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Effect of *Myristic Acid* Supplementation and Calliandra (*Calliandra calothyrsus)* on Complete Feed based Corn Straw on Proximate Analysis and Crude Protein Digestibility *In Vitro*

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----------ABSTRACT----------

The research purposed to evaluate the effect of Myristic acid supplementation and condensed tannins sourced from Calliandra leaf flour on a complete feed based corn straw on proximate analysis and Crude Protein Digestibility (CPD). Research was conducted in vitro (Tilley and Terry, 1963). The treatment used was : P1= Complete Feed (40% corn straw + 60% concentrate), P2 = Complete feed (40% corn straw + 60% concentrate + 0% Calliandra leaf flour + Myristic acid 30 grams/kgDM, P3= Complete feed (40% corn straw + 35% concentrate + 25% Calliandra leaf flour + Myristic acid 30 grams/kgDM, P4= Complete feed (40% corn straw + 30% concentrate + 30% Calliandra leaf flour + Myristic acid 30 grams/kgDM, P5= Complete feed (40% corn straw + 25% concentrate + 35% Calliandra leaf flour + Myristic acid 30 grams/kgDM. The variables of research were the nutritional content of DM, OM, CP, CF, EE, Ash, NDF, ADF and CPD.The data obtained were analyzed using the Randomized Block Design (RBD) method consisting of 5 treatments and 3 repeats. If data shows a significant difference, proceed with Duncan Multiple Range Test (DMRT). The results showed a crude protein was increased when percentage of Calliandra leaf flour increase and very significant difference in CPD increase. The conclusion of this research was the best treatment on P5 (complete feed 40% corn straw + 25% concentrate + 35% Calliandra leaf flour + Myristic acid 30 grams/kgDM), P5 could increase rumen fermentation products by in vitro. Therefore, it could be alternative solution to obtain more protein with low cost.

KEYWORDS: *Calliandra, Myristic acid, in vitro, rumen fermentation products*

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I. INTRODUCTION

An important factor supporting the production of ruminant livestock is the availability of feed materials in terms of quality, quantity, and continuity. One of the efforts to meet the availability of feed can be done by looking for alternative feed materials, which are relatively cheap and do not compete with human needs. An Alternative feed can be obtained from agricultural waste.

Ruminants have a characteristic in the process of digestion of feed nutrients, namely the presence of fermentation activity by microbes in the rumen. Feed fermentability due to microbial activity in the rumen is one of the factors that affect the productivity of ruminant livestock (1). The efforts of rumen microbes to obtain energy, carbon, and nitrogen sources for their breeding are derived from the balance of given proteins and the fermentation activity of rumen microbes such as ammonia (NH_3).

Calliandra leaf flour (*Calliandra calothyrsus*) contains condensed tannins that can protect proteins from microbial degradation (protein bypass) so that they can be directly absorbed by the small intestine (2). Another active ingredient that can be used for ruminant animal feed supplementation is fatty acids. Fatty acids are compounds that have great potential as suppressors for methane gas production in the rumen and without lowering the nutritional value of feed. So there needs to be complete feed supplementation to optimize the use of protein by rumen microbes.

This research aims to create a supplement feed made from local Indonesian ingredients, namely *Myristic acid* which is a fatty acid, and Calliandra leaf flour as a source of condensed tannins applied to complete feed based corn straw through a proximat analysis approach and crude protein digestibility *in vitro.*

II. MATERIAL AND METHOD

1. Sample Collection and Preparation

Raw material treatment, which contains of corn straw, coffee skin, bran, tapioca residue, soybean meal, palm oil meal, copra meal, urea, molasses were obtained from livestock shop in Malang. Calliandra leaf was obtained from Pagerwojo, Tulungagung, East Java. Tannin content test were carried out at LPPT Universitas Gajah Mada, Yogyakarta, and tannin condensation content test were carried out at BPPT Ciawi, Bogor. The feed materials are dried in an oven at temperature 40°C for 3 days, then the samples are ground into flour. The fatty acids used were obtained from CV.Cipta Anugrah Bakti Mandiri, Banyuwangi with 99.7% *Myristic Acid*, 0.1% *Lauric Acid*, 0.1% *Palmitic Acid* and 0.1% other compounds. This research was used *in vitro* method (Tilley and Terry, 1963) with crude protein digestibility was carried out at the Livestock Food Nutrition Laboratory, Faculty of Animal Science, University of Brawijaya Malang. The treatment was based on the addition of Calliandra leaf flour (25%, 30%, and 35%) and *Myristic acid* (30 grams/kgDM). This feed treatment was formulated using Microsoft Excel provided that the feed iso-protein value of 13-15%. The treatments applied were formulated based on DM as follows :

