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Proximate Analysis of Merang Mushrooms (*Volvariella volvacea*) Cultivated on Corncob and Rice Bran Media

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A B S T R A C T

Merang Mushroom (*Volvariella volvaceae*) is one of the edible mushrooms. The nutritional content of merang mushrooms makes this mushroom has potential as a medicine and food supplement. Merang mushrooms are known to function as antioxidants, antidiabetic, antiviral, and can lower cholesterol. The purpose of the research is to find out the nutritional content of merang mushrooms that are cultivated in corncob media with the addition of rice bran. The analysis used was proximate analysis to determine moisture, ash, and fiber content using the AOAC method, fat content analysis using the Soxhlet method, protein content analysis using the Kjeldahl method, and carbohydrate analysis (By difference). The results of the analysis were 2.17% ash content, 85.14% water content, 3.65% crude fiber content, 1.99% fat content, 2.7% crude protein content, and 8.0% carbohydrate content. Based on research, it can be said that mushroom has a good nutritional content that can provide health benefits.

1. Introduction

Mushrooms have long been used as medicines by our ancestors, but mushroom cultivation, both in terms of types and numbers, is still relatively small.[1] According to Suparti & Utami, based on the nature of life, mushrooms consist of edible (edible) mushrooms and non-edible mushrooms.[2] Straw mushroom (*Volvariella volvacea*) is one type of mushroom that is consumed. Straw mushrooms are widely cultivated in Indonesia because this mushroom is a type of mushroom that has a relatively short harvest time.[3] Raw materials for mushroom cultivation are easy to obtain and do not require a large area of land, so from a business perspective, mushroom cultivation is a profitable business.[2]

Mushrooms have good prospects to be developed as food diversification because the nutritional content of these mushrooms is equivalent to meat and fish.[4] According to Wahidah et al., Mushrooms have a high nutritional content such as carbohydrates, fats, proteins, and vitamins, as well as several minerals such as potassium, calcium, and phosphorus.[5] The protein content of mushrooms is higher than that of fruits and vegetables. Mushrooms are a potential source of vitamins and minerals.[6] more, according to Suparti & Noris that the content of edible mushrooms per 100 grams contains 6.9 grams of carbohydrates, 3.8 mg of protein, 6 grams of fat, 0.17 vitamin B2, 94 mg of calcium, 3 mg of phosphorus, and essential amino acids such as lysine, leucine, isoleucine, and valine.[7]

The nutritional content contained in the mushroom makes this mushroom has the potential as a medicine and a food supplement.[1] Mushrooms are known to

function as antioxidants and lower cholesterol.[8] In addition, the bioactive content in this fungus can function as antidiabetic, antimicrobial, and antiviral.[1] Mushrooms also contain bioactive compounds such as ergosterol (provitamin D), phenolic acids, amino acids ergostianin, and lovastatin, which function to improve health.[9]

So far, edible mushrooms have been cultivated by utilizing lignocellulosic waste. This is because the lignocellulosic decomposition process produces lignin, hemicellulose cellulose, and protein which are nutrients needed for mycelia growth and fungal body development.[10] Lignocellulosic waste that is often used for mushroom cultivation is rice straw. However, currently, the amount of rice straw is decreasing, so an alternative is needed other than rice straw. Agricultural waste that can be used as an alternative medium for fungal growth is corn stalks. According to Silva et al., Corn stalks after harvest contains cellulose as much as 40-44%, hemicellulose as 31-33%, and lignin as 3-5%.[11] This content is a requirement for fungal growth media. Citing previous research, Elawati & Dewi use corncobs as a medium for growing cob mushrooms, or edible mushrooms[3], as well as Sari et al. also utilize corn waste as a medium for growing cob mushrooms.[12]

In addition to using corncob waste, you can also add rice bran as a medium for mushroom growth. Rice bran is rice milling waste that still contains a lot of fat, protein, carbohydrates, vitamins, and minerals.[13] The addition of rice bran to the mushroom growing media sawdust rubberwood turned out to affect the appearance of the mycelium, the number of mushroom fruit bodies, and the wet weight of the fruit body but did not affect the diameter of the mushroom cap.[14] Naim mentioned that rice bran could be used as a growth medium for enzyme-producing fungi, such as *Rhizopus sp, Aspergillus niger,* and *Mucor sp.*[15] In addition, research by Widiani et al. states that the use of rice bran as a medium for fungal growth is based on the nutritional needs of microorganisms.[13]

The availability of abundant corn cobs and rice bran, but its utilization is still lacking, making this waste potential as a raw material for edible mushroom growth media because it has high growth criteria, and the lignocellulose content is still quite high compared to other agricultural wastes. Therefore, it is necessary to research the potential of corn cobs and rice bran as a medium for growing mushrooms based on the nutritional content of straw mushrooms.

