b
Mixed sawdusts	21.16d	0.33c	7.96d	6.39d	6.01d	76.26c

Means sharing similar letter in a column are statistically non-significant (p>0.05)
Small letters represent comparison among interaction means

Conclusion

The imperative findings of this study are summarized like exotic strain of *pleurotus* spp. i.e., *Pleurotus (flabellatus) djamor (R-22)* was cultivated on sawdusts of various woods for estimation of several nutrients. Protein was observed on control treatment (cotton waste), (kikar), (mango), (mixed sawdusts), (simbal) and (kail) were (21.89), (21.64), (21.34), (21.16), (21.03) and (20.75) % correspondingly. *Pleurotus (flabellatus) djamor (R-22)*exhibited comparatively more contents on cotton waste (control treatment) as compared to additional substrates.Nevertheless, The maximum amont of protein, fat, crude fiber, ash, dry matter and moisture contents in *P. (flabellatus) djamor (R-22)* was achieved on Kikar sawdust as compared to other sawdusts of different woods.

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