T1 = Complete Feed (40% corn straw + 60% concentrate)
T2 = Complete feed (40% corn straw + 60% concentrate + 0% Calliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T3 = Complete feed (40% corn straw + 35% concentrate + 25% Calliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T4 = Complete feed (40% corn straw + 30% concentrate + 30% Calliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T5 = Complete feed (40% Corn straw + 25% concentrate + 35% Calliandra leaf flour + *Myristic acid* (30 grams/kgDM)

2. Research Variabel :

The variables observed in this research were as follows:

1. Complete feed nutrition content (DM, OM, CP, CF, EE, Ash (AOAC, 1995) and NDF, ADF (Van Soest, 1994).
2. *In vitro* Crude Protein Digestibility (CPD) using Tilley and Terry (1963) method.

The calculation formula was:

Crude Protein Digestibility (CPD) :

$$\text{CPD (\%)} = \frac{(\text{ECP}-\text{ROM}-\text{Blanko}) \times 100\%}{\text{ECP}}$$

Explanation :
ECP = Early Crude Protein
ROM = Residual Organic Matter

3. Statistical Analysis :

The experimental design used was Randomized Block Design (RBD) consisting of 5 treatments and 3 repeats. If the data analysis of each variable obtained between treatments shows a significant difference, then continued with the Duncan Multiple Range Test (DMRT).

III. RESULT VIEW

The nutritional content of the complete feed ingredients can be seen in Table 1, the percentage of feed treatment can be seen in Table 2, the chemical composition of the complete feed based on corn straw with the addition of *Myristic acid* and Caliandra leaf flour with different levels (%DM) can be seen in Table 3, and the results of the analysis of crude protein digestibility could be seen in Table 4,

Table 1. Nutritional Content of Complete Feed Materials :

No.	Raw Material	BK	Abu*	BO*	PK*	SK*	LK*	Tanin (100%)	C.Tannin (100%)
1.	Coffee skin	94,14	10,58	89,42	10,11	34,00	1,50	-	-
2.	Bran	90,63	12,60	87,40	10,15	16,20	13,00	-	-
3.	Tapioca residue	92,59	17,13	82,87	1,76	25,39	0,44	-	-
4.	Soybean meal	93,53	8,38	91,62	47,53	4,04	2,57	-	-
5.	Palm kernel meal	95,39	5,03	94,97	14,24	20,91	10,01	-	-
6.	Copra meal	95,69	7,77	92,23	22,12	21,78	2,45	-	-
7.	Urea	99,88	0,07	99,93	244,60	-	-	-	-
8.	Molasses	78,47	15,43	84,57	4,55	9,81	-	-	-
9.	Corn Straw	94,46	10,17	89,83	5,13	36,43	0,63	-	-
10.	Caliandra leaf flour	93,67	7,63	92,37	23,16	12,08	3,90	8,86	0,46

Note : - * Based 100%DM
- Analysis results of Animal Nutrition and Food Sciences Laboratory, Faculty of Animal Science, University of Brawijaya (2020)
- The analysis of tannin nutrient was conducted in Integrated Research and Testing Laboratory, Gadjah Mada University, Yogyakarta (2020)
- The analysis of Tannin Condensation content (C. Tannin) was conducted at BPPT Ciawi, Bogor (2021)

Tabel 2. Feed Treatment Percentages :

