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Nutritional Profile Study of Oyster Mushroom *(Pleurotus ostreatus)* at Different Storage Conditions

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Abstract

Mushrooms have been utilized as food and supplements since the dawn of mankind. They are becoming more well recognized as one of the most important food components due to their important functions in human health, nutrition, and disease. If waste is not managed, it can cause environmental concerns, but it can be beneficial if is used as a growing media supplement for oyster mushroom production. The goal of this research is to evaluate the impact of sawdust (SD), rice straw (RS), and pulverized paper (PP), as well as their mixtures, on the yield and nutritional composition of *Pleurotus ostreatus* mushrooms. The results revealed that different substrates formulas gave a significant difference in total colonization period, characteristics of fruiting bodies, yield, biological efficiency (BE), nutritional composition of *Pleurotus ostreatus* (os) mushroom. The highest length and diameter of stock, highest diameter and thickness of pileus were observed in the treatment SD+RS+ PP (3.32,1.24,7.32,0.88cm) and the lowest was observed in PP (2.1,0.89,5.73,0.71 cm). The highest time from inoculation to primordia initiation was observed in paper (47 days) and the lowest time from inoculation to primordia initiation was in the treatment rice straw (26 days). The highest average number of fruiting body/packet was observed in the treatment saw dust + rice straw + paper (23.00) and the lowest average number of fruiting body /packet was in the treatment paper (15.00). The highest biological yield obtained under treatment SD+RS+PAPER (253.41g) and the lowest biological yield obtained under paper (177.5g). The content of protein varied from 12.88-9.03% (w/w). The lowest lipid percentage obtained under treatment saw dust + rice straw (3.38%) and the highest lipid percentage obtained under saw dust (7.71 %). The highest percentage of crude fiber obtained under treatment SD+RS+PAPER (10.48%) and the lowest crude fiber percentage obtained under RS+SD (7.01%). The lowest percentage of carbohydrate obtained under treatment SD (51.82%) and the highest carbohydrate percentage obtained under SD+RS (56.63%). The lowest percentage of moisture obtained under treatment SD+RS (8.86%) and the highest moisture percentage obtained unde rRS (11.2%). The highest percentage of ash obtained under treatment SD+RS (13.5%) and the lowest ash percentage obtained under RS (9.1%). Therefore, it can be concluded that sawdust + rice straw + pulverized paper can be utilized as a better

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substrate for the cultivation of *Pleurotus ostreatus* oyster mushrooms than SD+RS in lowering costs while enhancing yield and nutritional quality.

Keywords: *Pleurotus ostreatus,* rice straw, saw dust, pulverized paper, biological yield.

Introduction

Mushrooms are non-green fungus plants that grow seasonally in a variety of settings ranging from plains to dense forests, lush meadows, and roadside walks all over the world. It is made up of a vast collection of different forms, sizes, appearances, and edibility. There are around 140,000 distinct types of mushrooms in the globe [1]. Mushrooms come in a variety of genera and species, but they all have the capacity to take nourishment from their surroundings through their cells. Some mushrooms have beneficial or parasitic relationships with other plants, feeding off of them, while others feed on and decompose dead organic matter. White mushrooms are edible, while some are toxic and dangerous; yet, all mushrooms have similar but differing descriptive qualities [2].

The soft and edible fruit bodies of numerous species of macro fungi are edible mushrooms (fungi which bear fruiting structures that are large enough to be seen with the naked eye). They can grow below ground (hypogeous) or above ground (epigeous), both of which can be harvested by hand. Edible mushrooms are a good source of nutrients and bioactive chemicals, and their tastes and culinary qualities are attracting more people. They've recently gained popularity as functional meals due to their possible health benefits [3].

Mushrooms are high in nutraceuticals, which provide antioxidant, anticancer, and antibacterial benefits. Wild mushrooms are becoming more significant in our diet due to their nutritional value, which is linked to their high protein and low fat/energy content [4]. Antioxidants can scavenge free radicals and extend shelf life by slowing the lipid peroxidation (LPO) process, and eating antioxidant-rich foods can provide a variety of physiological advantages to consumers, including protection against oxidative stress-related illnesses [5-8]. Most of the nutritional studies on mushrooms have been performed using fresh mushrooms or mushroom powder. There is scarcity of data representing comparative study on fresh and stored mushrooms. Thus, the present study had been aimed at determining the comparative nutritional profile of *P. ostreatus* at its fresh, sun dried, oven dried, blanched, freezed and refrigerated condition [9-13].

