The Effect of Protected Soybean Oil and Soybean Groats Base on in Vitro Dry Matter Digestibility, in Vitro Organic Matter Digestibility in the Rumen and Post Rumen

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Abstract. The aim of this study was to evaluate protected of soybean oil and soybean groats as feed supplement based on dry matter digestibility, organic matter digestibility in vitro in the rumen and post-rumen. Protected feed supplement was produced from soybean oil through two protection methods. It was saponification and microencapsulation. Soybean groats protected through formaldehyde 1%. This research uses a completely randomized design with 3 treatments which each treatment was repeated 10 times. Treatments were P0: 40% elephant grass + 60 basal concentrate; P1: 40% elephant grass + 50 basal concentrate + 10% soybean oil and soybean groats protected; P2: 40% elephant grass + 45 basal concentrate + 15% soybean oil and soybean groats protected. The results in the first step (rumen) of the P0 showed that has dry matter digestibility 69.50% and organic matter digestibility 69.74%, P1 has dry matter digestibility 50.07% and organic matter digestibility 52.55%, and P2 has dry matter digestibility 48.45% and organic matter digestibility 49.75%. In the second step (post rumen) the digestibility of P0 has dry matter digestibility 70.64% and organic matter digestibility 70.85%, P1 has dry matter digestibility 70.56% and organic matter digestibility 71.74%, and P2 has dry matter digestibility 73.17% and organic matter digestibility 73.86%. The results could be concluded that in the rumen protected of soybean oil and soybean groats have more resistant (stable) to microbial degradation than the basal diet and it can be degraded and digested in the abomasum to the small intestine.

1. Introduction
Energy and protein are the main nutrients needed for hormone synthesis, tissue growth and repair, milk synthesis and other physiological functions to meet basic life needs, growth, milk production and animal reproduction [1]. Increased energy intake in ruminants can be done by increasing feed energy using fat (oil), while protein intake can be increased by providing protected proteins that can escape degradation by rumen microbes [2]. Soybean oil and soybean groats are potential sources of protein. They both have the advantages that high of protein content, digestibility, and ration palatability [3]. However, soybean groats without protection in ruminant digestion has very degraded by rumen microbes. Therefore protection for soybean groats are needed to made bypass protein and soybean oil protection is needed to prevent unsaturated fatty acids from biohydrogenation process by rumen microbes [1]. Protection is also useful to eliminate the negative effects of high concentration of unsaturated fatty acid supplementation, and reduction in fiber degradability [4]. The aim of this study was to evaluate protected of soybean oil and soybean groats as feed supplement based on dry matter digestibility, organic matter digestibility in vitro in the rumen and post-rumen.
2. Material and Methods

2.1. Sample preparation
The ration was used in this research consisted of elephant grass, basal concentrate (rice bran, tofu waste, coconut meal, coffee pulp, pollard, vitamins, cassava waste, minerals and husk), soybean oil and soybean groats. Soybean groats was protected using formaldehyde as much as 1% of the dry matter for soybean groats. Rumen fluid is used as a microbial source. Rumen fluid was obtained from SimPO (Simmental Ongole Cross Breed) male cattle which were cut at the Jagalan Surakarta Slaughterhouse.

2.2. Study design
This study uses a completely randomized design with 3 treatments which each treatment was repeated 10 times. Treatments were P0: 40% elephant grass + 60 basal concentrate; P1: 40% elephant grass + 50 basal concentrate + 10% protected soybean oil and soybean groats; P2: 40% elephant grass + 45 basal concentrate + 15% protected soybean oil and soybean groats.

2.3. Data analysis
The data obtained in this study were analyzed using analysis of variance to determine the effect of treatment on the variables observed. If there is a treatment effect then proceed with Duncan's Multiple Range Test (DMRT) to determine the differences between treatments.

