Fermentation characteristic with addition of Jengkol (Archidendron jiringa) peel powder on in vitro

Desi Purnama Sari¹, Sulaila¹, Ade Ahmad Almas Pabengsyah Putra Gustari¹, M Rofid Hibatullah¹, Nur Hidayah²*

¹ Undergraduate Program of Animal Husbandry Department, Faculty of Agricultural, University of Muhammadiyah Bengkulu, Bengkulu, Indonesia.
² Department of Animal Husbandry, Faculty of Agricultural, University of Muhammadiyah Bengkulu, Bengkulu-38119, Indonesia.
*Corresponding author e-mail: nurhidayah@umb.ac.id.

Abstract. This study was aimed to utilize jengkol (Archidendron jiringa) peel as a natural feed additive for ruminant livestock. Jengkol (A. jiringa) peel has a good nutritional content and contains of bio-active compounds (tannin and saponin) that can be potential to increase the productivity of ruminant livestock. Tannin had the function to bind protein and decreased methanogen population, and saponin had used as defaunation agent to decreased the rumen protozoa population. The treatments were arranged in a randomized block design with 4 treatments (0%, 2%, 4%, 6%) and 4 replications. The variables observed included pH value, dry matter and organic matter digestibility, and NH₃ concentration. Data were tested using Analysis of Variance (ANOVA) and the differences among treatments means were examined by Duncan Multiple Range Test. The results showed that the addition of Jengkol (A. jiringa) peel powder until 6% did not disturb (P> 0.05) pH value and digestibility (dry matter and organic matter digestibility), and strong significant (P <0.01) increased NH₃ concentration. The research concluded that the addition of Jengkol (A. jiringa) peel powder had potency to increase livestock productivity because increased NH₃ and did not disturb pH rumen, dry matter and organic matter digestibility.

Keywords – fermentation, jengkol peel, powder, in vitro.

1. Introduction

One of the most important aspect and determinant of success beef cattle business are cheap feed cost, good quality, and sufficient throughout the year. Good quality of feed is very important for livestock business because feed took 70% of the total production costs [1]. Another aspect, the feed that given for livestock must provide benefits to farmers and sufficient for livestock requirements. Feed supplementation is one of manipulation technique to increase beef cattle productivity. Tannin and saponin are bioactive compounds that can modified rumen microbe. These bioactive compounds can be beneficial or detrimental to ruminant livestock according to their structure and concentration [2]. Jengkol (A. jiringa) is one of plant that contain tannin and saponins with a total production in Bengkulu Province as much 2,822 tons in 2017 [3]. Another from production, Jengkol has potential from nutrition aspect. Jengkol peel contains of ash (3.39%), CP (8.83%), EE (0.65%), CF (27.50%), NFE (59.62%), tannins (7.82%), and saponins (56.92%) [4]. This study aimed to evaluate supplementation of Jengkol peel powder on digestibility (dry matter and organic matter) and pH in vitro.
2. Materials and methods

2.1. Preparing materials

Jengkol peel and forage was dried for 5-6 hours under the sun until got stable weigh. After that, the materials were milled with grinding machine to got materials into a fine powder form.

2.2. In vitro fermentation

In vitro fermentation was conducted according to the method of Tilley and Terry [5]. Into each 100 mL fermentation tube, 500 mg substrate, 40 mL McDougall buffer, and 10 mL rumen fluid were added at conducted at 39 °C. The rumen fluid for this experiment was collected after 3 h morning feeding from the 3 rumens fistulated Ongole crossbred beef cattle with Ethical Approval from Animal Care and Use Committee (AUAC) 01-2013b LIPI Cibinong. Samples from aliquol were taken after 4 h incubation for pH and after 48 h incubation for dry matter and organic matter digestibility analysis.

2.3. Sampling and measurement

The rumen’s pH was measured with pH meter and the dry matter digestibility (DMD) and organic matter digestibility (OMD) were measured using Tilley and Terry method [5].

2.4. Statistical analysis

The experiment was conducted in a randomized block design with 4 treatments (0%, 2%, 4%, 6%) and 4 replications. The treatment tested was the ration:

- A = Native grass (100%) + Jengkol peel powder (0%)
- B = Native grass (98%) + Jengkol peel powder (2%)
- C = Native grass (96%) + Jengkol peel powder (4%)
- D = Native grass (94%) + Jengkol peel powder (6%)

Data were tested using Analysis of Variance (ANOVA) and the differences among treatments’ means were examined by Duncan Multiple Range Test [6].