Materials and Methods

Location of the experiment

The experiment was carried out at the Mushroom Development Institute, Savar, Dhaka, Bangladesh.

Determination of Optimum Conditions for Drying Mushrooms

Fresh mushrooms were collected from Mushroom Development Institute, Savar, Dhaka, Bangladesh. The mushrooms were washed under running tap water to remove soil particles and sliced into small pieces with a knife. Then two methods were used for drying mushrooms. After drying, the dried chips were ground into coarse powders using a blender having high-capacity grinding power. Then the powder was stored in an airtight container with necessary markings for identification and kept in a cool, dark and dry place for further investigation.

Sun Drying

Mushrooms were spread on two separate porcelain trays and sun dried. The atmospheric temperature during the 7 days drying period ranged between 30°C – 33°C and relative humidity ranged from 65 – 70 percent.

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Oven Drying

Mushrooms were spread on stainless steel trays and kept in an oven at 80°C for 2 hours. The samples were removed from the oven and allowed to cool at room temperature.

Pre-Treatment and Cold Preservation

Each species needs compatible and distinctive alternative techniques for their active, pure and viable physiology in terms of colour, texture, and taste. Preservation protocols are applied accordingly. The shelf life of fresh mushrooms may be extended by refrigeration at 1-4°C. Cooling the mushrooms results in lower rates of all the physiological processes within the mushrooms. During the initial cooling there is a high cooling load. Once the mushrooms are pre-cooled, however, the cooling load is much reduced. Freshly harvested mushrooms are highly perishable as they are susceptible to deterioration by enzymes and microorganisms. It has been realized that merely producing mushrooms is of no use unless these are properly preserved, keeping in view the export objectives. Hence, following of proper processing and storage techniques is of utmost importance. Among different techniques, refrigerating and freezing with blanching are mostly utilized.

Refrigeration

Low temperature is effective for short-term preservation. Mushrooms were stored in a perforated plastic box at 4-7ºC for up to 3 days, 5 days and 7 days interval for experiment.

Freezing with Blanching

Cold-preservation of mushrooms is the most important aspect for long term preservation. Freezing was done of two sample up to 1 month and 2 months at a temperature of below -18°C. Blanching is defined as the enzyme deactivation phenomena, which helps in retaining color, reduction in initial microbial growth, cleansing the product, helps to release carotenoids, thus enhancing their bioavailability and extractability. The main purpose of blanching is to inactivate enzymes that cause browning as well as textural changes of mushroom. For blanching, mushrooms were soaked in a mixture containing water with a small amount of lemon juice. Then, mushrooms had been steamed for 4-5 minutes followed by placing the mushroom in an ice bath for the same amount of time.

Extraction Procedure

Fruiting bodies of *P. ostreatus* were dried first and then powered. The powered sample was then kept in 95% ethanol in different conical flask. 5% extraction of mushroom was done here (5gm mushroom in 100 ml ethanol). The conical flask of mushroom was kept in the shaker for two days in 40 °c. After that the solution was filtered by clothes to take the solvent portion and then again, the solvent portion was filtered through Whatman filter paper. After that the solvent is evaporated through a rotary evaporator and the solid portion is collected. From 500gm 45gm extract was collected.

Results and Discussion

Proximate composition of Sun dried and Oven dried mushrooms

The study indicated that sun dried mushrooms are quite rich in protein and lipid and low in ash, fiber and carbohydrate (Table 1). On the other hand, oven dried mushrooms are low in protein and lipid but high in carbohydrate (Table 1). This study also showed that sun dried oyster mushrooms maintain its original flavour and nutrient content.