2. Methods

This study uses equipment including glassware, wooden boards, knives, baking sheets, ovens, furnaces, and analytical balances. The materials used were mushrooms obtained from the Mak'e Agrofarm mushroom cultivation site located in Sukorejo village, Pekalongan Regency, corn cobs, rice bran, urea, tape yeast, Methylene blue, HCl, alcohol, NaOH, H_2SO_4, Methylene red, and PP indicator.

The mushroom growing media was made from wooden planks measuring 1 m x 4 m. The planting medium was made by mixing 5 kg of corn cobs, 4 kg of rice bran, and 10 g of tape yeast. Then covered with PP plastic and incubated for 30 days.

Proximate analysis was carried out through several stages, namely determining ash content, determining water content, fiber content, fat content, protein content, and carbohydrate content. Determination of the total ash content was determined by heating the pre-dried sample in a muffle furnace at 500°C for 4 hours. The percentage of ash content is calculated according to the Association of Official Analytical Chemists (AOAC).[16]

Determination of water content was determined using porcelain dishes that were dried for 60 minutes in an oven at a temperature of 105ºC. Then the cup is cooled and put in a desiccator for 15 minutes. Then the results are weighed. The 5-gram sample was placed in a cup and then in the oven for 5 hours at 105ºC and then weighed. The cup containing the extracted sample was cooled in a desiccator and then re-weighed. The water content value is calculated according to the AOAC.[16]

Determination of fiber content by weighing and inserting the sample into an Erlenmeyer, followed by

the addition of 200 ml of HCl. The solution was heated in a water bath at 90˚C for 2 hours. The results were then filtered and washed, then 200 ml of NaOH solution was added and reheated for 2 hours. The solution was then filtered and washed thoroughly with hot water, alcohol, and ether, followed by drying at 105ºC for 1 hour and continued until the weight was constant. Fiber content was determined by the AOAC formula.

Analysis of fat content using the Soxhlet method. The sample was weighed as much as 5 grams and then extracted with n-hexane using Soxhlet for 5 hours. The evaporation process of the extraction results is carried out. Then dry using an oven at a temperature of 105ºC for 15 minutes. The cooled sample was then placed in a desiccator and weighed until it reached a constant weight.

Analysis of protein content was carried out by the Kjeldahl method. Erlenmeyer flask was filled with 0.1 grams of sample, 1 gram of catalyst, 2.5 ml of concentrated H_2SO_4, and 5 boiling stones. The solution was shaken until homogeneous to produce a clear solution and then cooled. Next, add 15 ml of 50% NaOH into the distillation apparatus. Then put into the Erlenmeyer flask 0.02 N HCl as much as 25 ml and 2-4 drops of Mensel indicator (a mixture of 0.02% methylene red in alcohol and 0.02% methylene blue in alcohol (2:1). The distillation process is carried out until the volume is reduced. The solution reached twice the initial volume. Rinse with distilled water was carried out on the end of the condenser, which was submerged in HCl and accommodated with Erlenmeyer. The color change to purple would occur after the solution was titrated with 0.02 N NaOH. Then the blank was determined.[17] Carbohydrate content (%) is determined by adding up the results of water, ash, fat, and protein content and then subtracting 100.

3. Results and Discussion

This study used edible mushrooms grown on corncob media with the addition of rice bran. Corn cobs are known to contain lignin which can be used by fungi as a source of nutrition. Fungi convert food sources through the composting process. This composting aims to activate the thermophilic microflora, namely bacteria and fungi, that will degrade lignin, cellulose, and hemicellulose, making it easier for fungi to digest.[5] During the composting process, the media feels hot. This heat comes from thermophilic bacteria that work to kill competing organisms that are detrimental to fungal growth.[18]

The addition of rice bran serves as a coenzyme in the activation of lignocellulose-degrading enzymes. Rice bran contains thiamine which has the same function as a coenzyme. The protein in bran can accelerate the spread of fungal mycelium. This raw material is used because, at the research site, there is abundant agricultural waste, but it has not been widely used.[19] Mushrooms were harvested after 30 days of incubation. Then the proximate analysis was carried out. The results of the proximate analysis of edible mushrooms cultivated on a corncob and rice bran media are presented in Table 1.

Table 1. Results of the proximate mushroom analysis.

