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Effects of Addition Myristic Acid and *Calliandra calothyrsus* Leaf Flour Substitution in Concentrate Feed Based on Corn Stover to Nutrient Content and Blood Parameters of Thin Tailed Sheep

[1]Muhimmatu Mufidah, [2]Siti Chuzaemi, [2]Mashudi, [2]Herni Sudarwati, and [2]Poespitasari Hazanah Ndaru
[1]*Postgraduate Student, Faculty of Animal Science, Universitas Brawijaya, Malang, East Java, Indonesia, 65145*
[2]*Lecture of Faculty of Animal Science, Universitas Brawijaya*
Correspondence author:schuzaemi@ub.ac.id

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Abstract :

This study aimed to evaluate the effect of the addition of myristic acid treatment and substitution calliandra leaf flour on the nutrient content of concentrate feed and blood parameters thin tailed sheep.Calliandra leaf are taken and dried in the sun. This research in vivo method using fifteen male thin tailed a Randomized Block Design (RBD) with 3 treatments (T_0: without the addition of myristic acid and substitution calliandra leaf flour as a control, T_1: the addition of myristic acid and substitution 10% calliandra leaf flour, T_2: the addition of myristic acid and substitution 15% calliandra leaf flour and 5 replicates. The variables observed were dry matter, crude protein, crude fat, crude fiber, ash, tannins and blood parameters content. Data were analyzed by analysis of variance (ANOVA) and continued with Duncan's Multiple Range Test (DMRT). The results showed that several treatments of addition myristic acid and substitution calliandra leaf flour had a significant difference ($P<0.05$) on blood glucose concentration. The increase in the nutrient content of the treated concentrate feed was in line with the increase in the provision of myristic acid and the use of calliandra leaf flour did not have an effect on the treatment of concentrate feed on blood urea concentration. It was concluded that the addition of myristic acid and substitution with 15% calliandra leaf flour showed the best results of thin tailed sheep.

Keyword : *Myristic acid*, blood parameters, *Calliandra calothyrsus*

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I. INTRODUCTION

National meat demand continues to increase from year to year, this can be seen from the record of meat imports in the last 5 years. Data shows that the number of meat imports over the last 5 years has continued to increase, namely in 2016 imports of 146.671.9 tons, in 2017 as many as 160,197.5 tons, in 2018 207,427.3 tons, in 2019 as many as 262,251.3 tons and slightly decreased in in 2020 meat imports were 223,423.7 tons, less than the large amount of imported meat in the previous year. The large amount of imported meat indicates that Indonesia's meat demand is still not being met by the national meat production supply [4]. Sheep are ruminants, raising and breeding sheep is very possible in an effort to meet the national demand for meat. this is because sheep are able to reproduce quickly where in one calf produces more than 1 livestock. In addition, the period of raising livestock to adulthood is relatively short [3] reported that sheep production in 2018 and 2019 reached peak production compared to the previous and previous years. The amount of sheep production in 2018 reached 82,274.38 tons and slightly decreased, in 2019 sheep production was 70,072.93 tons. In the following year, sheep production also experienced a significant decline, which was 15,884.45 tons. Improving the quality of feed and maintenance is very necessary to increase the productivity and population of sheep.

Feed plays an important role in supporting the performance of livestock production, the feed consists of forage and concentrate. Forage feed is given to livestock as a source of energy. Generally forage fodder has a very low crude protein content, so it is necessary to add supporting feed in the form of concentrates to optimize livestock production performance [22]. Provision of forage to livestock should be done ad libitum this is because the provision of forage feed with a high fiber content affects the level of consumption and nutrition of the feed [8]. Assessment of the nutritional quality of forage fodder can be seen through the value of consumption, digestibility and its effect on livestock productivity such as the rate of body weight gain of livestock which describes the level of nutrient content of forage fodder [18]. The forage used in this study was corn stover. Utilization of corn stover is an effort that can be done in meeting the needs of forage feed in a sustainable manner and does not interfere with human food needs because corn stover is a by-product of the agricultural industry that is no longer used by the

community farmers [27]. The use of abundant local feed ingredients as a component of concentrate feed is highly recommended. Given the relatively low nutritional content of local feed, it is hoped that it can be covered with feed ingredients that contain higher other nutrients so that they can support livestock productivity and reduce feed costs [7] In addition, the addition of fatty acids into the feed ration at a certain level showed a good effect on increasing the digestibility value of the feed.