Treatment	Moisture %	Protein %	lipid %	Ash %	Fiber %	Carbohydrate %
Sun dried	9.44	27.72	3.32	11.93	10.14	46.89
Oven dried	7.92	24.99	2.98	12.48	10.51	49.04

Table 1: Proximate composition of Sun dried and Oven dried mushrooms

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Proximate Composition of Storage Mushroom in Normal Refrigerator

The study indicated that fresh mushrooms were quite rich in protein and fiber and low in lipid content making them excellent foods that can be used in low caloric diets (Table 2). But after stored mushroom in normal refrigerator the protein, fat and fiber content gradually decreased but carbohydrate and ash content gradually increased (Table 2).

Storage	Moisture %	Protein %	Fat %	Ash %	Fiber %	Carbohydrate %
AH	87.89	28.85	3.85	10.45	13.64	43.21
S3D	8.94	27.5	2.86	11.09	12.58	45.97
S5D	9.09	26.48	2.54	12.38	12.18	46.42
S7D	9.51	24.37	2.03	12.55	10.14	50.91

AH= After Harvest, S3D= Storage 3 Days, S5D= Storage 5 Days, S7D= Storage 7 Days

Table 2: Proximate composition of storage mushroom in normal refrigerator.

Proximate Composition of Storage Mushroom in Deep Freezer with Blanching Treatment

The study showed that stored mushroom in deep freezer with proper blanching technique contain excellent amount of protein, fat and fiber content that we found in fresh mushroom after harvest is almost same (Table 3).

Storage	Moisture %	Protein %	Fat %	Ash %	Fiber %	Carbohydrate %
S1M	8.86	27.08	3.67	11.4	13.74	44.11
S2M	7.28	27.34	3.56	11.87	12.18	45.05

S1M= Storage 1 Month, S2M= Storage 2 Month

Table 3: Proximate composition of storage mushroom in deep freezer with blanching treatment.

Nutritional Analysis

Protein Content

The protein content of different stages of *P. ostreatus* mushrooms is shown in figure 1. All the stages contain a considerable amount of protein. The content of protein varied from 24.37%-28.85% (w/w) in the fresh, dry and storage mushroom. The highest content of protein was found in fresh mushroom (28.85%) and the lowest protein was found in S7D stages (24.37%). The other experiments varied significantly in different stages.

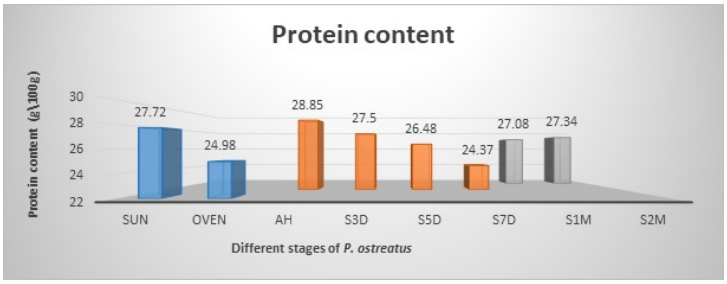

Figure 1: Protein content of different stages of *P. ostreatus*

Lipid Content

The lipid content of different stages of *P. ostreatus* mushrooms is shown in figure 2. All the stages contain a considerable amount of lipid. The content of lipid varied from 3.85%-2.03% (w/w) in the fresh, dry and storage mushroom. The highest content of lipid was found in fresh mushroom (3.85%) and the lowest lipid was found in S7D stages (2.03%). The other experiments varied significantly in different stages.

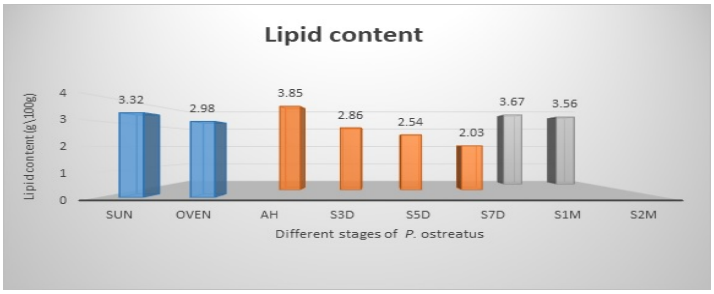

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Figure 2: Lipid content of different stages of *P. ostreatus*

Crude Fiber

The fiber content of different stages of *P. ostreatus* mushrooms is shown in figure 3. All the stages contain a considerable amount of fiber. The content of fiber varied from 13.74%-10.14% (w/w) in the fresh, dry and storage mushroom. The highest content of fiber was found in fresh mushroom after storage 1 month in deep freezer and the lowest content of fiber was found in sun dried and storage mushroom after storage 7 days in normal refrigerator. The other experiments varied slightly in different stages.

