Blood profiles of thin-tailed lambs fed different levels and sources of protein

C D Fathia, M Arifin*, S Mawati and V Restitrisnani
Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang Jalan drh. Soejojo Koesomowardjo, Kampus UNDIP Tembalang, Semarang – 50275, Indonesia

Corresponding author: mukh.arifin@live.undip.ac.id

Abstract. This study assessed protein utilization in Thin-Tailed lambs. A total of 20 lambs (13.03 ± 2.30 kg) were allotted using 2×2 factorial arrangement. The first factor was protein levels of the ration (13 and 15%); whereas second factor was source of the protein ration (fishmeal and soybean meal). All lambs were kept in individual compartments. Increasing blood glucose occurs up to 8 hours after feeding and the peak of urea nitrogen levels were found on 4 hours after feeding. An interaction occurred (P<0.05) between protein level and source on blood glucose levels at 6 hours and nitrogen urea at 2 hours after feeding. Protein levels affected (P<0.05) glucose blood at 4 hours and affected nitrogen level at 2 and 4 hours. Lambs fed 13% has lower blood glucose and urea nitrogen than 15%. Protein sources affected (P<0.05) blood glucose at 4 and 8 hours and nitrogen at 0, 2, 4 and 8 hours. Lambs fed soybean meal has lower blood glucose and higher urea nitrogen than fishmeal. It was concluded that 13% protein levels with fishmeal was more efficient in the digestive system as indicated by blood glucose and urea nirogen.

1. Introduction
Sheep fattening has received serious attention from farmers due to consumer’s preference for low-fat meat even though the price is expensive. This condition can be proven by the existence of many restaurants that provide "Balibul Goat Satay" (Indonesia local food that made from lamb meat under five months) or "Batibul Goat Satay" (under three months) which is spread throughout Indonesia.

Feed requirement in sheep fattening industry is need to be considered to obtain high productivity and efficiency. The standard of feed requirements for lamb fattening in Indonesia are not available yet. Most of the farmer using trial and error in feeding their lamb leading to inefficiency for their industry and causes high production cost. This problem is caused by the feed given less or more than their feeding requirement. Research to find a standard feeding requirement for lamb fattening in Indonesia was done by several researchers. Lamb fed 12% feed protein was able to produce body weight gain [1]. Lamb fed 14% protein result the highest body weight gain with the feeding efficiency around 12-15% [2].

Therefore, this study aimed to find the best efficiency of crude protein levels between 13% and 15% in different source of protein based on blood parameters profiles.
2. Material and methods

2.1. Material

The experiment was located in Faculty of Animal and Agricultural Sciences, Diponegoro University. A total of twenty thin-tailed lambs with average body weight of $13.03 \pm 2.30$ kg was housed in individual cage. The ingredients of the feed included cassava meal, sugarcane leaves, cassava peel, molasses, source of protein (soybean meal or fish meal). The feeds were provided in pelleted form.

2.2. Methods

2.2.1. General. The feeding trials was designed as 2×2 factorial arrangement. The First factor was protein levels of the ration (13 and 15%); whereas the second factor was protein source of the ration (fishmeal and soybean meal). The nutrients of feed and its composition are shown in Table 1. Lambs were rise for 9-week of treatments, the lambs were fed ad libitum according to feeding treatment. Blood samples was collected on day 63 of treatment at 0, 2, 4, 6 and 8 hours after feeding trough jugular vein as much as 5 ml. Hematocrit was measured by micro hematocrit methods [3], blood glucose levels were measured by Randox method [3] and blood urea nitrogen levels were measured according to Berthelot method [4].