Raw Material	Treatment (%)				
	T1	T2	T3	T4	T5
Caliandra leaf flour	0	0	25	30	35
Myristic Acid (%/kgDM)	0	0	3	3	3
Corn Straw	40	40	40	40	40
Concentrate Material					
Coffee skin	17	17	17	17	17
Bran	20	20	16	14	14
Tapioca residue	10	10	10	10	10
Soybean meal	21,67	21,67	16	15	14
Palm kernel meal	13,33	13,33	5	4	2
Copra meal	12	12	5	4	2
Urea	1	1	1	1	1
Molasses	5	5	5	5	5
Total	100	100	100	100	100

Note **:** T1 = Complete Feed (40% corn straw + 60% concentrate)
T2 = Complete feed (40% corn straw + 60% concentrate + 0% Caliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T3 = Complete feed (40% corn straw + 35% concentrate + 25% Caliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T4 = Complete feed (40% corn straw + 30% concentrate + 30% Caliandra leaf flour + *Myristic acid* (30 grams/kgDM)
T5 = Complete feed (40% Corn straw + 25% concentrate + 35% Caliandra leaf flour + *Myristic acid* (30 grams/kgDM)

Table 3. Chemical Composition of Complete Feed based Corn Straw with Addition of *Myristic Acid* and Caliandra Leaf Flour used Different Levels (%DM)

Nutritional Content (%DM)	Treatment				
	T1	T2	T3	T4	T5
Dry Matter (DM)	92,535	93,640	92,710	92,995	92,674
Organic Matter (OM)	93,381	93,065	93,325	93,127	93,130
Ash	6,577	6,907	6,675	6,873	6,870
Crude Protein (CP)	15,045	15,099	15,217	15,413	15,656
Crude Fiber (CF)	17,123	19,193	18,671	19,161	19,302
Ether Extract (EE)	3,710	3,724	2,604	2,576	2,429
***Neutral Detergent Fiber* (NDF)**	37,650	41,396	41,194	41,864	39,916
***Acid Detergent Fiber* (ADF)**	20,975	23,095	24,195	24,948	25,195

Note : Analyzed Value of Animal Nutrition and Food Sciences Laboratory, Faculty of Animal Science, University of Brawijaya (2020)

Corn straw has a low CP of 5.13% so in this research, corn straw was processed as a complete feed. The content of CP in the complete feed treatment based on corn straw supplemented with Calliandra leaf flour was seen in table 4, namely T1, T2, T3, T4, T5 consecutively is 15.045%, 15.099%, 15.217%, 15.413%, 15.656%. Crude protein in this complete feed was adapted to (3), it was used for fattening beef around 13-15% CP. Then this complete feed was appropriate if used for fattening beef.

The carbohydrate fractions of CF, NDF, and ADF are equal parts of the cell wall and are carbohydrate reactions (4). Crude fiber content in this research showed numbers around 17-19% with NDF results of 37.65% - 41.86% and ADF around 20.97-25.19%. The difference in the content of crude fiber in this complete feed was influenced by the addition of Calliandra leaf flour. That was in accordance with the research of (5), which states that the difference in the value of crude fibers in complete feed was caused by crude fibers from Calliandra leaf added to the complete feed.

Tannin content on Calliandra leaf flour could be seen in Table 1. The tannin content in the sample of Calliandra leaf flour was 8.86%, the content of tannin condensation Calliandra leaf flour was 0.46%. The result of this tannin content in Calliandra was less than that obtained by (6), which was 10%. According to (7), drying

and aging of the leaves can affect the content of bioactive compounds contained in a material. According to (8), drying time can affect the tannin content in the material, with the best drying time obtained was 8 hours.

The method used in this research was *in vitro* (9). According to (10), this method was simulation of the process of digestion on livestock carried out in the laboratory and useful for understanding the digestibility of animal feed. Digestibility was an important factor to determining the nutritional value of feed. One indicator to know the good quality of feed could be determined by the high value of digestion because the high value of digestibility indicates that the nutritional content in feed could be absorbed properly by the body (11). The following table 4 was the average result of Crude Protein Digestibility (CPD).

