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The Effect of Fermented Corn Cobs by Adding Different Sources of Carbohydrates on The Content of Dry Matter, Organic Matter, and Crude Protein as Ruminant Feeding

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ABSTRACT

This study aims to determine the effect of the fermentation of corn cobs using the *Panarochaeta Chrisosporium* white coating fungus with the addition of a different source of carbohydrates to the content of dry matter, organic matter, and crude protein. This study used a completely random design. Consists of 4 treatments and four replications in each treatment. The need in this study was a dose of carbohydrate source different from the use of inoculum of white fungus (*Panarochaeta chrisosporium*) 7%. P0 = corn cob + without carbohydrate, P1 = corn cob + 10%rice bran, P2 = corn cob + tapioca flour 10%, P3 = corn cob + 10%molasses. The parameters measured in this study are the content of dry matter, organic matter, and crude protein. The results showed no different effects (P> 0.05) on the content of dry matter, and the effects were highly significant (p <0.01) on the content of organic material and crude protein content. From the results of the study, it can be concluded that the effect of fermented corn cob is the best on the content of organic material and crude protein with the addition of carbohydrate sources using tapioca flour.

Keynote: corn cob, *P. chrisosperium*, carbohydrate source

INTRODUCTION

Feed is one of the determinants of the success of the livestock business, which is very influential on livestock productivity. Ruminant livestock are very dependent on forage feed. Forage productivity is very fluctuating, abundant in the rainy season, and shortcomings occur during the dry season. Efforts need to be made to find potential feed ingredients both in terms of quality and quantity, the feed ingredients used with the requirements for not competing as food, and sufficient nutritional content for principal life, growth, and production. One of the provisions of ruminant feed is the use of agricultural, plantation, and agro-industry by-products. The side products of crops that are quite abundant but are still rarely used as animal feed ingredients are corn cobs (Yulistiani, 2010). Corn cobs are waste that is obtained when corn seeds are shed from the fruit. Piping corn will be obtained

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as its main product and the rest of the fruit is called Tuna (Rohaeni et al., 2006). Corn cobs are agricultural waste that is quite a lot available and has very potential to be developed as ruminant feed when the grass supply is reduced. However, this by-product has not been utilized optimally as a feed. The nutritional content of corn cobs consists of 90.0%dry material, 2.8%crude protein, 0.7% crude fat, 1.5% ash, 32.7% crude fiber, 80%cell walls, lignin 6.0% and ADF 32% (Murni et al, 2008). Corn production in West Sumatra Province in 2017 was 6.93 tons/ha. Corn production in Solok City/Regency in 2017 was 5.24 tons/Ha Solok City and 10.12 tons/Ha Solok Regency (BPS West Sumatra 2018). The low content of crude protein and the presence of lignin and silica causes the digestibility of corn cobs to be low and consumption by limited livestock. So it is necessary to find technology that can increase the value of nutrition and digestibility. One of the alternative technologies for utilizing corn cobs as raw material for animal feed is by turning them into quality products, namely through fermentation technology. Research Ariyanti (2015) fermentation of corn cobs with 5% Trichoderma sp. Reducing the content of organic matter and increasing crude protein. Whereas the research of Imsya et al (2014) which fermented palm fronds using *P. chrysosporium* for 10 days can increase 13.93% of dry matter, 10.98% organic matter content, and increase crude protein content from 5.28% to 12, 39%. *P. chrysosporium* is a white-coating fungus from the basidiomycetes class that can degrade lignin and its derivative compounds effectively by producing extracellular peroxidase enzymes in the form of lignin peroxidase (lip) and peroxidase manganese (MNP) (Soilman et al, 2000). The fermentation process can run well if adequate dissolved carbohydrates are available. Rice bran, tapioca flour, and molasses are fermented media used in this study as a source of food for bacteria during the fermentation process. Giving 10 % rice bran in oil palm coating fermentation using *Aspergillus niger* can increase the crude protein content in all treatments. Fine bran can increase the value of dry material digestibility and the digestibility of organic matter as an indicator of feed quality (Wajizah et al, 2015).

The use of tapioca flour carbohydrate sources has a significant effect on the color, odor, and pH of sugar cane shoots (Jamarun et al, 2014).

Based on the description above, research on the use of fermented corn cobs using white coating mushrooms. The purpose of this study was to determine the effect of fermented corn cobs by adding different sources of carbohydrates to the content of dry materials, organic matter, and crude protein.