3. Results and discussions

3.1. Rumen pH value

| Jengkol Peel Powder (%) | pH         |
|------------------------|------------|
| 0                      | 6.95 ± 0.05|
| 2                      | 6.96 ± 0.07|
| 4                      | 6.90 ± 0.08|
| 6                      | 6.95 ± 0.09|

The addition of 2-6% Jengkol peel powder did not affect (P>0.05) on rumen pH value (Table 1). The result indicated that tannin and saponin on Jengkol peel powder did not disturbed activity of rumen microbial fermentation. The rumen pH value for all treatments was 6.90-6.96, which is still the normal range of rumen pH value 6.5-7.0 [7]. This is indicator that feed degradation process goes well, so that selulolitic bacteria can live optimally in the rumen [8]. The fermentation pH value of in all treatments at 6.8 which is still in the normal range of normal rumen pH.

3.2. Dry Matter and Organic Matter Digestibility

| Jengkol Peel Powder (%) | DMD (%)   | DMO (%)   |
|------------------------|-----------|-----------|
| 0                      | 45.83± 4.08| 46.04± 3.30|
| 2                      | 44.61± 3.96| 45.21± 3.07|
| 4                      | 44.32 ± 2.32| 45.23± 2.09|
| 6                      | 45.15 ± 3.38| 44.95 ± 3.33|
The results showed that the addition of Jengkol peel powder at 2-6% did not affect (P>0.05) on dry matter and organic matter digestibility (Table 2). This indicated that the addition of Jengkol peel powder until 6% did not disturb rumen microbial activity to digested feed. Dry matter and organic matter digestibility range from 45.21% until 46.04%. Complete feed range was used of dry and organic matter digestibility at 48.26 - 53.75% [9]. The addition of lerak extract (81.5% saponins) at 0.6 and 0.8 mg / ml of rumen fluid did not affected of dry and organic digestibility [10]. The addition of pure tannins 0.5 mg / ml on the hay substrate significantly (P <0.05) decreased organic digestibility up to 4.4% - 5.9% [11]. The different result depend on concentration and structure of saponin and tannin.

3.3. Rumen Ammonia (NH3) Concentration

The results showed that the the addition of Jengkol peel powder had strong significant effect (P<0.01) on NH3 concentration (Table 3). The higher addition of Jengkol peel powder given higher of ammonia concentration. The lowest ammonia concentration was found in the control (0%) treatment (5.92 mM) and the highest that found with the highest (6%) addition of jengkol peel powder (11.78 mM). The increased of ammonia concentration caused to be due to saponin in Jengkol peel powder can reduced protozoa population so increased bacteria population. The optimum concentration of ammonia in rumen between 85 - 300 mg /l or 6-21 mM [12]. This indicated that ammonia concentration still in the ideal range, which did not affected and disturbed rumen metabolic activity.

| Jengkol Peel Powder (%) | NH3 (mM)       |
|-------------------------|----------------|
| 0                       | 5.92 ± 0.52a   |
| 2                       | 6.78 ± 0.30b   |
| 4                       | 7.80 ± 0.61c   |
| 6                       | 11.78 ± 0.77d  |

Note: Means in the same coloumb with different superscript differ strong significantly (P<0.01)

The result showed that range of ammonia concentration from 5.92 to 11.78 mM in optimum conditions for microbial protein synthesis, and the normal ammonia concentration for rumen microbial growth at 4-12 mM [13]. The supplementation 0.1% extract lerak on high forage ration produced ammonia concentration at 4.11 - 9.86 mM [10]. Another result was reported, the addition of tannins and saponins in concentrated produced significant effect on increasing ammonia concentration [14]. The highest concentration of ammonia was produced with the addition of combination 1.5% tannin and 0.3% saponin (21.74 mM).

4. Conclusion

The research concluded that the addition of Jengkol (A. jiringa) peel powder had potency to increase livestock productivity because increased NH3 and did not disturb pH rumen, dry matter and organic matter digestibility.

5. References

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Acknowledgments
This experiment was funded by Directorate General of Higher Education, Ministry of National Education of Indonesia through “Program Kreativitas Mahasiswa” grant 2018.