Calliandra (*Calliandra calothyrsus*) is a type of plant that belongs to the tree legume group. Calliandra plant has a fairly good nutritional content, especially crude protein content. Calliandra is one of the leguminous plants that has a high protein content. Reproduction of calliandra plants is included in the category of easy and does not require complicated care. Calliandra plants can survive in areas of soil that are not too fertile such as laterite, limestone and clay soil types [17]. The use of calliandra as animal feed has the potential to meet the nutritional needs of feed and forage for livestock. The protein content of calliandra leaves is 20.49% while the protein content of the calliandra bark is 16.76% [9].

Blood chemestry content can be used as an illustration of how effective the absorption of feed nutrients by livestock is. Protein-rich feed will be absorbed and then circulated through the blood throughout the body. Blood glucose is the result of carbohydrate metabolism, while blood urea is the result of protein metabolism that occurs in the liver with constituent materials derived from ammonia and the part of amino acid metabolism which is then used as an energy source. The purpose of this study was to examine the effect of addition myristic acid and substitution calliandra leaf flour in animal feed concentrate rations on the blood glucose and blood urea content of male thin-tailed sheep.

II. RESEARCH METHOD

The livestock used in this study were fifteen male sheep thin tailed, aged 8-12 months with an average initial body weight of 18.70 kg, with a coefficient of variation of 1.78%. Sheep are placed in individual metabolic cages, the adjustment period or feed adaptation period takes 2 week. The purpose of the adaptation stage is to gradually adjust livestock to new feeds to avoid stress.

The feed ingredients for the concentrate ration research consisted of pollard, rice bran, cassava flour, copra meal, soybean meal, molasses and minerals. The source of tannins used in this study was calliandra plant. The treatment of calliandra plants before being substituted with concentrate was done by drying and milling to obtain the same size as other feed ingredients. The shape and particle size of the feed ingredients that make up the concentrate need to be equalized to avoid livestock choosing when given.

Maintenance consists of feeding, health checks, and weighing body weight. The length of the collection period was carried out for 2 months after the feed and cage adaptation stage. Feeding was carried out 4 times a day with 2 different types of feed, namely forage and concentrate. After feeding, the next day the remaining feed was collected and recorded the amount of remaining feed in the right feed. Weighing of sheep is done every 2 weeks. Blood samples were taken before the animals were fed in the last collection period, 3 ml of blood was drawn from each sheep through the jugular vein using a 10 ml spluit. Blood samples that have been taken directly into the EDTA tube. Handling of blood samples when going to the laboratory is to protect them from direct sunlight and immediately taken to the laboratory to be centrifuged at 3000 rpm for 10 minutes to get plasma samples. Plasma samples were put into a PCR tube then stored at -20^{0}C before further blood analysis was performed.

The parameters tested were the nutrient content of the treated feed concentrate, blood glucose and blood urea concentration. This research was conducted by in-vivo method using a Randomized Block Design (RBD) which consisted of 3 treatments and 5 replications in each treatment. The treatments were as follows:

T0 = 40% Corn Stover + 60% Concentrate,
T1 = 40% Corn Stover+ 10% Calliandra Leaf Flour + 50% Concentrate + Myristic Acid 30 g/kgDM, and
T2 = 40% Corn Stover+ 15% Calliandra Leaf Flour + 45% Concentrate + Myristic Acid 30 g/kgDM.

Analysis of variance was used in this study to determine the effect of treatment on the variables, while to find out the difference between treatments, Duncan's Multiple Range Test (DMRT) was performed.

III. RESULT AND DISCUSSION

Nutrient Contents.

Feeds with high nutrient content have a positive effect on increasing feed degradation caused by an increase in the microbial population in the rumen which comes from an increase in feed protein as a nitrogen source for rumen microbial growth [8]. Mixing process concentration of feed ingredients is carried out until all ingredients are well mixed and have homogeneous particle sizes, this is to prevent feed selection from occurring when feed is given to livestock [23]. Proportion Ingredients concentrat feed shows in Table 1.

