International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Feed Digestibility Contained Fermented Goroho Banana Skin (*Musa acuminafe, sp*) in Layer

Sri Suryaningsih Djunu[1], Siti Chuzaemi[2], Irfan H. Djunaidi[2], M. Halim Natsir[2]
[1]Students of the Faculty of Animal Husbandry University of Brawijaya, Malang 65145, Indonesia
[2]Lecturer Faculty of Animal Husbandry Brawijaya University, Malang 65145, Indonesia

Abstract— *The aim of the study was to determine the dry matter digestibility (BK), crude protein digestibility (PK) and crude fiber digestibility (SK) of alternative feed ingredients of Goroho banana peel fermented by Rhizopus Oligosphorus and Trichoderma Viride as feed ingredients for layer. The research method was a field experiment, using 35 discarded Brown Leghorn layer aged 2 years and 3 months. Experimental feed consisted of basal feed about 29% layer concentrate, 55% corn and 16% rice bran and fermented Goroho banana peel feed (KPGF) consisting of 7 treatments with 5 replications, such as: P0: 100% basal feed (control); P1: Baseline feed 90% + 10% KPGF Rhizopus oligosphorus 0.3%, incubation 48 hours; P2: Basal feed 90% + 10% KPGF Trichoderma viride 0.3%, incubation 120 hours; P3: Basal feed 90% + 10% KPGF Rhizopus oligosphorus 0.15%, 48 hours incubation followed by Trichoderma viride 0.15%, 120 hours incubation; P4: Basal feed 90% + 10% KPGF Trichoderma viride 0.15%, incubation 120 hours followed by Rhizopus oligosphorus 0.15%, incubation 48 hours; P5: 90% basal diet + 10% KPGF Rhizopus oligosphorus 0.15% + Trichoderma viride 0.15%, 120 hours incubation and P6: 90% basal feed + 10% maize. Data were analyzed using a completely randomized design (CRD), if there was a significant difference tested with Duncan's multiple spacing. The results showed that the dry matter digestibility, crude protein digestibility and crude fiber digestibility of Goroho banana peels using the Rhizopus oligosphorus fermentation method 0.15% + Trichoderma viride 0.15%, incubated 120 hours (P5) in layer produced the best value.*

Keywords— *Feed, fermented, goroho banana skin, layer.*

I. INTRODUCTION

Layers are chickens that are very efficient in producing eggs, and have great potential to be cultivated because they are easy to maintain, fast produce and eggs production were most liked by the community. In terms of productivity, layer need adequate and quality feed, so far, in fulfilling the need for quality feed, farmers use commercial feed, one of the main raw materials is corn. Corn is an energy source of feed, a source of fatty acids and a source of beta carotene (pro vitamin A), in the corn ration used up to 50%.

Commercial feed is relatively expensive, corn as the main raw material is limited in availability because it competes with human food needs and is still imported from abroad, so it is necessary to find alternative feed ingredients that have the same energy content as corn, are available throughout the year and are of good quality. One of the alternative feed ingredients as an energy source, which is a banana plant waste with good nutritional content, is Goroho banana peel (*Musa acuminafe sp*). The nutritional content of Goroho banana peel consists of protein 6.4, fat 4.72, crude fiber 17.29, extract material without nitrogen: 55.75, beta-carotene: 0.61% and energy 5290 kcal/kg (Djunu et al., 2020).

The use of banana peels as layer feed has a problem was the high crude fiber content. Layers in their digestive tract are not able to digest feed ingredients that are high in crude fiber, so that they are used as feed ingredients in limited quantities. To overcome this, it is necessary to give treatment, one of which is by fermentation. Fermentation can use *Rhizopus oligosphorus* and *Trichoderma viride*. The fungus *Rhizopus oligosphorus* can produce protease enzymes that can increase the protein value of the fermented material. *Trichoderma viride* mold can produce cellulase enzymes that can degrade cellulose so that it can reduce the value of crude fiber. The method of using different types of molds with different incubation times during fermentation resulted in different nutritional values and digestibility of feed ingredients. Optimizing the use of fermented Goroho banana peel as an alternative feed ingredient for layer needs to be evaluated for the digestibility value of the feed ingredients, on this basis it is necessary to conduct research. The purpose of this study was to evaluate the value of dry matter digestibility, crude protein digestibility and crude fiber digestibility of Goroho banana peel fermented feed ingredients *Rhizopus oligosphorus* and *Trichoderma viride* as feed ingredients for layer.

