Evaluation Additional of Synbiotic Powder in Feed to Improve Milk Production and Quality of Dairy Cattle

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Abstract. Lignochlitic bacteria have a high ability to degrade complex and synthetic organic compounds. Lignochrolitic bacteria-based probiotics can improve gas production, digestibility of organic matter, efficiency of microbial protein synthesis, production of NH3 and VFA *in vitro*. The purpose of the study is the optimization and testing of the synbiotic potential of lignochloritic bacteria–based powder *in vivo*. The research was conducted in collaboration with PT. Agro Gemilang Indonesia for synbiotic production, PT. Milkindo Berkah Abadi for *in vivo* test in dairy cows. The test variables include nutritional performance, production and quality of dairy cow's milk given synbiotic powder to the feed. The synbiotic formula used is the best result on *in vitro* testing.

Keywords: Friesian holstein, increase production, *in vivo*, lignochloritic bacteria, waste utilization

1 Introduction

Ruminant feed is generally agricultural waste whose quality is very limited so as to reduce digestibility and supply of nutrients for livestock [1]. Agricultural waste feed that is commonly consumed by ruminants, especially beef cattle, is rice straw [2, 3]. Rice straw is a biomass that is chemically rich in lignocellulose compounds. According to Guan *et al.* [3] and Goodman [5] the largest components constituting rice straw are cellulose (35 % to 50 %), hemicellulose (20 % to 35 %) and lignin (10 % to 25 %) and other substances. Lignin will limit the digestibility of cellulose and hemicellulose to energy and lower the digestibility of other nutrients will be the energy used to digest lignin [6]. The silica (SiO_2) present in rice straw exists in crystalline, amorphous, and silica gel forms [7]. Ruminant

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feed from waste is also low in protein and minerals, thereby reducing productivity and livestock health.

The results of previous studies obtained the administration of lignochloritic probiotics based on *Cytophaga* sp. bacteria with M1 mineral carrier media and rice straw lignocellulose substrates showed high fermentation activity both *in vitro* and *in vivo* which was shown by an increase in feed consumption and digestibility [8]. Productivity and health of livestock increase with an increase in the level of probiotic administration. Cows show an optimal level of health and are more resistant to infection with diseases of both bacterial and fungal diseases [9]. The results of previous studies have shown that during the biodegradation process, twelve kinds of different active compounds will be produced at different fermentation times.

One of the active compounds produced is a triterpenoid from the terpenoid group which contains compounds to suppress the growth of pathogenic bacteria and fungi that interfere with the health of livestock. The results of previous studies found that livestock productivity and health increased with an increase in the level of probiotic administration. Cattle show an optimal level of health and are more resistant to infection with diseases of both bacterial and fungal diseases [9].

Probiotics that have been produced and produced from previous research are in liquid form for application to drinking water and feed for fermentation. The production process of liquid probiotics is easier and faster because bacteria as starters are easy to grow on liquid nutrient media. However, the constraints on the application for commercial feed mixing where it is very difficult to provide homogeneous mixtures and balanced cell probiotic compositions in solid feed mixtures. So, it will affect the quality of the feed mixture for livestock. For this reason, it is necessary to conduct research if probiotics in the formulation in the form of powder or flour with carrier media are prebiotic ingredients that can be a source of nutrition for probiotics and rumen microbes so that it is expected to increase feed digestibility and nutrient availability to increase productivity and health of dairy cows.

1.1 Research purposes

The purpose of the study was to determine the potential of synbiotic powder in nutritional performance, production and quality of dairy cow's milk and optimization of the use of synbiotic powder based on lignochloritic bacteria.

1.2 Research benefits

First, knowing the benefits of synbiotic powder on the performance of production, nutrition, and quality of dairy cow's milk. Second, optimization of the use of synbiotic powder based on lignochloritic bacteria in dairy cows.

2 Research materials and methods

2.1 Time and place

Further research on synbiotic powder phase III is a synbiotic powder test on ruminants, namely dairy cows during the lactation period. This research will be carried out from March to October 2021, the experimental location is located at CV. Milkindo Berka Abadi, Kol street. Kusno. No. 77, Tegalsari, Kepanjen, Malang Regency, East Java, Indonesia. Laboratory analysis of milk quality is carried out in the CV laboratory Milkindo.

2.2 Research materials

The material used in this study was synbiotic powder based on lignochloritic bacteria which it is known that the isolate is bacterium *Lysinibacillus fusiformis* BIP-211 [10], Friesian Holstein dairy cows totaling 16 heads who were lactating to four with a body weight of + 400 kg and elephant grass forage feed and concentrate feed as used by the company.

2.3 Observed variables

The variables observed are feed consumption and efficiency, milk production and milk quality (physical, chemical and biological).