Table 1. Propirtion of use of feed ingredients for concentrate

Proportion of use of feed ingredients for concentrate			
Feed ingredients (%DM basis)	T0	T1	T2
Pollard	24	21,6	20,4
Rice bran	19	17,1	16,15
Cassava fluor	18	16,2	15,13
Copra meal	23	20,7	19,55
Soybean meal	9	8,1	7,65
Molasses	5	4,5	4,25
Mineral	2	1,8	1,7
Calliandra leaf flour	0	10	15
Total	100	100	100
Myristic acid(g/kg DM)	0	30	30

Nutrient content in feed rations is used as a benchmark in assessing the extent to which feed affects the digestibility coefficient and livestock growth. The use of fiber in feed is as a source of energy for the sustainability of rumen microbial growth which will have an impact on the efficiency of digestion and livestock growth [19]. Based on the reference protein nutrient requirements for the growth of sheep described in the [20] it is known that the provision of feed containing high protein is very good for growing sheep, but the provision of feed containing 10% protein based on dry matter rations is sufficient to meet the needs of sheep maintenance. Supported by [11] statement which states that the protein feed needed to meet the basic needs of sheep is 8% based on the dry matter of the ration, while the need for crude protein for sheep in their growing period requires feed with a minimum crude protein content of 11% based on ration of dry matter. Other sources also mention that the crude protein needed to meet the needs of growing sheep and goat is 13% to 14%, while the TDN required is 56% to 57% [19]The results of the analysis of the nutrient content of the concentrate feed are shown in Table 2.

Table 2. Nutritional content of concentrate feeds and corn stover

Nutritional content of concentrate feeds and corn stover(%DM basis)				
Nutrient Content	Corn stover	T0	T1	T2
Dry matter	25,08	89,2	88,7	88,7
Organic matter	87,98	88,93	90,76	90,96
Ash	12,02	11,07	9,24	9,04
Crude protein	12,13	17,54	18,43	19,05
Crude fiber	25,95	23,58	14,59	15,12
Crude Fat	6,11	2,66	4,8	4,6
NFE	43,77	45,20	52,92	52,17
TDN	51,49	59,12	66,09	65,78

The results showed that the treatment had no significant (P>0.05) on the nutritional content of the concentrate feed. the increase in the number of substitutions calliandra leaf flour was in line with the increase in the nutrient content of the feed, especially the crude protein and crude fiber content.Based on the results of the study, it was known that the average NFEvalue in the treatment of addition myristic acid and replacing concentrate with calliandra leaf flour at the level of 10% and 15% showed an increase in the NFE value compared to the control feed, which was 45.20% to 52.92% and 52.17%. In the treatment the addition of myristic acid and replacement with calliandra leaf flour at a level of 10% showed an increase in NFE compared to the control feed, however, the treatment with the addition of myristic acid and replacement with calliandra leaf flour at a level of 15% showed a decrease in the NFE value compared to the treatment substituted with calliandra leaf meal. at the 10% level. When viewed from the crude fiber value of the feed, it was known that the treatment of addition myristic acid and replacement with calliandra leaf flour at the level of 10% decreased compared to the control feed which was 23.58% to 14.59%, while the value of crude fiber in the treatment with the addition of myristic acid and the replacement of concentrate with calliandra leaf flour at a level of 15% showed an increase in the value of crude fiber compared to the replacement of concentrate with calliandra leaf flour at a level of 10%, namely 14.59% to 15.12%. [15] stated that the high and low NFE value of the feed was influenced by the crude fiber content of the feed. if the crude fiber content of the feed is high, the NFE value shows a low yield, otherwise if the crude fiber content of the feed is low, the NFE value of the feed is high.

TDN is a picture of total energy based on all digested feed nutrients, so the TDN value can be used as a reference for assessment to find out how much nutrient is absorbed by the body to support its productivity. The high or low TDN value of feed is influenced by several things including the nutrient content of the feed, the type of feed, the quality of the feed and the physiological condition of the livestock. In addition, the amount of TDN value is closely related to the content of organic matter, crude protein, crude fat, especially crude fiber content and NFE value [17] In the results of the study, it was known that the average TDN value in the treatment of addition myristic acid and replacing concentrate with calliandra leaf flour at the level of 10% showed an increase compared to the control feed, namely 59.12% to 66.09%, while in the treatment of addition myristic acid and replacement of concentrate with calliandra leaf flour at a level of 15% showed a decrease in the TDN value compared to the treatment of replacing concentrate with calliandra leaf flour at a level of 10%, namely 66.09% to 65.78%. The increase and decrease in the TDN value is thought to be influenced by the crude fiber content and the NFE value of the feed, it is known that the results of this study indicate that the NFE value is in line with the results of the TDN value. Where the NFE and TDN values both experienced an increase in the substitution treatment with calliandra leaf flour at the level of 10% and a decrease in substitution with calliandra leaf flour at the 10% level.

