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# Evaluation of Rumen Fermentation Performance and Characteristic in Local Domestic Goat Fed with White Teak Leaf (*Gmelina arborea*) or Corncob-Based Complete Feed

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**Abstract:** The purpose of this study is to analyze fermentation characteristic and production performance on local domestic goat fed with white teak or corncob-based complete feed (*Gmelina arborea*). 10 domestic goats with age mean of 1 year were divided randomly into two groups (5 goats for each group). Each group will be provided with different treatment of complete feed including (R1) white teak leaf-based complete feed or corncob-based complete feed (R2). Feeding was performed for 2 months. Measured parameter of this experiment was rumen fermentation characteristic encompassing pH, NH3 content, and VFA content in rumen. The statistical analysis based on independent samples t-test showed that rumen pH, and VFA content of goats with treatment R1 was not significantly different (P>0,05) from domestic goats with treatment R2, that was 6.63 vs 6.39 for rumen pH and 118.74 mM vs 109.76 mM for total VFA. Concerning the goats production performance, both R1 and R2 treatments were not significantly different (P>0.05) in the daily body weight gain (58.09 gram/ head/ day vs 39.35 gram/head/day) and feed conversion (10,70 vs 9,82). In contrast, NH3 content in rumen of goats provided with treatment R1 (4,27 mM) was significantly lower (P<0,05) than goats with treatment R2 (7,16 mM) and goat consumption on treatment R1 (550.39 gram/head/day) was significantly higher (P<0,05) from goat consumption provided with R2 (414.51 gram/head/day). As a conclusion, both white teak leaf and corncob are able to be processed into primary fiber source in complete feed formulation for local domestic goat.

**Keywords:** complete feed, white teak leaf, corncob, rumen characteristic, production performance, domestic goat.

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## Introduction

Low availability of feed is one of the problems for the farmers especially in dry season, ruminants are in need of feed with high fiber content to serve as energy source, to sustain rumen microbial activity as well as the rumen function. Therefore, as the alternative feed to substitute forage, utilizing agricultural waste such as rice straw, corn straw, bean straw, corncob and white teak leaf can be very effective to address this problem (Krishna and Umiyasih, 2004).

One resource that plays important role in goat production is feed. Feed is a major component in the economic effort because it is estimated that it can contribute cost accounted for 50-60% of the total production cost (Devendra and Sevilla, 2002). Feed quality and quantity with inadequate nutrition may result in low cattle productivity which is indicated by slow growth rate and low body weight (Soeprano, 1994). One alternative to provide nutritious balanced ration that can improve livestock production is by utilizing concentrated feedstuff source mixed with crude fiber source (forages) in accordance with its proportion of the ration or commonly known as complete feed (Purbowati, 2009).

The utilization of fiber source in feed requires supplementation of energy and protein source feed since the quality is low. This is due to the low digestibility as the consequence of high fiber content. Nutrient supplementation of either energy or protein is used for optimizing microbial growth and therefore, high fiber content feed is possible to be utilized effectively (Suhartanto *et al.*, 2003). Widyobroto (1992) stating that the ideal circumstance for microbial protein formation existed when the fermented carbohydrate is available with protein source and therefore, balance energy and protein content is one requirement in concentrate composition for ruminants.

Complete feed is a complete formula consisted of various mixed feedstuffs with high protein and energy content. Complete feed is produced feed that is provided for cattle as potential feed to sustain feeding needs and production without any other additional substances except water (Hartadi *et al.*, 2005). According to Saragih (2000), the production of complete feed should include local feedstuff considering that livestock agribusiness resilience should prioritize the use of available local feedstuff with little amount of imported feedstuff. Corncob is one of the agricultural waste that has not been used effectively as livestock feedstuff in spite of its massive availability (Yulistina, 2010). This waste can be utilized as the alternative forage substitution. Efforts to improve the quality of corncob as a ruminant feed can be performed through complete feed production, where complete feed is one method to improve agricultural waste recycling with additional feed (concentrate) considering the nutritional needs of livestock, both fiber nutritional needs and other feed substances (Chuzemi, 2002). This study was conducted to evaluate the use of two types of fiber source that were white teak leaf and corncob, in complete feed formulation and their effect to the rumen fermentation characteristic and local domestic goat production performance.