II. METHOD AND MATERIAL

The method used was a field experiment, using 35 discarded Brown Leghorn layer aged 2 years and 3 months. The experimental feed consisted of basal feed, it was about 29% layer concentrate, 55% corn and 16% rice bran and fermented Goroho banana peel feed (KPGF). The dry matter digestibility (BK), crude protein digestibility (PK) and crude fiber digestibility (SK) tests were carried out using the total excreta collection method. The experimental feed was composed of 7 types of feed treatment consisting of 5 layers for each treatment. Experimental feed were: (1). P0: 100% basal feed, (2). P1: 90% basal feed plus 10% Goroho banana peel fermented *Rhizopus oligosphorus* 0.3%, 48 hours, (3). P2: 90% basal feed plus 10% Goroho banana peel fermented *Trichoderma viride* 0.3%, 120 hours, (4). P3: 90% basal feed plus 10% Goroho banana peel fermented *Rhizopus oligosphorus* 0.15%, 48 hours and continued with 0.15% *Trichoderma viride* fermentation, 120 hours (5). P4: 90% basal feed plus 10% Goroho banana peel fermented *Trichoderma viride* 0.15%, 120 hours and continued with 0.15% *Rhizopus oligosphorus* fermentation, 48 hours, (6). P5: 90% basal diet plus 10% Goroho banana peel fermented *Rhizopus oligosphorus* 0.15% plus *Trichoderma viride* 0.15%, 120 hours, and (7). P6: 90% basal feed plus 10% maize. The

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construction, composition and nutritional content of the treatment feed are shown in Tables 1 and 2.

TABLE 1. Nutrient content of experimental feed ingredients

Food Ingredients	BK (%)	PK (%)	EM (kkal/kg)	SK (%)	LK (%)	Ca (%)	P (%)
Basalt Feed (P0)	87,61	17,91	2902,20	5,48	4,97	3,49	0,67
KPGF 1st treatment (P1)	87,81	16,85	2898,58	6,55	5,05	3,27	0,64
KPGF 2nd treatment (P2)	87,71	16,92	2902,78	6,40	5,17	3,25	0,63
KPGF 3rd treatment (P3)	87,87	17,02	2912,88	6,34	5,28	3,27	0,64
KPGF 4th treatment (P4)	87,71	16,93	2902,78	6,40	5,17	3,25	0,63
KPGF 5th treatment (P5)	88,02	17,20	2931,88	6,17	5,45	3,24	0,64
Corn Feed (P6)	87,16	17,19	2812,30	4,32	7,49	3,33	0,71

TABLE 2. Feed composition and nutritional content of experimental feed.

Food Ingredients	P0	P1	P2	P3	P4	P5	P6
Basalt Feed (P0) (%)	100	90	90	90	90	90	90
KPGF 1st treatment (P1)	-	10	-	-	-	-	-
KPGF 2nd treatment (P2)	-	-	10	-	-	-	-
KPGF 3rd treatment (P3)	-	-	-	10	-	-	-
KPGF 4th treatment (P4)	-	-	-	-	10	-	-
KPGF 5th treatment (P5)	-	-	-	-	-	10	-
Corn Feed (P6)	-	-	-	-	-	-	10
Total	100	100	100	100	100	100	100

Nutritional Content	P0	P1	P2	P3	P4	P5	P6
EM (Kkal/kg)*	2902,20	2898,58	2902,78	2912,88	2902,78	2931,88	2771,90
BK (%)	87,61	87,81	87,71	87,87	87,71	88,02	87,16
PK (%)	17,91	16,85	16,93	17,02	16,93	17,20	16,96
SK (%)	5,48	6,55	6,40	6,34	6,40	6,17	4,27
LK (%)	4,97	5,05	5,17	5,28	5,17	5,45	8,23
Ca (%)	3,49	3,27	3,25	3,27	3,25	3,24	3,29
P (%)	0.67	0,64	0,63	0,64	0,63	0,64	0,81

* EM was calculated by Balton's formula (Sibbald, 1987). EM: 40.81 (0.87(crude protein+2.25 crude fat + BETN)+2.5)

Digestibility test method according to the method Farell, (1978). The procedure was that layer are kept for two weeks (seven days for adaptation and three days for data collection). Individually layers are placed in battery cages made of wire material equipped with feed and drink containers. The feeder is well designed so that the feed does not spill easily, the layers are managed to consume 100 g/head/day of feed for one hour. The experiment lasted for three days, namely the first day the layers were fasted for 32 hours. The excreta reservoir is lined with a plastic sheet, during feeding the excreta container is pulled out, then the excreta reservoir is pushed in so that all excreta can be accommodated. Excreta collection was carried out for 42 hours. The feathers and layer scales that enter the container are removed, after 42 hours the plastic container with excreta is dried in an oven at 60^{o}C for 24 hours or if the feces are too wet it can be dried for 48 hours. The dried excreta were weighed dry and ground for analysis.