Parameters	Analysis results
Ash content	2.17%
Water content	85.14%
Fiber content	3.65%
Fat level	1.99%
Protein content	2.70%
Carbohydrate levels	8.00%

The results of the proximate analysis on straw mushrooms showed that the mushroom was rich in protein, fat, and carbohydrates. This is following research Okoro that mushrooms have high nutritional content and have the potential for industrial applications. The value of protein, fiber, and

mushrooms is reported to have a greater content than legumes.[20]

Table 1 shows that the water content obtained is 85.14%. The high moisture content of the mushroom indicates that the mushroom is very easily damaged.[20] The high water content causes the fungus to be susceptible to microbial growth and enzyme activity[17], so more attention is needed in handling and cultivating it. In addition, the moisture content of mushrooms depends on the time of harvest and environmental conditions such as humidity and temperature during growth and storage conditions.[20] The results of the straw mushroom moisture content in this study were lower than the research Khotimah & Popang is 89.52%.[21]

The ash content obtained is 2.17%, indicating that the mushrooms contain several important minerals that are useful for the body. The ash content obtained was lower than that reported by Khotimah & Popang, which is 2.51%.[21]

The main compounds of mushrooms are protein and carbohydrates. It was reported that the protein content of mushrooms was influenced by several factors, namely the type of fungus, stage of development, the part sampled, nitrogen availability, and planting location.[20] Protein content was determined by the Kjeldahl method, to determine the amount of nitrogen (N) contained in a sample. Mushrooms are a good source of protein. According to Wahidah et al., states that every 1 gram of mushroom sample contains 0.0268 protein.[5] Turfan et al., mention that in mushrooms there are free amino acids that are useful for medicine.[23] The results of the proximate analysis showed that the protein content of straw mushrooms was 2.7% higher than the previous study conducted by Khotimah & Popang, namely 1.34%, and research Wahidah et al., 1.6%.[21,5]

Carbohydrate levels obtained indicate that mushrooms are a good source of energy supply. Mushroom carbohydrates belong to the group of glucans, monosaccharides, disaccharides, sugar alcohols, glycogen, and chitin.[20] The results of the proximate analysis showed that the carbohydrate content was 8.0%. The carbohydrates produced are quite high, this indicates that the mushroom can be used as a good source of energy. The carbohydrate proximate analysis of edible mushrooms cultivated on corn cobs and rice bran showed better results than those grown on oil palm waste as carried out by Wahidah et al., which is 7.0%.[5]

The role of fat in the body is as a store of energy and processes in the body to regulate temperature, assist digestion, and absorption of food and nutrients. Mushrooms generally contain low fat, so mushrooms are used as a good source of dietary supplements for someone who has a history of heart and fat disorders.[24] The results of the study of the fat value in straw mushrooms were 1.99%. The amount of fat content in the edible mushroom obtained was higher than that reported by Khotimah & Popang is 1.95%.[21]

The fiber content obtained is higher than in the study Khotimah & Popang.[21] The fiber in mushrooms is considered a good source of dietary fiber which can be used as an additional supplement for foods that are lacking in fiber, so mushrooms are used as an immune stimulant and help the digestive process[24], which can lower blood glucose.[25] Fiber can also lower blood cholesterol. This was reported by Damayanty et al. that the fiber contained in straw mushrooms, namely polysaccharide-glucan can reduce blood cholesterol levels.[8]

The nutritional content of the edible mushroom studied is greater than the literature. This is because the growing media used also greatly affects the cultivation of edible mushrooms. This is following the statement of Suparti et al. that the growth of edible mushrooms is influenced by the medium for growing the fungus.[4] It is known that corn cobs contain 42.4% cellulose, 21.7% lignin, and 29.6% hemicellulose.[26] These components are a good medium for fungal growth. Besides that, the addition of rice bran serves as a source of carbohydrates, the addition of lime aims to neutralize the media, while the addition of urea aims to increase the nitrogen (N) content in the growing media.[5]

Rice bran is known to contain 17% lignin, 35% cellulose, and 25% hemicellulose, these contents affect the growth of mushroom weight and protein content in the mushroom body. Several previous studies have found that the protein content in mushroom fruiting bodies depends on the chemical composition and C/N ratio of the substrate, as well as the species of mushroom cultivated.[27] The composition of the proximate content in mushrooms can be different. This is influenced by the type of species, the type of substrate, atmospheric conditions, the age of growth, and the part of the productive organs of the fungus. Regardless of the growing conditions, mushrooms remain a prospective source of nutrients.[25]

The utilization of agricultural waste for mushroom cultivation has a positive impact on the environment both in real terms, namely being able to reduce environmental pollution in the form of ammonia production and unpleasant odors through the composting process carried out by Merang mushrooms.

4. Conclusion

Based on the results of the proximate analysis, edible mushroom cultivated on corncob media with the addition of rice bran is very good for consumption. The nutritional content of mushrooms has the potential to maintain health. It is known that mushroom ash content is 2.17%, water is 85.14%, fiber is 3.65%, fat is 1.99%, protein is 2.7%, and carbohydrates are 8.0%.

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