| Table 1. Feed and nutrient composition |
|--------------------------------------|
| Treatment                          | L1S1 | L1S2 | L2S1 | L2S2 |
| Feed ingredients/nutrient          |      |      |      |      |
| Cassava meal                       | 32.00| 34.00| 30.00| 32.80|
| Sugarcane leaves                   | 37.50| 33.00| 33.20| 29.80|
| Cassava peel                       | 1.50 | 1.80 | 3.00 | 1.30 |
| Molasses                           | 8.00 | 8.00 | 7.40 | 7.30 |
| Mineral                            | 2.00 | 2.00 | 2.00 | 2.00 |
| Soybean meal                       | 19.00| -    | 24.40| -    |
| Fish meal                          | -    | 21.20| -    | 26.80|
| Dry matter (DM)                    | 89.94| 88.96| 91.30| 89.58|
| Nutrient composition (100% DM)     |      |      |      |      |
| Ash                                | 14.16| 11.45| 14.34| 18.62|
| Crude protein (CP)                 | 13.13| 13.58| 15.20| 15.20|
| Ether extract (EE)                 | 1.15 | 2.76 | 1.99 | 6.41 |
| Crude fiber (CF)                   | 14.45| 12.85| 11.80| 12.65|
| Nitrogen free extract (NFE)        | 57.11| 59.36| 56.67| 47.12|
| Total digestible nutrients (TDN)   | 53.49| 50.49| 50.76| 49.22|

L1S1: 13% protein levels with soybean meal as a protein source, L1S2: 13% protein levels with fishmeal as a protein source, L2S1: 15% protein levels with soybean meal as a protein source and L2S2: 15% protein levels with fish meal as a protein source.

2.2.2. Statistic. The data obtained in this experiment were analyzed using analysis of variance [5].

3. Results and discussion

3.1. Pattern of blood glucose and blood urea nitrogen

The peak of blood glucose was found at 8 hours after feeding, while urea nitrogen at 4 hours after feeding (Figure 1).
Figure 1. Graph of blood glucose and blood nitrogen urea

Based on the results, blood glucose continues to increase until 8 hours after feeding (39.29; 47.88; 51.40; 55.56 dan 67.96 mg/dl). The peak of blood glucose concentration was found at 3 hours after feeding [6]. It was due to the feed was given ad libitum therefore the rumen digestion process keep continue. The animal with ad libitum feeding can maintain their blood glucose concentration, while restricted feeding result in decreasing blood glucose level at several hours after feeding [7]. The increase in blood glucose indicates utilization of feed energy, especially the formation of propionic acid in the process of carbohydrate fermentation in the rumen. Blood glucose in ruminants is strongly influenced by the rate of volatile fatty acids (VFA) production, especially propionic acid in the rumen [8]. Thus, it can be interpreted that the feed provided can meet energy requirement, the feed treatment can be effectively utilized by lambs, this is evidenced by the defend of blood glucose up to 8 hours after the start of feeding.

Urea nitrogen were found to decrease at 4 hours after feeding (18.00; 27.19; 26.05; 27.21 and 21.21 mg/dl). Increased urea nitrogen until 4 hour indicates an increase in the amount of ammonia production of feed fermented in the rumen that cannot be utilized by rumen microbes for microbial protein biosynthesis. Increase in urea nitrogen in protein consumption is due to the small number of rumen microbes [9]. So that it can be interpreted that protein feed at 4 hours after feeding can not be used efficiently by the digestive system. High concentration of blood urea nitrogen indicates that feed energy is not efficiently utilized by livestock in the rumen [10].

3.2. Blood glucose
The results of this study indicated no interaction (P>0.05) between factor of levels and source protein in affecting blood glucose at 0 to 8 hours after feeding, except at 6 hours after the start of feeding (Table 2). The source of feed protein was individually affected (P<0.05) at blood glucose at 4 and 8 hours after feeding. Lambs fed soybean meal has lower blood glucose than fish meal (45.34 vs. 57.47 mg/dl and 64.04 vs. 71.87 mg/dl, respectively). This is possible because fish meal contains more glucogenic amino acids than soybean meal. Total glucogenic amino acids (arginine) contained in fish meal are 3.65%, while for soybean meal is 2.01% [11]. The total amino acid in fish meal is also higher than soybean meal [12]. Glucogenic amino acids would form pyruvate and keto acids (h-ketoglutarate, succinyl CoA, fumarate and oxaloacetate), which used in krebs cycle to produce CO₂, H₂O and energy in the form of ATP [13]. Thus, feed with protein sources of fish meal can be used more efficiently as a source of blood glucose than soybean meal.

