# Substitution of Native Grass with Jengkol (*Archidendron jiringa*) Peel on Rumen Fermentation Characteristic in Sheep

Nur Hidayah[1*], Komang Gede Wiryawan[2], Sri Suharti[2], Wismalinda Rita[3], Nurhaita[3]

[1]*Department of Animal Science, Faculty of Agriculture, Tidar University, Indonesia*
[2]*Department of Nutrition and Feed Technology, Faculty of Animal Science, IPB University, Indonesia*
[3]*Department of Animal Science, Faculty of Agriculture, Bengkulu Muhammadiyah University, Indonesia*
[*]*Corresponding author. Email: nurhidayah@untidar.ac.id*

**ABSTRACT**
Jengkol (*Archidendron jiringa*) peel is potential crude fiber source for ruminant feed. Jengkol peel had higher fiber content (33.07-35.28%) than *Native grass* (29.65%), *Pennisetum purpureum* (31.29%), *Brachiaria decumbens* (30.55%), *Pennisetum purpupoides* (32.23%), and almost similar with *Brachiaria humidicola* (34.18%). Therefore, this research aimed to evaluate the effect of substitution of native grass with jengkol peel on rumen fermentation characteristics in sheep. Randomized block design with three treatments was used in this research. Treatments were substituted for jengkol peel 0, 15, 22.5% with five replications. Data were analysed using ANOVA and the differences among the means of the treatments were examined using DMRT. This research used 15 sheep with bodyweight ±15-27 kg; jengkol peel and concentrate were mixed as pellets. The result showed that native grass substitution with jengkol peel until 22.5% had no significant effect on pH (6.06-6.24) and $NH_3$ value (13.39-18.35%), but total VFA (68.90-103.23%) decreased with substitution of jengkol peel 15-22.5%. In conclusion, jengkol peel can't be used as a substitution native grass at 15-22.5% because can reduce energy supply for sheep.

***Keywords:*** *Jengkol peel, native grass, sheep fermentation characteristic.*

## 1. INTRODUCTION

Tropical countries have abundant agricultural waste [1]. This waste has been using many farmers as the main source of feed livestock in these countries. Azevêdo *et al.* [2] stated that ruminants can convert agro-industrial and agricultural by-products into high quality ruminant feed. Reutilization of agricultural wastes in farm animal nutrition is significant on economic, environmental, and social [3]. This condition indicated that using agricultural wastes as feed can help farmers to minimize feed costs and environmental waste impacts.

Jengkol (*Archidendron jiringa*) is a by-product of the jengkol tree. Jengkol peel considers as agricultural waste that did not optimize yet to utilize, just as garbage causes environmental pollution [4]. Hidayah *et al.* [5] stated that jengkol peel has potential as a ruminant feed. The percentage of jengkol peel (60%) had higher than jengkol. seed (40%). Statistic Center Data [6] reported that the quantity of Jengkol in Central Java Province at 11,127 tons, so the quantity of jengkol peel is around 6,676 tons. Jengkol peel had higher fiber content (33.07-35.28%) than *Native grass* (29.65%), *Pennisetum purpureum* (31.29%), *Brachiaria decumbens* (30.55%), *Pennisetum purpupoides* (32.23%), and almost similar with *Brachiaria humidicola* (34.18%). This is indicated that jengkol peel has potential as a crude fiber source for ruminant feed.

Native grass is a common fiber source that gives farmers to their livestock. But, the availability of native grass is fluctuates especially in the dry season, it becomes limited. Jengkol peel can be an alternative source of fibrous energy that can substitute of native grass. This research aimed to evaluate the effect of substitution of native grass with jengkol peel on rumen fermentation characteristics in sheep.

 

## 2. MATERIALS AND METHODS

### *2. 1. In vivo Experiment*

The material in this research was fifteen sheep with ±15-25 kg live body weight that randomly divided into three groups, native grass, pellet feed from jengkol peel powder and concentrate (rice bran, tapioca industry by-product, molasses, copra meal, NaCl, $CaCO_3$, urea, and premix) with 10-11% crude protein and 56-60% total digestible nutrient (Table 1 and 2). The experiment was conducted at the Research Farm of Animal Science Faculty of IPB University in 2019. The experimental protocols were reviewed and approved by the Animal Care Committee of the IPB University, Bogor, Indonesia. All animals were fed their daily diet with 3.5-4% of their body weight. The concentrate was offered twice daily at 8 am and 1 pm, whereas the native grass at 10 am and 3 pm. The native grass was chopped to 5-8 cm and clean water had excess to the animals twice daily after concentrate given.

