UNIVERSITI PUTRA MALAYSIA

THE POTENTIAL USE OF SPENT MUSHROOM WASTE FROM *Pleurotus ostreatus* CULTIVATION AS RUMINANT FEED

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Serdang, Selangor

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By

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A Project Report Submitted to Faculty of Agriculture, Universiti Putra Malaysia, In Partial Fullfillment of the Requirement of SHW 4999 (Project) for the Award of the Degree of Bachelor of Agriculture (Animal Science)

Department of Animal Science

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CERTIFICATION

The project report attached here entitled:

The potential use of spent mushroom waste from (*Pleurotus ostreatus)* mushroom as ruminant feed

And submitted by **Amirul Hakim Bin Shaharul Badri**

In partial fulfillment of the requirement of SHW 4999 (project) for the award of the degree of

Bachelor of Agriculture (Animal Science) is hereby accepted.

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LIST OF ABBREVIATION

DM	Dry Matter
NDF	Neutral Detergent Fiber
ADF	Acid Detergent Fiber
ADL	Acid Detergent Lignin
CP	Crude Protein
TMR	Total Mixed Ration
OMMM	Oyster Mushroom Mycelia Mass
OMSS	Oyster Mushroom Spent Substrate
SMW	Spent Mushroom Waste
SMC	Spent Mushroom Compost
SMS	Spent Mushroom Substrate

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TITLE: THE POTENTIAL USE OF SPENT MUSHROOM WASTE FROM *Pleurotus ostreatus* CULTIVATION AS RUMINANT FEED

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KEYWORDS: SPENT MUSHROOM COMPOST, *Pleurotus ostreatus*, NUTRIENT COMPOSITION, DIGESTIBILITY, GROWTH PERFORMANCE

ABSTRACT

Spent mushroom compost (SMC), otherwise known as spent mushroom substrate (SMS), or spent mushroom compost (SMW), is the leftover after different flushes of growing and cropping mushroom. Oyster mushroom (*Pleurotus ostreatus*) is a white, gray-brown or ivory coloured mushroom which resembles oyster shell. This study was conducted in Universiti Putra Malaysia to evaluate the nutrient composition and digestibility of ensiled guinea grass treated with spent mushroom waste in goats. The main objective of this study is to determine the dry matter intake of the feed, nutrient digestibility, and daily weight gain of the goats. A total of 4 adult crossbred Kacang goats were allocated in each pen and given 4 dietary treatments which were 0% spent mushroom waste as a control (T1), 5% spent

mushroom waste (T2), 10% spent mushroom waste (T3), and 15% spent mushroom waste (T4). They were given 10 days adjustment period followed by 7 days collection period. Feed intake and feces were weighed during 7 days of collection. Samples of feed, and feces were analyzed for dry matter, ash, crude protein, NDF, ADF, and ADL. All data on nutrient composition, digestibility, and daily weight gain were subjected to one way analysis of variance with SAS version 9.3. No significant difference ($P > 0.05$) in dry matter intake of the goats with every dietary treatment given. There was no significant difference ($P > 0.05$) in nutrient digestibility of the feces and feed. But, there is a significant difference ($P < 0.05$) in ADL digestibility. The ADL digestibility increase from 5.966% in T1 to 9.905 in T3 and decrease to 8.753% in T4. There is no significant difference ($P > 0.05$) in weekly gain of goats in each treatment. These findings could be due to animal's preference for forages over ensiled guinea grass treated with spent mushroom waste, and feed may had strong ammonia odor. It can be concluded that there is no significant different in giving spent mushroom waste in feed intake, digestibility, and weight gain of the animals. Further study is required to increase the digestibility and palatability of the sawdust-based spent mushroom waste.