Table 4. The Results Analysis of Crude Protein Digestibility (CPD)

Treatment	CPD (%)
T1	$70{,}90 \pm 2{,}96^{a}$
T2	$71{,}13 \pm 5{,}88^{a}$
T3	$73{,}64 \pm 4{,}54^{ab}$
T4	$80{,}60 \pm 2{,}90^{b}$
T5	$80{,}60 \pm 2{,}59^{b}$

Note :

- Different superscripts on the results of each CPD treatment's analysis show very significant differences ($P<0.01$)

IV. CONCLUSION

Based on the results of the study it could be concluded that :

- *Myristic acid* supplementation and Calliandra leaf flour on complete feed based corn straw exert a very significant influence on the increase in crude protein digestibility.
- The best treatment in this research was treatment 5 (complete feed 40% corn straw + 25% concentrate + 35% Calliandra leaf flour + *Myristic acid* 30 grams/kgDM) where the treatment could increase fermentation products in the rumen *in vitro*. Therefore, it could be alternative solution to obtain more protein with low cost.

REFERENCE

[1]. Hapsari, N. S., D, W., Harjanti dan A. Muktiani. 2018. Fermentabilitas Pakan dengan Imbuhan Ekstrak Daun Babadotan (*Ageratum conyzoides*) dan Jahe (*Zingiber officinale*) pada Sapi Perah secara *In Vitro*. Agripet 18 (1):1- 9.

[2]. Wiryawan, K.G., Wina, E., dan Ernawati, R. 1999. Pemanfaatan Tanin Calliandra (*Calliandra calothyrsus*) sebagai Agen Pelindung Beberapa Sumber Protein Pakan (*In Vitro*). Prosiding Seminar Hasil-Hasil Penelitian Bidang Ilmu Hayati. Pusat Antar Universitas Ilmu Hayat IPB. 278-289.

[3]. NRC. 1996. National Science Education Standards. The National Academy of Science. National Academy Press: Washington Dc, Usa.

[4]. Toharmat, T., Pangestu, E., Sofjan, L.A.,Manalu, W., Dan Tarigan, S. 2003. Variasi Produksi *Volatile Fatty Acids* pada Pakan Ruminansia Dengan Kandungan NDF Berbeda. J. Indon. Trop. Anim Agric Special Edition (Oktober).

[5]. Akbar, M., Chuzaemi, S., dan Mashudi. 2020. The Evaluation of Raw Material of Complete Feed based on Corn Stover with Calliandra Leaf (*Calliandra calothyrsus*) and *Myristic Acid* Addition. The International Journal of Engineering and Science (IJES). 7(8): 56-60.

[6]. Widarta, I. W. R., Wiadnyani. A. A. I. S. 2019. Pengaruh Metode Pengeringan terhadap Aktivitas Antioksidan Daun Alpukat. Jurnal Aplikasi Teknologi Pangan. 8(3): 80 – 86. [13].

[7]. Karto, A. P., Kusumadewi., Sutjipto. 2008. Pengaruh Waktu PengeringanTerhadap Kadar Tanin Daun Jati Belanda (*Guazumaul mifolia Lamk*.). Jurnal Tumbuhan Obat Indonesia. 1(1): 38-47.

[8]. Permana, H., Chuzaemi. S., Marjuki., Mariyono. 2014. PengaruhPakandengan Level Serat Kasar Berbeda terhadap Konsumsi, Kecernaan dan Karakteristik VFA pada Sapi Peranakan Ongole. Fakultas Peternakan : Universitas Brawijaya.

[9]. Tilley, J.M.A And Terry, R.A. 1963. A Two Stage Technique for *In Vitro* Digestion of Forage Crops. J. British Grassland Sac. 18: 104-111.

[10]. Olivo, P.M., Santos, G.T., Ítavo, L.T.C., Junior, R.C.S., Leal, E.S., and Prado, R.M. 2017. Assessing The Nutritional Value of Agroindustrial Co-Products and Feed through Chemical Composition, *In Vitro* Digestibility, and Gas Production Technique. Acta Scientiarum. Animal Sciences Maringá. 39(3): 289-295.

[11]. Sumadi, A. Subrata dan Sutrisno. Produksi Protein Total dan Kecernaan Protein Daun Kelor Secara *In Vitro* Production of Total Protein and *In Vitro* Protein Digestibility of *Moringa* Leaf. 2017. Jurnal Sain Peternakan Indonesia. 12(4): 419-423.

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