3. Result and Discussion

3.1. Dry matter digestibility
In vitro digestion is one method to determine the percentage loss of nutrient content of feedstuff during the fermentation process by rumen microbes which are simulated in the rumen. By knowing the digestibility of a feedstuff, especially in the research aimed at protecting fatty acids and feed proteins, the digestibility value is important to be used as a parameter or to determine the stability of the feedstuff in the rumen.

The result of protected soybean oil and soybean groats on the dry matter and organic matter digestibility in the rumen can be seen in Table 1.

| Variable       | Treatment        | P0     | P1     | P2     |
|----------------|------------------|--------|--------|--------|
| Dry matter     |                  | 69.50^A| 50.07^B| 48.45^B|
| Organic matter |                  | 69.74^A| 52.55^B| 49.75^B|

Notes: A, B= Different superscripts on the same line show significant differences (P<0.001).

The results showed that the average of dry matter digestibility on the rumen P0, P1 and P2 were 69.50%, 50.07% and 48.45% respectively. Organic matter digestibility of P0, P1 and P2 were 69.74%, 52.55% and 49.75% respectively. The result showed that protected soybean oil and soybean groats have a very significant effect on the rumen dry matter and organic matter digestibility. The rumen digestibility of this research was lower than previous research used protected of sardine fish oil 51.40% dry matter digestibility and 52.50 organic matter digestibility [4], but higher than Suhartanto previously research which used 1% formaldehyde concentration in complete feed pellets, which organic matter digestibility was 33.96 ± 2.32%. [5]

The stability of the protected soybean oil and soybean groats existed due to the saponification process and microencapsulation (calcium salt) of the soy bean oil and formaldehyde protected of protein soybean groats. soybean oil and soybean groats that have been saponified and microencapsulated can be an agent of protection [6] that resulted in decreasing the value of digestibility of dry matter and organic matter in the rumen digestion. The 2 formulations of lipid supplements for ruminants most investigated and applied commercially are calcium salts of free fatty acids and formaldehyde-protected...
the protein. Soybean oil calcium salts have typically been used to increase the energy density of the diet and are considered rumen inert as they do not adversely affect microbial degradation of feed. Formaldehyde protection involves encapsulation of lipid and protein within a formaldehyde-treated matrix and enables the use of esterified fatty acids and the protein [4,7].

3.2. Post rumen dry matter digestibility

Digestion is an early indication of the availability of nutrients contained in feedstuff. High digestibility manifestation of the large contribution of nutrients to livestock. The results of in vitro post-rumen testing on dry matter digestibility and organic matter protected supplementary feed can be seen in Table 2.

Table 2. In vitro test on post rumen dry and organic matter digestibility

| Variable                        | Treatment |     |     |
|---------------------------------|-----------|-----|-----|
|                                 | P0        | P1  | P2  |
| Dry matter digestibility        | 70.64^A   | 70.56^A | 73.17^B |
| Organic matter digestibility    | 70.85^A   | 71.74^B | 73.86^B |

Notes: A,B= Different superscripts on the same line show significant differences (P<0.001).

The results showed that the protected supplement feed in the ration had a very significant effect on dry and organic matter digestibility in post rumen (Table 2.).

The results of this research indicate that the digestibility mechanism of protected soybean oil and soybean groats in the rumen depends on the level of acidity rumen pH and small intestine. protected soybean oil and soybean groats will stable in a neutral pH (pH 7), but will dissolve in an acidic condition (pH 2-3). In pH neutral condition protected soybean oil and soybean groats remains stable so that it will prevent the biohydrogenation process by rumen microbes and did not interfere with the rumen fermentation process.

Protected feed supplement is reversible. It means the product is stable (not easily melted or decomposed) in the rumen liquid has a neutral pH, but the Ca, fatty acid bonds and the protein when passing the abomasum and small intestine which has a very acidic pH will release resulting in Ca ions, free fatty acids and protein then be absorbed in the small intestine [4,6].

4. Conclusion

The results could be concluded that in the rumen protected of soybean oil and soybean groats have more resistant (stable) to microbial degradation than the basal diet and it can be degraded and digested in the abomasum to the small intestine.

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