TAJUK: POTENSI PENGGUNAAN BAHAN BUANGAN CENDAWAN DARI *Pleurotus ostreatus* SEBAGAI MAKANAN RUMINAN

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KATA KUNCI: bahan buangan cendawan, *Pleurotus ostreatus,* komposisi nutrien, penghadaman, prestasi tumbesaran

ABSTRAK

Bahan buangan cendawan, atau dikenali sebagai bahan substrat cendawan, adalah sisa selepas hasil penuaian cendawan. Cendawan Tiram *(Pleurotus ostreatus)* berwarna putih, kelabu-coklat atau mempunyai warna menyerupai tiram. Kajian ini dijalankan di Universiti Putra Malaysia untuk menilai komposisi nutrien dan penghadaman rumput guinea peram dirawat dengan sisa cendawan oleh kambing. Objektif utama kajian ini adalah untuk menentukan pengambilan bahan kering makanan oleh haiwan, pencernaan nutrien dan pertambahan berat badan mingguan kambing.Sebanyak 4 kambing Kacang dewasa telah digunakan dalam setiap sangkar dan diberikan 4 rawatan pemakanan iaitu 0% sisa cendawan sebagai kawalan (T1), 5% sisa cendawan (T2), 10% sisa (T3), dan 15% (T4). Kambing-kambing diberikan 10 hari tempoh penyesuaian diikuti dengan 7 hari tempoh

penggumpulan sampel. Pengambilan makanan dan najis telah ditimbang dalam 7 hari tempoh penggumpulan sampel tersebut. Sampel makanan, dan najis dianalisis untuk bahan kering, abu, protein kasar, serat detergen neutral;, serat detergen asid, dan asid detergen lignin. Semua data mengenai komposisi nutrien, penghadaman, dan kenaikan berat badan mingguan adalah melalui cara analisis varians satu arah dengan SAS versi 9.3. Tiada perbezaan yang signifikan (P> 0.05) dalam pengambilan bahan kering kambing dengan setiap rawatan pemakanan yang telah diberikan.Tiada perbezaan yang signifikan (P> 0.05) dalam penghadaman nutrien daripada najis dan makanan. Tetapi, terdapat perbezaan yang signifikan (P <0.05) dalam penghadaman asid detergen lignin. Penghadaman asid detergen lignin meningkat daripada 5,966% dalam T1 kepada 9,905 dalam T3 dan menurun kepada 8,753% dalam T4. Tiada perbezaan yang signifikan (P> 0.05) dalam kenaikan berat badan mingguan kambing dalam setiap rawatan. Penemuan ini mungkin disebabkan oleh kebergantungan haiwan terhadap foraj lebih daripada rumput gajah yg diperam dengan sisa cendawan, dan makanan mungkin mempunyai bau ammonia yang kuat. Kesimpulannya, tiada perbezaan yang signifikan dalam memberi sisa cendawan dalam pengambilan makanan, penghadaman, dan pertambahan berat badan haiwan. Kajian lanjut diperlukan untuk meningkatkan penghadaman dan penerimaan sisa cendawan berasaskan habuk papan terhadap ruminant.

CHAPTER 1

INTRODUCTION

Spent mushroom waste (SMW), otherwise known as spent mushroom substrate (SMS), or spent mushroom compost (SMC), is the leftover after different flushes of growing and cropping of mushrooms. About 5kg of SMW are produced for each 1kg of mushroom. This mass of SMW will become an increasing problem and disposal of the large volumes of material produced on a sizeable farm can present considerable environmental concerns. Some of these wastes include sawdust, banana leaves, peanut hull, corn leaves, rice and wheat straw, paper wastes, horse manure, and various other wastes. The widely used substrate for cultivating of mushroom in Asia is rice straw base, while in South East Asian countries sawdust is more common. Therefore, recycling of SMW as animal feeds may benefit the farmers as well as having a resource recycling effect.

Oyster mushroom (*Pleurotus ostreatus*) is cultivated by two different methods, a straw-based compost culture and a sawdust-based plastic bottle culture system. Spent straw compost could be directly fed to the ruminant animal or reprocessed by fermenting the compost supplemented with corn meal, soybean meal and wheat bran using *Aspergillus sp.* and yeast to improve the nutritional value, especially the crude

protein level (Zhang et al., 1995; Adamovic et al., 1998). However, the sawdust-based SMW was hard to recycle due to the low nutritional value and short storage time. There is limited information regarding the nutritive value and utilization of spent mushroom compost in animal nutrition.