Research Variable

The research variables consisted of dry matter digestibility (BK), crude protein digestibility (PK) and crude fiber digestibility (SK) of fermented Goroho banana peels in layer. Measuring the digestibility of BK, PK and SK using the Scanes et al., (2004) method. Calculation of the digestibility test for PK using the formula:

$$Crude\ Protein\ Digestibility = \frac{A - B}{A}\ X\ 100\%$$

Details:

A = (Feed Consumption x % BK of feed) x % PK of feed

B = dry weight of excreta x protein excretion

The same method is used to calculate the digestibility of BK and SK

Data Analysis

Data analysis used a completely randomized design (CRD). If there is a difference between the treatments, Duncan's multiple distance test is used. Data tabulation and data analysis were carried out according to the procedure of Steel and Torrie, (1997).

III. Discussion

Digestibility is defined as the amount of nutrients in the feed retained or can be absorbed by the body (Tilman et al., 1998). Digestibility can assess a feed ingredient, the more nutrients absorbed, the higher the digestibility value of the feed ingredient. Factors that affect digestibility include: physical form of feed ingredients, feed composition, feeding rate, crude fiber content of feed, livestock species, temperature and disturbances in the digestive tract.

The average digestibility value of dry matter, crude protein and crude fiber of layer containing fermented Goroho banana peel can be seen in table 3.

TABLE 3. Average digestibility values of BK, PK and SK from treatment feed on layer.

Treatment	BK Digestibility(1)	Digestibility PK (2)	Digestibility SK (3)
	----------%----------		
P0	78,34 ± 3,48^{ab}	80,07 ± 2,63^{bc}	33,34 ± 9,63^{a}
P1	74,19 ± 4,74^{a}	72,52 ± 3,71^{a}	41,77 ± 9,93^{ab}
P2	79,78 ± 7,32^{ab}	72,82 ± 2,95^{a}	49,66 ± 8,04^{bc}
P3	79,62 ± 0,75^{ab}	75,91 ± 1,64^{ab}	59,47 ± 3,82^{c}
P4	76,80 ± 1,53^{a}	74,28 ± 4,20^{a}	46,95 ± 8,70^{b}
P5	79,79 ± 2,86^{ab}	80,36 ± 5,67^{bc}	47,08 ± 10,30^{b}
P6	82,96 ± 2,17^{b}	84,57 ± 2,48^{c}	50,92 ± 4,45^{bc}

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[a,b,c,] Different superscripts in column 1 show significant differences (P<0.05), different superscripts in columns 2 and 3 show very significant differences (P<0,01).

Dry Matter Digestibility

Dry matter digestibility is the difference between the amount of dry matter consumed minus the amount of dry matter in the feces or excreta of layer. Dry matter digestibility of layer in all treatments (P0 to P6) the results ranged from 74.19 to 82.96%. Between feed treatments (P0) and (P1, P4 and P6) were significantly different (P<0.05). Between (P0, P2, P3 and P5) were not significantly different (P>0.05).

Dry matter digestibility at (P6): 82.96% (Table 3) was higher and significantly different (P<0.05) from all treatments due to more dry matter feed that could be absorbed in the digestive tract of layers. The dry matter of feed is a reflection of the amount of carbohydrates contained in feed ingredients, it is known that approximately 50 to 80% of dry matter comes from plants composed of carbohydrates. In treatment (P6) the feed material tested was yellow corn which contains high carbohydrates with low crude fiber so that nutrients, especially dry matter, are easier to digest. Rajhan, (1980) stated that the type and quantity of carbohydrates of a feed ingredient used in feed rations reflects the digestibility of other feed ingredients in relation to the increase in crude fiber in layer feed which causes the digestibility of other feed ingredients to decrease.