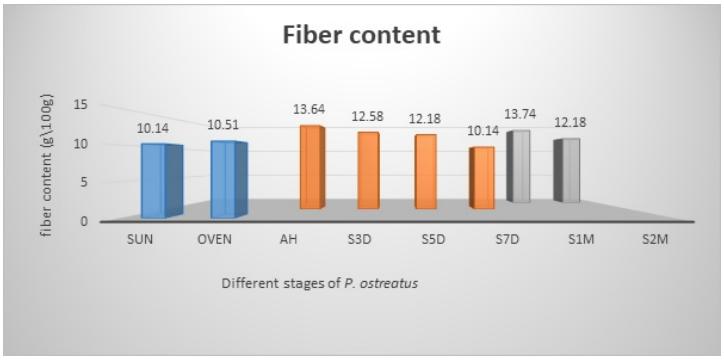

Figure 3: Fiber content of different stages of *P. ostreatus*

Ash Content

The ash content of different stages of *P. ostreatus* mushrooms is shown in figure 4. All the stages contain a considerable amount of ash. The content of ash varied from 10.45%-12.55% (w/w) in the fresh, dry and storage mushroom. The highest content of ash was found in fresh mushroom after storage 7 days in normal refrigerator and the lowest ash content was found in fresh mushroom after harvest. The rest of the experiments were statistically different but varied significantly in different stages.

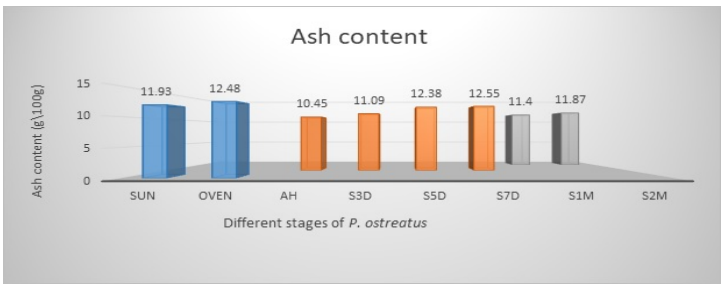

Figure 4: Ash content of different stages of *P. ostreatus*

Carbohydrate

The carbohydrate content of different stages of *P. ostreatus* mushrooms is shown in figure 5. All the stages contain a considerable amount of carbohydrate. The content of carbohydrate varied from 43.21%-50.91% (w/w) in the fresh, dry and storage mushroom The lowest percentage of carbohydrate was found in fresh mushroom after harvest (43.21%) and the highest carbohydrate percentage was found in fresh mushroom after storage 7 days in normal refrigerator (50.91%). The rest of the stages were statistically different but differed significantly in respect to percent carbohydrate content.

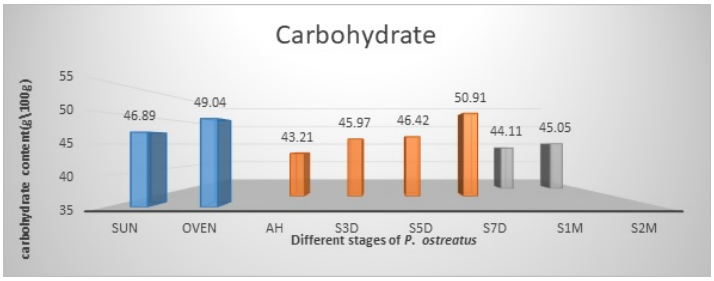

Figure 5: Carbohydrate content of different stages of *P. ostreatus*

Conclusion

In the present study, comparative nutritional profile of the oyster mushroom *(P. ostreatus)* has been studied. Between sun drying and oven drying techniques, the former had been found better in maintaining the nutritional status. Between freeze drying and refrigerating, the letter had upper hand in this aspect. Thus, finding of the current research would be of immense benefit in preserving and maintaining the nutritional status of different edible mushroom species. This knowledge would aid the mushroom growers and consumers as well as mushroom researchers globally.

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