MATERIALS AND METHODS

This study uses a completely random design . Consists of 4 treatments and each treatment is repeated 4 times. Where acting as managing is a different source of carbohydrates from the inoculum of the white coating fungi (*Panarochaeta chrisosperium*) 7%, which is more detailed as follows:

P0 = corn cob + without carbohydrates
P1 = corn cob + 10% rice bran
P2 = corn cob + tapioca flour 10%
P3 = corn cob + molasses 10%

The parameters measured in this study are:
a) The content of dry matter
b) The content of organic matter
c) The content of crude protein

Fermentation process

1. Rejuvenation of mushrooms, (a) weighing Potato Dextro Agar (PDA) produced by Merck as much as 6 grams; (b) Mix with MNSO4 150 ml; (c) Insert in a test tube then close tightly with cotton and let stand until thickened and sterilize the tool for scratching in autoclaved; (d) Perform scratching on PDA with sterile OC needles and add mushroom seeds; (e) Stored for 7 days.
2. Preparation of mushroom inoculum that is grown in Potato Dextro Agar (PDA). Meanwhile, it is used up a 20 gr bran media, 80 gr corn cob 60 ml of distilled water, and 4 ml of minerals, then put into a plastic bag and sterilized for 30 minutes in the autoclave (1210C: 1 atm). To complement the nutritional elements needed by mushrooms, a mixture of 6 ml (Brook et al., 1969) is used. Then fermented for 7 days.
3. Corn cobs that will be used for finely cut fermentation and weighed each treatment 100 gr.
4. Considering the inoculum of the white coating mushroom (Panarochaeta chrisosperium) 7% of the weight of the

corn cob treatment (100 gr) is as many as 7 gr/treatment.

5. Weigh rice bran, tapioca flour, and molasses as a source of carbohydrates as much as 10% of the weight of corn cobs/treatment (100 gr), 10 gr/treatment, and then sterilize with an autoclave.
6. Corn cobs that have been chopped finely, then put into a small basket, covered with plastic bags and mixed with carbohydrate sources according to the treatment and added inoculum of white coating mushrooms (*Panarochaeta chrisosperium*) 15 gr / the next treatment is stirred until evenly distributed.
7. After being tied with a rubber piece and stored in a storage site that is protected from sunlight and rain for 14 days.
8. After 14 days, the plastic bag is opened, and then aerated, and physical testing can be done. After that, it is ground into flour to do a laboratory test.

RESULTS AND DISCUSSION

The Effect of Fermentation of Corn Cobs with the addition of different sources of carbohydrates on the content of dry ingredients, organic matter, and crude protein. The average content of dry matter, organic matter, and crude protein Corn cobs Fermented with adding by Different sources of carbohydrates can be seen in Table 1.

The results of Statistical analysis show the average content has no effect (P> 0.05) on dry matter of fermentation corn cobs with the addition of different carbohydrate sources. This is caused by the source of carbohydrates given to fermented corn cobs making *P. Chrysosporium* mushrooms have almost the same growth in every treatment. According to Imsya (2014), changes in the content of dry matter can occur due to changes in the amount of mold biomass in the substrate, the process of decomposition, and changes in water content during fermentation. Based on Table 1, the highest average of the dry matter in the treatment of corn cobs fermentation using tapioca flour (P2 = 89.17%) and the lowest in the treatment without carbohydrate administration (P0 = 83.70%). Although the results of this study showed different effects, when compared to each treatment there was an increase. Observations in the fermentation of corn

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cobs using *P. Chrysosporium* mushrooms with the addition of carbohydrate sources for 14 days, there was more white mycelium growth in the treatment of fermented corn cobs using tapioca flour carbohydrate sources. Research of Astuti et al (2017) Fermentation of oil palm fronds with the addition of carbohydrate sources increases the content of dry ingredients because tapioca flour is included in starch which has the absorption of water so the content of dry ingredients is higher.

Table 1. The average content of dry matter, organic matter, and crude protein of fermented corn cobs with Addition of Different Carbohydrate Sources (%).

Treatments	dry matter	organic matter	crude protein
P0	83,71	97,33[a]	9,34[a]
P1	88,87	94,45[b]	9,76[a]
P2	89,17	97,73[a]	9,58[a]
P3	87,94	97,88[a]	8,01[b]

Note: superscripts (a, b, c) in the same column shows the effects of significantly different (p <0, 05).
P0 = No carbohydrates,
P1=Rice bran,
P2= Tapioca flour,
P3= Molasses

The fermentation process can also result in a decrease in the amount of dry matter. Data in Table 1, visible dry matter content in the addition of carbohydrate sources of molasses (P3 = 87.935%) is thought to be due to increased water content and overhaul of corn cob components by molds that produce metabolites in the form of water components during substrate hydrolysis. Gervais et al. (2008) state changes in dry matter can occur due to fungal growth and changes in water content. Changes in water content occur due to substrate hydrolysis or metabolic water production. During fermentation, microorganisms use carbohydrates from the substrate as an energy source and produce water molecules and CO2.