Crop residues are characterized by low protein and high fibre content and limit their nutritive value for ruminants. Nitrogen (N) supplementation increase digestibility and intake. Crop residues usually consist of the above ground part of plant. Due to the prevalence and intensity of agriculture in most part of Asia, crop residues represent a high proportion of total feed of herbivores. However, they are not all well utilized as energy at present, since their digestibility is often low. They are partly resisting rumen microbial action so their digestion is far from complete. Due to their rigid structure and poor palatability, intake of crop residue is low. These constraints are mostly related to their specific cell wall structure and chemical composition.

Feed is the single largest cost associated with raising ruminants, typically accounting for 60% or more of total production costs. The utilization of agricultural wastes may only offer a partial solution. Some waste have definite value for ruminants but require a better form of processing if they are to become suitable products for use in prepared feedstuffs for pigs and poultry. The processing naturally increases costs, rendering them less competitive with other materials of the same nutritive values. The ruminant industry offers better scope to usage of these agricultural waste products.

While much progress has been made in this field there is still room for much improvement. Huge amounts of crop residues particularly spent mushroom waste are

under utilize due to the fact insufficient nourishment can be extracted from them. Treatment with urea as a source of ammonia has been very successful in some countries, where this technology is particularly useful for small farmers. For large scale treatment anhydrous ammonia has been equally successful.

Upgrading crop residues using microbial fermentation need to be further studied. If successful and if this can be accomplished with low organic matter loss then this is a very cheap process for improvement of the nutritive value of crop residues.

We can enrich the nutritive value of crop residue by ensilaging. Silage is a wet form of preservative. When crop residue is ensiled, it will increase the soluble sugar content thus increasing the energy content of the feed. Increase in soluble sugar content is due to the fermentation of carbohydrate in the crop residue. There is an increase in crude protein after ensiling but the dry matter will be reduced. Low dry matter content is a result of ensiling process where the crop is preserved in a wet environment. Preserving crop or grass into silage will also increase intake of the ruminants due to the high palatability of the products. Making silage is a feasible technology and also cost effective. Crop residue including spent mushroom waste has high lignin content. Plant cell wall material is composed of three important constituent: cellulose, hemicelluloses, and lignin. Lignin constituents. Lignin in plant cell walls is physically and chemically associated with wall polysaccharides and proteins.

When feed is eaten by animal, the ruminal microbial populations attack, degrade and ferment structural carbohydrates in forage cell walls and thereby provide volatile fatty acids and protein to the host animal (Gabriella *et al*., 1997). However, when

animal consume lignin feed like crop residue, the rumen microbial is unable to penetrate the cell wall due to lignin chemically tight bond. The strong linkage between lignin and polysaccharides or proteins would definitely prevent cell wall components from enzymatic hydrolysis by ruminal microorganisms, and thus limit the digestion of cell walls. This will cause the nutrient inside, unable to be use efficiently and nutrient in the feed will just be wasted in the feces. To increase the feed nutrient efficiency by rumen microbial, we need to find a solution to decrease or degrade lignin compound in the crop residue. The nutrient is in the crop residue so it is up to us to use the best method so that the nutrient can be utilized more efficiently.

1.1 Objectives

The general objective of this study was to evaluate the effects of spent mushroom waste supplement in animal trials in Kacang goat.

The specific objectives of this experiment:

I. To determine the dry matter intake of goats fed on spent *Pleurotus ostreatus* mushroom waste.
II. To determine the nutrient digestibility of spent *Pleurotus ostreatus* mushroom waste in goat.
III. To evaluate the daily weight gain of the Kacang goat.

1.2 Hypothesis

The spent *Pleurotus ostreatus* mushroom wastes can potentially used as ruminant feed.

1.3 Significant of study

The spent mushroom wastes are able to increase the digestibility and dry matter intake of the goats. Also reduce the disposal problem environment pollution.

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