Feed (P5) had a higher digestibility value than (P0, P1, P2, P3 and P4) although not significantly different (P>0.05) with (P0, P2 and P3), because in this method the layers consumed feed containing skin fermented Goroho bananas which have better nutritional value such as high protein and fat content, with low crude fiber content, these components are part of the dry matter which is easier to digest. In Tilman et al., (1998) it was stated that the crude fiber content of feed ingredients, protein and fat of feed, treatment of feed ingredients, the amount of feed given to livestock are factors that affect digestibility. Another thing is the physical form of the feed, the composition of the ration, the rate of travel of the feed in the digestive tract and the ambient temperature affecting the level of digestibility of the feed (Anggorodi, 1994)..

Crude Protein Digestibility

The digestibility of crude protein in layer was between 72.52 to 84.57% (Table 3). The highest protein digestibility in the feed treatment (P6): 84.57 and the lowest at (P1): 72.52%. The digestibility of protein was higher in (P6) and (P0) than (P1, P2, P3 and P4) because (P0) and (P6) did not use Goroho banana peel in their feed mixture, so that the layers received feed with easily digestible crude fiber in the digestive tract digestion compared to treatment using Goroho banana peel. In the treatment feed using fermented Goroho banana peel, the crude fiber in the feed ingredients is difficult to digest by the layers, because it is covered in high lignin, cellulose and hemicellulose. Another thing is suspected because the Goroho banana peel has anti-nutritional substances, namely tannins, the presence of tannins can inhibit the work of digestive enzymes. The bioactive components of tannins and their derivatives such as *ellagitanins*, *proanthocyanidins* can inhibit the work of protease and lipase enzymes. Consumption of tannins can reduce the absorption of protein and amino acids in the digestive tract of layers. Tannins can bind to proteins that form indigestible tannin protein complexes (Asquith et al., 1987 in Sunu et al., 2014).

In the feed which added with fermented Goroho banana peel, the feed treatment (P5: 80.36%) had a higher protein digestibility value than (P3: 75.91; P4: 74.28; P2: 72.82; and P1: 72.52 %), this is because the Goroho banana peel (P5) which uses *Rhizopus oligosphorus* plus *Trichoderma viride* incubation 120 microorganism activity is more optimal and effective in breaking down complex bonds including proteins into simpler ones so that they enter the digestive tract of layers and are assisted by enzymes. digestive enzymes become more easily digested and absorbed by the digestive organs. The same thing also applies to treatments (P3, P4 and P2) which have a higher protein digestibility value than (P1).

Crude Fiber Digestibility

The digestibility of crude fiber in table 3 shows various yield values, which are between 33.34 to 59.47%. The digestibility of crude fiber in layer was highest at (P3): 59.47; and the lowest at (P0): 33.34%. Suprijatna, (2010) stated that the digestibility value of crude fiber in poultry generally ranges from 20 - 30% and the average digestibility value of crude fiber in the study feed treatment (P0 to P6) has a high value.

The data showed that feed (P0) or basal feed had low crude fiber digestibility compared to other treatments, because feed (P0) was associated with the use of rice bran as a mixed feed ingredient which contained difficult-to-digest crude fiber components such as cellulose. Layers do not have cellulase enzymes, so difficult-to-digest feed is excreted in the form of feces. In treatment (P1 - P5) using fermented Goroho banana peel, there were molds *Rhizopus oligosphorus* and *Trichoderma viride* which produce digestive enzymes including cellulase enzymes that can break down the cell walls of crude fiber in feed ingredients so that they are easily digested and absorbed in the digestive tract of layers.

The higher digestibility of crude fiber in (P3) was caused because feed (P3) was easier to digest in the digestive tract of layers than other treatments. Factors that affect the digestibility of crude fiber include crude fiber content in feed ingredients, crude fiber composition and activity of microorganisms (Maynard et al., 2005). It is suspected that the activity of microorganisms contained in the Goroho banana peel with the fermentation method (P3) which enters the digestive tract of layers becomes more active and with optimal digestive enzymes digests crude fiber so that it is easily absorbed and utilized by the body of layers. The feed (P6) had higher digestibility of crude fiber than (P2), (P5), (P4) and (P1), because the feed (P6) added to the basal diet was corn which had crude fiber content which was easier to digest. compared to Goroho banana peel, so the digestibility value is also high.

IV. CONCLUSSION

The method using a combination of 2 types of mold *Rhizopus oligosphorus* plus *Trichoderma viride* incubation on

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120 hours on Goroho banana peel fermentation (P5) resulted in dry matter digestibility, crude protein digestibility and crude fiber digestibility with the best values in layer.

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