The average organic matter of fermented corn cobs with the addition of carbohydrate sources was obtained sequentially from the highest, namely P3 = 97.88; P2 = 97.73; P0 = 97.33; P1 = 94.45. Based on the analysis of the variety, it can be seen that the treatment of fermentation of corn cobs on the content of organic matter shows a very significant effect ($p < 0.01$). This is caused by the content of different sources of carbohydrates to produce different organic matter content. The content of organic matter is also associated with the availability of dissolved carbohydrate content which is an organic component derived from free extract nitrogen. After further tests, DMRT shows the fermentation of corn cobs with the addition of sources of carbohydrates of rice bran (P1 = 94.45%) has a significantly lower organic matter content than other treatments. This is caused by the fermentation of corn cobs with the addition of rice bran (P2 = 94.45%) to make organic material overhauled by the enzyme to meet the energy needs for the growth of *P. Chrysosporium* mushrooms, as a result, changes in the composition of the material. This is in accordance with the opinion of Rahman (1992) that organic material is a source of nutrition for molds and its use is greatly influenced by the ability of metabolism and the solubility of the nutritional material. The content of organic matter in the treatment of P2 (tapioca flour) and P3 (molasses) has increased this is caused by tapioca flour and molasses which are high dissolved carbohydrates causing an increase in mold activity. Based on the U.S. Department of Agriculture, the content of tapioca flour carbohydrate sources is 86.9 gr/100 gr and molasses 75 gr/100 gr, while rice bran is slightly lower at 66 gr/100 gr. The DNMRT test without carbohydrates is not different from tapioca flour and molasses caused by the growth of *P. Chrysosporium* mushrooms which are almost the same, so the organic matter content is also the same. This is supported by Wilkinson (1998) that the fermentation process which is the activity of microorganisms, results in changes that affect nutritional value, namely carbohydrates are converted into alcohol, organic acids, water, and carbon dioxide. In line with the opinion of Ensminger and Olentine (1999) who state that the fermentation process has something to do with the resulting fermented heat. This is caused by the presence of microbial activity that utilizes the constituent of the content of organic matter in the fermentation process, resulting in changes that affect nutrition. This result is not much different from the results of Ariyanti's research (2006) which the content of organic matter in the fermentation of corn cobs using Trichoderma sp ranges from 96.72 to 98.32 %. Based on the results of the statistical analysis show that the treatment of fermentation of corn cobs with the addition of different carbohydrate sources shows a highly significant effect ($p < 0.01$) on the crude protein content of corn cob fermentation. This is caused by different nutritional content in the source of carbohydrates given, resulting in an increase in the mold's biomass in the fermentation for 14 days. According to Nelson and Suparjo (2011), the secretion of the Extracellular enzyme by the *P. Chrysosporium* fungus also plays a role in increasing the protein content of the biomass of the fermented substrate.

After the DNMRT test, the crude protein content in the P3 treatment is lower than the treatment of P0, P1, and P2. This is caused by the fermentation of corn cobs with the addition of molasses carbohydrate sources that are suspected because the nut *P. Chrysosporium* is starting to use fermented substrate protein for its growth, but is not balanced by the protein by mold to the ingredients. Winarno and

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Fardiaz (1989) states that the process of fermentation of feed ingredients by microorganisms can improve the quality of feed ingredients and their digestive power. Fermentation products usually have a higher nutritional value than the original material due to the enzymes produced by the microbes themselves. The highest crude protein content is shown in the addition of rice bran. This is caused by a pretty good crude protein content of rice bran (9.76%), in addition to being rich in vitamins and minerals needed by microorganisms to grow optimally and move in microbial protein synthesis (Luh, 1991). The success of the fermentation process is determined by the ability and ability of microbes to adapt to the substrate to be used for the nutritional growth and development of microbes (Zakaria et al., 2013). Mushroom cell walls contain 6.3% protein, while cell membranes in fungi that have hyphae contain 25-45% protein and 25-30% carbohydrates. In line with Wilkinson (1998) states that the fermentation process is the activity of microorganisms that cause changes, thus affecting nutritional value, namely carbohydrates converted into alcohol, organic acids, water, and carbon dioxide. The increase in crude protein content in rice bran is suspected during the fermentation process that takes place in the fungus *P. Chrysosporium* can produce lipoprotein enzymes which increase the crude protein content of corn cobs. In addition to carbon mushrooms, *P. Chrysosporium* also requires nitrogen for its growth, but because one component of P. chrysosporium mushroom itself is in the form of protein, proportionally the protein content in the substrate continues to increase. This result is higher than the results of research conducted by Ariyanti (2016) The content of crude protein in the fermented corn cobs using *Trichoderma sp*. ranges from 2.99 to 6.07%.