2.4 Research methods

The data analysis method used is to use quantitative descriptive analysis. The analysis used is to describe the research with the existing literature. The treatments used in this study are:
P0 : Synbiotic 0 % (Control)
P1 : Synbiotic 0.025 %
P2 : Synbiotic 0.0 5 %
P3 : Synbiotic 0.1 %
Each treatment consists of four tests with a complete random design of 4 × 4.

2.4.1 Cows preparation

The preparation of cows carried out is cow weighing, grouping cows based on the lactation period and providing cow identity.

2.4.2 Ration treatment

The feed ingredients used are in the form of feed rations that are used daily. The concentrate was given the addition of synbiotic powder based on lignochloritic bacteria. The available feed ingredients will be weighed according to the formulation of the treatment ration. Forage feed is given more so that the remaining value can be calculated.

2.4.3 Adaptation period

The adaptation period of cows to the treatment ration and the environment of the stall is carried out for 18 d before data collection is carried out. Data collection is carried out for 10 d after going through the adaptation period.

2.4.4 Cage preparation and research layout

Cage preparation includes the cleaning of the cage, the preparation of feed bins and drinking places, as well as the creation of an experimental layout. Stall preparation is carried out by cleaning individual pens that will be used for research, thereby reducing the chances of accidents in cows during the study. The cages used are located not far from each other. Individual cages were prepared for 16 heads and marked with treatment for each experimental unit.

2.5 Data retrieval

The data collection stage was carried out for 28 d including the collection of feed residues and milk production. Data is taken every day and feed is given twice every day, namely in the morning at 08.00 West Indonesia Time (*Waktu Indonesia Barat* - WIB) and in the afternoon at 16.00 WIB. The provision of drinking water is given ad libitum. The data obtained was then analyzed descriptively based on the average of the replicates of each treatment.

3 Results and discussion

3.1 Feed consumption, feed efficiency and milk production

The average feed consumption value, feed efficiency and the amount of milk production can be seen in the Table 1.

Table. 1. Average number of feed consumption, feed efficiency and milk production.

Treatment	Feed consumption (kg cow^{-1} d^{-1})	Feed efficiency (% cow^{-1} d^{-1})	Milk production (L cow^{-1} d^{-1})
P0	12.04	47.78	6.23
P1	12.55	52.35	6.96
P2	13.13	69.85	9.73
P3	12.52	62.51	8.86

The table above shows that the average feed consumption is different from treatment to treatment. In addition, it can be seen that the P2 treatment of 0.05 % synbiotic administration gives the appearance of higher feed consumption when compared to other treatments. This shows that synbiotic administration in feed increases feed digestibility better where lignochloritic bacteria can degrade lignin in the rumen so as to increase the digestibility of dry matter of feed. This is in accordance with the opinion of Purwanti *et al.* [11] that probiotics can cause the digestive process to increase and the digesta rate to be faster thereby increasing the consumption of dry matter. The activity of lignochloritic bacteria in the rumen will accelerate lignin degradation so that it will also accelerate the digestive process in the rumen of dairy cows. With the increase in the process of digestion of nutrients in the rumen, the process of nutrient absorption will also increase, causing the rumen to quickly experience emptiness so that livestock will easily get hungry and increase their feed consumption [8].

Table 1 showed that the P2 treatment with 0.05 % synbiotic administration showed a higher feed efficiency appearance than other treatments. The results showed that the P0 and P1 treatments had low efficiency values while those for P2 and P3 had better efficiency values. This is thought to be influenced by the concentration of treatment. The higher the value of synbiotic administration, the efficiency value will also increase. This is influenced by the activity of lignochloritic bacteria given. Lignoclitic bacteria will increase digestibility so that it will have an impact with increasing existing feed and nutrients. So that the supply of nutrients will be able to be used by livestock for milk production so that production will increase and the efficiency value will also increase.

Milk yield values in Table 1 it can be seen that P2 is the data with the highest average milk yield compared to other treatments. Probiotics given to dairy cows can improve nutrition for livestock and can degrade residues from feed, and are expected to increase milk production [12]. According to Xu *et al.* [13] the possibility of high production is influenced by probiotics because microorganisms can increase milk production of dairy cows, judging from one of the highest treatments in milk production, this indicates that probiotics have a high intensity in milk production.

3.2 Nutritional content of milk

3.2.1 Solid Non Fat (SNF), fat content, protein, and lactose content

SNF content, fat content, protein and lactose levels in milk from the study can be seen in the Table 2.

Table. 2. Average SNF content, fat content, protein, and lactose content.