## Research Methods

The study was performed from December 2018 to January 2019 at Animal Unit, Faculty of Animal Husbandry, Hasanuddin University, Makassar by using 10 domestic local goats with age mean of 1 year old and randomly placed I wooden individual pen with pen size 80 cm x 90 cm and 1 m space from the ground. Each pen was equipped with separated feeder and water bucket. Ten experimental goats were divided randomly into two groups (5 goats/ group). Each group was given with one of two treatments of complete feed. The treatments were white teak leaf-based complete feed (R1) or corncob-based complete feed (R2). Goat

feeding was performed twice in a day, at 08.00 AM and 04.00 PM with ad libitum access to feed.

In the complete feed production, each used feedstuff including white teak leaf and corncob were firstly milled to convert their size into smaller particle and the texture was softened for easy mixing process. After that, each feedstuff including bran, tofu waste, milled corn, molasses, mineral and salt was weighed proportionally on the treatment and mixed equally. The feed mixture was packaged into plastic bag and prepared for feeding the experimental goats. Complete feed composition on each treatment is presented in table 1.

**Table 1. Feedstuff Composition in Complete Ration Production**

| No | Feedstuff | Feed Presentation (%) | |
|---|---|---|---|
| | | R1 | R2 |
| 1 | White Teak Leaf | - | 45 |
| 2 | Corncob | 45 | - |
| 3 | Bran | 31,5 | 30 |
| 4 | Tofu Waste | 2.5 | 2,5 |
| 5 | Milled corn | 12,5 | 12,5 |
| 6 | Molasses | 2,5 | 2,5 |
| 7 | Mineral | 2 | 2 |
| 8 | Salt | 1 | 1 |
| 9 | Urea | 0,5 | 1,5 |
| **Total** | | **100** | **100** |

The experimental feeding was performed for 2 months before collecting the samples. Rumen fluid sampling was performed by using stomach tubing method. Rumen fluid was collected for 4 hours after the feeding using stomach tube device. The goats were laid down and the stomach tube was inserted into the rumen. After that, rumen fluid was collected for 5-10 ml. Rumen pH was measured and stored in cole box before it was stored to the laboratory for NH3 and rumen VFA measurement.

The observed parameters in this study were the rumen fermentation characteristic that included pH, NH3 content, and VFA content, as well as the goat performance which included dry matter consumption, daily body weight gain, and feed conversion. The observed parameter at this research stage was rumen characteristic (pH, VFA, dan NH3), as well as production performance (feed consumption, body weight gain, feed conversion). NH3 content was measured by using Conway method. VFA content was measured by using titration method.

As for the parameter of goat performance, it was measured by applying the following method:

$$\text{Body Weight Gain} = \frac{\text{Starting Weight} - \text{Ending Weight}}{\text{Observation Period}}$$

$$\text{Feed consumption} = \text{total amount of feed consumed} - \text{remaining feed}$$

$$\text{feed conversion} = \frac{\text{The Amount of Feed Fed}}{\text{Body Weight Gain}}$$

The data was analyzed using Independent Samples –t-Test with SPSS v.16.

## Result and Discussion

### The effect of the treatments to rumen fermentation characteristic

Mean of rumen fermentation characteristic that included rumen pH, NH3 content and rumen VFA content was presented in Table 2.

**Table 2. Mean of rumen fermentation characteristic in domestic goat based on the treatment**

| Parameter | Treatment | |
|---|---|---|
| | R1 | R2 |
| pH | 6.63±0.13 | 6.39±0.28 |
| $NH_3$(mM) | 4.27±0.96[b] | 7.16±2.57[a] |
| VFA (mM) | 118.74±8.44 | 109.76±37.41 |

Description: [a,b] Mean followed by different letters in the same row indicate significant difference (P<0.05); R1= White teak leave-based complete feed; R2= Corncob-based complete feed

The result of the data analysis showed that rumen pH of treatment R1 was not different (P>0,05) from goat rumen pH of treatment R2. Similarly, rumen VFA content of treatment R1 was not different from VFA content of treatment R2 (Table 1). However, rumen NH3 content of treatment R1 (4.27 mM) was significantly lower (P<0,01) than rumen NH3 content of treatment R2 (7.16 mM).