**Table 1**. Feed formulation (% DM)

| Material | P1 | P2 | P3 |
|---|---|---|---|
| Native grass | 60 | 45 | 30 |
| Jengkol peel | 0 | 15 | 22.5 |
| Rice brand | 5 | 6 | 9 |
| Cassava by-product | 8 | 9 | 9 |
| Molasses | 8 | 8 | 8 |
| Copra meal | 15 | 13 | 10 |
| NaCl | 1 | 1 | 1 |
| CaCO3 | 1.5 | 1.5 | 1.5 |
| Urea | 1 | 1 | 1 |
| Premix | 0.5 | 0.5 | 0.5 |

**Table 2.** Nutrition content native grass substitution with jengkol (*A. jiringa*) peel (% DM)

| Material | P1 | P2 | P3 |
|---|---|---|---|
| Ash | 10.54 | 8.41 | 7.63 |
| Ether extract | 3.08 | 1.84 | 2.19 |
| Crude protein | 11.12 | 10.74 | 11.11 |
| Crude fiber | 22.93 | 24.32 | 23.58 |
| Nitrogen free extract | 52.32 | 54.70 | 55.49 |
| Total digestible nutrient | 60.24 | 56.81 | 59.07 |

### *2.2. Sampling and Measurement*

The pH value, NH3, and VFA total sample were from sheep rumen fluid that was taken 3 days before feces were collected. HANA pH meter was used to measure rumen pH. The Micro-diffusion Conway method [7] was used to measure ammonia ($N\text{-}NH_3$). A distillation method for analyzed total VFA concentration [7].

### *2.3. Statistical Analysis*

Randomized block design with three treatments and five replications was used in this experiment.
P1: Concentrate (40%) + Native grass (60%)
P2: Concentrate (40%) + Native grass (45%) + Jengkol peel powder (15%)
P3: Concentrate (40%) + Native grass (37.5%) + Jengkolpeel powder (22.5%)

Data were tested using Analysis of Variance (ANOVA) and the differences among the means of the treatments were examined using Duncan Multiple Range Test (DMRT) [8].

## 3. RESULTS AND DISCUSSION

Substitution of native grass with jengkol peel until 22.5% had no significant effect ($p$>0.05) on pH value (6.06-6.24) (Table 3). The Same result reported by Saro *et al.* [9], the different type of forage on ruminally cannulated sheep did not affect ruminal pH. The pH value at 6.23-6.83 on alfalfa hay (AL) and 6.27-6.63 on grass hay (GR) from rumen fluid were taken at 0, 4, and 8 hours after the morning feeding. Dehority [10] reported that the pH value in this research was normal (5.4-7.8).