Treatment	Solid non fat (%)	Fat (%)	Protein (%)	Lactose (%)
P0	8.92	7.84	3.05	4.59
P1	10.00	7.89	2.91	4.37
P2	5.80	8.20	2.86	4.31
P3	8.96	8.01	2.92	4.23

In Table 2 shows that the average value of Solid Non Fat (SNF) P2 content is lower than other treatments, which is directly proportional to milk production. Solid Non Fat (SNF) dairy cow's milk can decrease influenced by several factors, namely the method of giving the quality and quantity of feed, changes in seasons, lactation periods and milking methods. Lignochloritic bacteria have the ability to degrade lignin in the rumen and also accelerate the digestive process in the livestock rumen thus the absorption of nutrients increases and causes the rumen to empty quickly [8]. Livestock is also easily hungry and consumption rates increase. So, that milk production increases, which causes the quality of fats, especially fats, Solid Non Fat (SNF) and Total Solid (TS) to decrease. The results of the study on milk production showed the highest production at P1 and corresponding to the lowest SNF at P2.

In Table 2 above it can be seen the difference in milk fat content, all samples in this study have met the SNI standard of at least 3 % with the highest fat content in P2. According to Wang *et al*. [14] the provision of forage and concentrates will differentiate acetic acid and propionic in the rumen. The forage given will affect the fat content of milk, while the concentrate will increase the propionate in the rumen so as to make milk production increase, by providing the right balance of forage and concentrates to livestock, namely 70 : 30. According to Razzaghi *et al.* [15] the fat content in milk produced by mother cows that are given forage with a higher balance than concentrates produces higher fat content, compared to a balance of more concentrates. Feeding dairy cows makes the fat content in milk can increase what if dairy cows consume a lot of forage, on the contrary, what if dairy cows consume a lot of concentrates will result in milk fat levels decreasing.

Based on the average milk protein content data in Table 2, the protein content is relatively equal between 2.8 % to 3 %. This shows that cow's milk protein is in the normal range of numbers. The milk protein value is higher than the quality requirement of fresh milk based on National Standardization (*Standar Nasional Indonesia* – SNI) 3141.1:2011 [16] which is at least 2.8 %. The giving lignochloritic bacteria probiotics has no effect on protein levels, because giving lignochloritic bacteria probiotics is not able to improve the quality of protein levels due to giving too little amount of probiotics, so it is not able to increase digestibility in the rumen.

Based on Table 2, the results of the average analysis showed that the treatment of giving synbiotic powder based on lignochloritic bacteria did not provide an increase but decreased the lactose value of milk, because the addition of these bacteria did not help the activity of enzymes for the glucose formation process. According to Wang *et al.* [14] argues that when the ration energy in the form of carbohydrates and fats is insufficient, then part of the amino acids will be converted into glucose through the process of gluconeogenesis. Feed protein also plays a role in the formation of the lactose synthetase enzyme used in the formation of milk lactose.

3.3 Physical and biological quality of milk

3.3.1 Freezing point, reductase test and number of bacteria

The following describes the results of the physical and biological quality tests of dairy cow's milk found in Table 3.

Table 3. Average freezing point value, reductase test and content of bacteria.

Treatment	Freezing point (°C)	Reductase test (h)	Content of bacteria (10^6 mL^{-1})
P0	–0.57	8 to 9	0.69
P1	–0.54	> 9	0.55
P2	–0.48	> 9	0.55
P3	–0.60	> 9	0.59

From Table 3 above, it can be seen that the P3 treatment of 0.1 % synbiotic administration gives the appearance of a higher freezing point value when compared to other treatments. This shows that synbiotic feeding in feed increases the quality value of milk, because lignochloritic bacteria can degrade lignin in the rumen so as to increase the quality value in dairy cow's milk. The freezing point value of milk is influenced by the components of nutrient substances such as protein, fat, lactose, vitamins and minerals.

Based on the average data, the test of giving synbiotic powder based on lignochloritic bacteria still has no significant impact on the results of the reductase and microorganism tests on milk because the average results are relatively the same between P0 to P3. There is a relationship between the number of bacteria in milk and the speed of reduction. The change in blue color to white color is caused by the ability of bacteria in the milk to grow and use dissolved oxygen, causing a decrease in the reduction cyclide force of the mixture. As a result, metylen blue will be reduced to a white color. The faster the time (< 2 h) needed to neutralize the color of the biriu, the worse the microbiological quality of fresh milk will be [17].

4 Conclusions and suggestions

The results of the study can be concluded that the addition of synbiotic powder to feed can increase milk production of dairy cows, nutritional content and quality of dairy cow's milk. Giving synbiotic powder based on lignocloritic bacteria can be given to dairy cows with a level of 0.05 % of the weight can increase production optimization, namely increasing feed efficiency and milk production of dairy cows.

Thank you to Dwi Cahyo, Suhita Candra Wardana, Anisa Febri Ariyana1, Fitrotihi Islamiyah Putri, and Imas Diah Herawati for support this research.

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