Mean of goat pH on each treatment was different in optimal pH that ranges from 6 to 7. Therefore, it will give a positive effect to the degradation process of feed in rumen. This is in accordance with Arora (1995) stating that normal pH on goat ranges from 6 to 7. It is one of the indicators of effective feed degradation process because, on pH 6-7, microbes that produce crude fiber digestive enzymes may live optimally in rumen. Factors that affect rumen pH were physical characteristic, species and consumed feed chemical composition. Hariyani (2011), stating that another factor that affect pH in rumen fluid is the duration of feed digestion in rumen that is measured from feeding process and saliva secretion.

In relation to the total of rumen VFA, the two treatments did not show different effect. Mean of VFA content in treatment R1 (118.74 mM) was relatively not different from the mean of VFA content in treatment R2 (109.76). Generally, VFA content in goats on both experimental groups was still on the normal range to sustain optimal rumen condition. Required VFA total for a goat to grow normally ranges from 80-160 mM (Suryapratama, 1999). Additionally, the range of VFA concentration is also sufficient to fulfil microbial needs to grow in rumen (Sutardi, 1977). VFA concentration is affected by types of feed, high concentration of VFA indicated an increase in protein content and soluble carbohydrate in feed. VFA production in rumen fluid can be used as an indicator of feed fermentability (McDonald *et a*l (2002). Complete feed treatment with white teak leaf and corncob-based fiber source is possibly used as feed that supplies good energy source for cattle with high concentration of VFA.

In contrast to rumen pH parameter and rumen VFA total, rumen NH3 content with treatment R1 (4.27 mM) was significantly lower (P<0,05) than NH3 content with treatment R2 (7,16 mM). However, although NH3 content of treatment R1 was lower than treatment R2, NH3 content of treatment R1 and R2 was still in the normal range (4-12 mM) that could support optimal rumen function (Sutardi *et al.*, 1993). This is in accordance with Sattle and Lyter's

statement (1074) stating that ammonia production is affected by protein source in feed and the degradation level of protein in rumen.

## The effect of the treatments to Production Performance

Mean of daily body weight gain, feed consumption and conversion in white teak leaf and corncob-based complete feed is presented in Table 3.

**Table 3. Mean of daily body weight gain, feed consumption and conversion in white teak leaf and corncob-based complete feed**

| Parameter | Treatment | |
|---|---|---|
| | R1 | R2 |
| Feed consumption (g/head/day) | 414,51±121,13 [a] | 550,30±38.631 [b] |
| Body weight gain (g/head/day) | 39,35±10.73 [a] | 58,09±14.58 [b] |
| Feed Conversion | 10,70±2.44 | 9,82±1.78 |

Description: [a,b] different letters in the same row indicate significant difference (P<0.05); R1= White teak leave-based complete feed; R2= Corncob-based complete feed

The results of the statistical analysis showed that feed consumption of white teak leave-based complete feed was higher (P<0.05) than feed consumption of corncob-based complete feed (550,39 g/tail/day and 414,51 g/head/day). This is due to better cattle palatability to white teak leave-based complete feed than corncob-based complete feed. This is supported by the statement (Elita, 2006) stating that feed consumption is influenced by the palatability, energy level, protein and amino acid concentration, forage composition, temperature and body size.

The results of statistical analysis showed that body weight gain of domestic goats provided with white teak leave-based complete feed was higher (P<0.05) than body weight gain of domestic goats provided with corncob-based complete feed (58.09 gram/head/day and 39.35 gram/head/day). This is due to the difference in the amount of feed consumption.

The consumed amount of white teak leave-based complete feed was higher than the consumed amount of corncob-based complete feed. This resulted in rapid body weight gain during maintenance. This is supported by the statement of Parakkasi (1999) stating that one of the factors affecting body weight gain is feed consumption. The higher the amount of consumed feed the higher the livestock growth rate is.

Feed conversion on corncob-based complete feed was higher compared to the feed conversion on white teak leave-based complete feed (10, 70 and 9,82). The result of statistical analysis showed that feed conversion of each treatment was not significantly different (P>0.05), it showed that efficient use of domestic goat feed provided with corncob-based complete feed and white teak leave-based complete feed was relatively similar. Siregar (1994) adds that the efficiency of livestock is determined by two factors, feed consumption and body weight gain.

## Conclusion

1. Both types of fiber source, white teak leaf and corncob, used in complete feed formulation that sustain optimal rumen fermentation.
2. Although there were different level of consumption and daily body weight gain of both treatment groups, insignificantly different feed conversion in both groups showed that both types of complete feed had similar feed efficiency level.

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