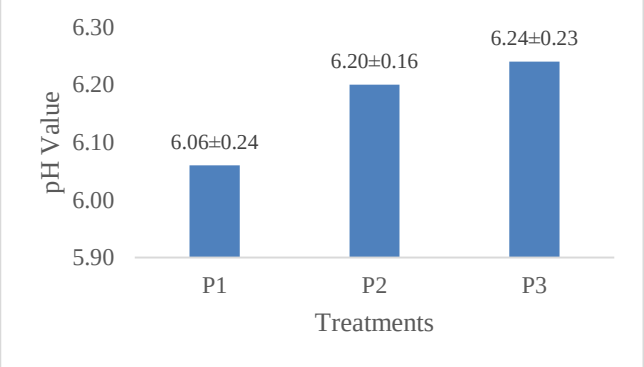


**Figure 1.** Sheep rumen pH from the substitution of native grass with jengkol peel

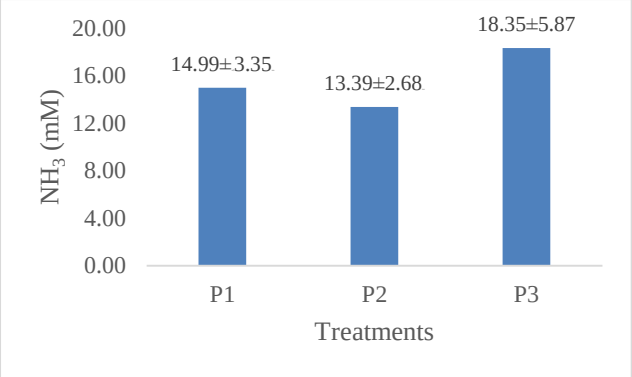


**Figure 2.** Sheep rumen $NH_3$ from substitution of native grass with jengkol peel

The same result with pH value, the substitution of native grass with jengkol peel until 22.5% had no significant effect ($p$>0.05) on $NH_3$ (13.39-18.35 mM) (Table 4). Valente *et al.* [10] stated that, the diet is very great contribution to $NH_3$ concentration in the rumen. The same result reported by Suryani *et al.* [11], the crude protein content of ration (12.04-15.09%) didn't affect $NH_3$ rumen fermentation (11.91-12.11%) of Bali cattle heifers age of 18 months. The higher protein content in diet (21.87% vs. 26.54%) had higher $NH_3$ rumen of sheep [12]. Sun *et al.* [13] stated that at the low feeding level, rumen fluid ammonia concentrations were lower when sheep were fed chicory (5 mM with crude protein 11.4%) than perennial ryegrass (18 mM with crude protein 19.7%). According to McDonald *et al.* [14], the concentration of $NH_3$ that optimal for microbial protein synthesis at 6-21 mM.

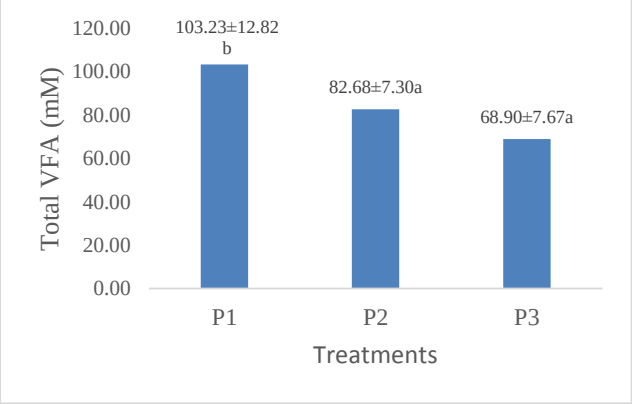


**Figure 3.** Sheep rumen total VFA from the substitution of native grass with jengkol peel

The treatment without substitution with jengkol peel had higher ($p$<0.05) total VFA (103.23 mM) than other treatments (68.90-82.68 mM) (Table 6). Substitution jengkol peel until 22.5% increased crude fiber and decreased TDN on ration (Table 2) that decreased total VFA. Jengkol peel had CF (33.07-35.28%), NDF (55.33-58.74%), ADF (40.84-43.78%), and TDN (51.56-52.81%) [5]. Soto-Navarro *et al.* [15] reported that forage with high NDF and ADF decreased total VFA. Alfalfa, grass hay, and lovegrass hay respectively had NDF (34.1; 74.7; 81.9%), ADF (23.1; 41.6; 44.9%) with total VFA rumen on streets (216.9; 160.8; 88.7 mol/100mol).

## 4. CONCLUSION

Jengkol peel can't be used as a substitution native grass at 15-22.5% because can reduce energy supply for sheep.

## AUTHORS' CONTRIBUTIONS

Nur Hidayah formulated and experimental design, analyzed the data, and drafted the manuscript. Komang Gede Wiryawan and Sri Suharti supervised the experimental design and checked the data analysis; Wismalinda Rita and Nurhaita read and approved the final version of the manuscript.

## ACKNOWLEDGMENTS

The authors acknowledge the financial support from the Ministry of Research, Technology, and Higher Education of Indonesia through "Penelitian Kerjasama Perguruan Tinggi" grant No. 2128/SP2H/LT/K2/KM/2019. Thank to D. Anggraeni, Een, Yogo, Andri, and Riandri for assistance in sampling and laboratory analyses. The authors also thank the Department of Nutrition and Feed Technology, Faculty of Animal Science, IPB University, Bogor, Indonesia to support for research facilities.

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