CONCLUSION

From the results of the study, it can be concluded that the effect of fermentation of corn cobs with the addition of different sources of carbohydrates has a different effect (P> 0.05) on the content of dry matter and has a highly significant effect (p <0.01) on the content of organic matter and The content of crude protein.

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REFERENCES

Ariyanti YD. (2015. The Content of organic matter and Crude Protein in the Corn Cob (Zea mays) Inoculated with Fungi *Trichoderma sp* at Different Incubation Time. Skripsi. Fakultas Peternakan Universitas Hasanuddin. Makassar

Astuti, T, M. N. Rofiq dan Nurhaita. 2017. Evaluasi Kandungan Bahan Kering, Bahan Organik Dan Protein Kasar Pelepah Sawit Fermentasi Dengan Penambahan Sumber Karbohidrat. Jurnal Peternakan Vol 14 No 2 (42–47).

Badan Pusat Statistika. 2018. Luas Panen dan Produksi Tanaman Jagung Menurut Kabupaten/Kota di Sumatera Barat.

Ensminger. M. E. and C.E. Olentine. 1999. Feed and Nutrision Complete. Ensminger Publishing Company California. USA.

Gervais P. 2008. Water Relations in Solid State Fermentation.In:Pandey A, C. R.Soccol, C. Larroche, Editor. Current Developments in Solid State Fermentation. Asiatech Publisher Inc. New Delhi.

Imsya A, E.B. Laconi, K.G. Wiryawan, dan Y. Widyastuti. 2014. Biodegradasi Lignoselulosa dengan Phanerochaete chrysosporium terhadap Perubahan Nilai Gizi Pelepah Sawit. Jurnal Peternakan Sriwijaya Vol. 3, No.2, Desember 2014, pp. 12-19

Jamarun N, I. Ryanto dan L. Sanda.2014.Pengaruh Penggunaan BerbagaiBahan Sumber Karbohidrat terhadap Kualitas Silase Pucuk Tebu. Jurnal Peternakan Indonesia

Murni, R., Suparjo, Akmal dan B.L. Ginting. 2008. Buku Ajar. Teknologi Pemanfaatan Limbah untuk Pakan. Laboratorium Makanan Ternak Fakultas Peternakan Universitas Jambi. Jambi.

Nelson dan Suparjo, 2011. Penentuan Lama Fermentasi Kulit Buah Kakao dengan Phanerochaete Chrysosporium: Evaluasi Kualitas Nutrisi Secara Kimiawi Agrinak. Vol. 01 No :1-10

Rahman, A., 1992. Teknologi Fermentasi Industrial. Penerbit Arcan. Jakarta

Rohaeni, E. S., Subhan dan A. Darmawan. 2006. Kajian penggunaan pakan Lengkap dengan memanfaatkan janggel jagung terhadap pertumbuhan sapi. Pros. Lokakarya nasional jejaring pengembangan sistem integrasi jagung Sapi. Pontianak, 9-10 Agustus 2006. Puslitbang Peternakan, Bogor. Hlm.185-192.

Soilman, H, Hamza AS, Shinnawy El MM. 2000. Effect of incubation Periods with White Rot Fungi on The nutritional value of Corn Stalkss. http://www.actahort.org/books/608.

Wajizah S, Samadi, Yunasri U, dan Elmy M. 2015. The evaluation of nutritive value and In Vitro digestibility of oil palm fronds through fermentation by using Aspergillus niger with different soluble carbohydrate sources. Agripet Vol 15 No 1. Pp 13-19.

Wilkinson. J. M. 1998. The Feed Value of By Product and Wastes In Feed Science. Edited Ab 2 9 SB. Scotland.

Winarno, F.G., S. Fardiaz dan D. Fardiaz, 1989. Pengantar Teknologi Pangan. Gramedia Pustaka Utama, Jakarta

Yulistiani, D. 2010. Fermentasi Tongkol Jagung (Kecernaan>50%) dalam Ransum Komplit Domba Komposit Sumatera dengan Laju Pertumbuhan >125 gram/hari. Balai Penelitian Ternak, Bogor.

Zakaria. Y., C. I. Novita dan Samadi. 2013. Efektivitas fermentasi dengan sumber substrat yang berbeda terhadap kualitas jerami padi. Agripet. 13(1): 22-25