Blood Glucose Consentration

Blood glucose can be affected by the carbohydrate content of feed, amino acids and propionic acid, and liver glycogen in the process of gluconeogenesis. Blood glucose is used as an energy source to support the development of brain cells, nervous system, red blood cells and fetal development [10]. Blood glucose concentration can shows in Table 3.

Table 3. Blood glucose concentration

Treatment	Blood glucose (mg/dL)
T_0	71.20 ± 10.33^{b}
T_1	70.20 ± 9.52^{b}
T_2	55.60 ± 3.51^{a}

Note:
Values are mean of five replications ± Standard Error
$^{(a-e)}$ Differences in superscript on the same line indicate significant different ($P<0.05$)

Based on the statistical analysis in Table 3. it was found that the use of calliandra leaf flour in concentrate showed a significant difference (P<0.05) on blood glucose concentration. Based on the statistical analysis table 3, it is known that blood glucose levels have decreased starting from T_0 indicating the highest blood glucose concentrationcompared to other treatments, which is 71.20 mg/dL, while T_1 blood glucose concentration are 70.20 mg/dL, and T_2 is 55.60 mg/dL.

[14] reported that based on the results of their research, the addition of vegetable oil in feed rations by 5% showed a decrease in blood glucose concentration. In addition, the decrease in blood glucose values is thought to be due to the treatment of substitution of concentrate feed with calliandra leaf flour can reduce blood glucose concentration. The results of research conducted by [10] showed that the addition of 70% ethanol extract of red calliandra leaf flour linearly could show a decrease in the value of blood glucose concentration along with the addition of ethanol extract in animal feed. However, the level of addition of certain tannins in the feed has an effect on increasing blood glucose concentration. Wherein, the added tannin in the feed causes an increase in the production of propionic acid [1]It is known that propionic acid is the main precursor in the gluconeogenesis stage, so that if the availability of propionic acid in large quantities can cause an increase in blood glucose levels. Strengthened by [26] which states that the addition of tannins in feed can increase the production of propionic acid and the addition of tannins to a certain level can reduce CH4 production. Although the results of this study show a negative correlation to blood glucose concentration, it is still at normal levels.[13] reported that the normal range of blood glucose concentration in livestock is 40-60 mg/dL, this statement is reinforced by [22] which states that the normal blood glucose concentration is 40-60 mg/dL. other sources also found that the normal range of blood glucose concentration in goats is 50-80 mg/dL [12]

Blood Urea Concentration

Blood urea is a product of the protein metabolism process in the body that is not utilized by livestock so that it is excreted through urine. The lower blood urea levels indicate the more efficient use of feed in supporting basic living needs and livestock production [25]. Blood urea is the result of protein metabolism in the liver which is the residue from the deamination of amino acids. Urea is one source of NPN that is often used as a substitute for true protein feed.

Table 4. Blood Urea concentration

Treatment	Blood Urea (mg/dL)
T_0	22.72±1.63
T_1	26.90±5.10
T_2	28.38±2.49

Based on the statistical analysis in Table 4. it was found that the use of calliandra leaf flour in the concentrate showed a significant difference (P>0.05) on the blood urea concentration. Based on the statistical analysis table 4, it is known that blood urea concentration decreased starting from T_0 indicating the lowest blood urea concentration was 22.72 mg/dL, while the highest blood urea concentration was in T_2 treatment, which was 28.38 mg/dL. the value of blood urea concentration in T_1 treatment was 26.90 mg/dL.

The use of mixed tannins, namely feed containing condensed and hydrolyzed tannins, has a positive effect on decreasing methane gas production, while the use of mixed tannins with different concentrations in feed rations affects the decrease in the value of Blood Urea Nitrogen (BUN) [16]. Although the results showed a negative correlation between the administration and consumption of high protein concentrates on blood urea concentration, the amount of blood urea concentration was still at a normal level. [5] stated that the normal range of blood urea concentrationin livestock is 26.6 – 56.7 mg/dL. The high blood urea content in the blood needs to be removed immediately through the kidneys and through the skin in small amounts [15], the late in releasing blood urea can have a bad effect on livestock such as cattle experiencing uremia, if the livestock has been exposed to uremia what can be done namely the provision of feed containing carbohydrate sources [6].

IV. CONCLUSION

Treatment 2 (T_2), namely the addition of 30 g/kgDM myristic acid and substitution calliandra leaf flour at a level of 15% show the best results :

1. Increasing crude protein, increasing TDN and decreasing crude fiber
2. Decreasing blood glucose concentration, didn't influence about blood urea concentration.

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