The protein levels ration was individually affected (P<0.05) at blood glucose at 4 hours after feeding. Lambs fed 13% has lower blood glucose than 15% (41.84 vs. 60.96 mg/dl, respectively). This shows that After 4 hours of feeding, lambs need energy to degrade nutrients in rumen, so that protein is used as an energy source. Protein can be degraded in the rumen requires enough energy and must be balanced with the crude protein to encourage rumen microbial activity [14]. It can also cause because after 4 hours of feeding, activity of amylolytic is still low so that crude fiber has not been degrade
optimally as a source of VFA. This shows, an increase in protein ration that is not balanced with an increase in energy sources that caused protein not used efficiently because protein is used as an energy source.

### Table 2. Hematocrit, blood glucose and urea nitrogen on Thin-Tailed Lambs

| Parameter               | Time | Level  | Sources Protein | Average |
|-------------------------|------|--------|-----------------|---------|
|                         |      |        | Soybean meal    | Fish meal |
| Hematocrit (%)          | 0    | 13%    | 45.80           | 41.40    | **45.08** |
|                         |      | 15%    | 47.20           | 45.90    |
| Blood Glucose (mg/dl)   | 0    | 13%    | 44.90           | 36.18    | **39.29** |
|                         |      | 15%    | 33.59           | 42.50    |
|                         | 2    | 13%    | 39.53           | 59.38    | **47.88** |
|                         |      | 15%    | 48.06           | 44.54    |
|                         | 4    | 13%    | 31.55           | 52.13    | **41.84** |
|                         |      | 15%    | 59.12           | 62.81    | **60.96** |
|                         |      |        | **45.34**       | **57.47** |
|                         | 6    | 13%    | 49.71           | 64.46    | **55.56** |
|                         |      | 15%    | 59.45           | 48.61    |
|                         | 8    | 13%    | 50.09           | 65.76    | **61.26** |
|                         |      | 15%    | 51.20           | 77.99    |
|                         |      |        | **50.64**       | **71.87** |
| Urea Nitrogen (mg/dl)   | 0    | 13%    | 19.74           | 17.47    | **18.00** |
|                         |      | 15%    | 22.09           | 12.69    | **20.92** |
|                         |      |        | **20.92**       | **15.08** |
|                         | 2    | 13%    | 24.20           | 18.90    | **21.55** |
|                         |      | 15%    | 40.50           | 25.16    | **32.83** |
|                         |      |        | **32.35**       | **22.03** |
|                         | 4    | 13%    | 24.08           | 20.50    | **22.29** |
|                         |      | 15%    | 33.49           | 26.12    | **29.80** |
|                         |      |        | **28.78**       | **23.31** |
|                         | 6    | 13%    | 25.08           | 22.53    | **27.21** |
|                         |      | 15%    | 35.68           | 25.56    |
|                         | 8    | 13%    | 24.68           | 16.67    | **21.21** |
|                         |      | 15%    | 25.76           | 17.71    |
|                         |      |        | **25.22**       | **17.19** |

Values within different superscript mean statistically significant difference (P>0.05)

#### 3.3. Blood urea nitrogen

The results of this study showed no interaction was found (P>0.05) between levels and sources protein on urea nitrogen at 0 to 8 hours after feeding, except at 4 hours after feeding (Table 2). The combination of 15% protein levels and soybean meal produced the highest urea nitrogen (40.50 mg/dl) (Table 5). The combination of 15% protein levels and soybean meal is inefficient because soybean meal has a highly degraded in the rumen, so many proteins are degraded into ammonia. The process of deamination in the rumen goes fast resulting high concentration of ammonia than peptides and amino acids [15]. Peptides and amino acids are used to support rumen microbial activity. Based on this
explanation, combination of 13% protein levels and fish meal can be used more efficiently in the digestive system.

The source of feed protein affected (P<0.05) urea nitrogen at 0, 2, 4 and 8 hours after feeding. Lambs fed soybean meal ration has higher urea nitrogen than fish meal (Table 2). Soybean meal has high degradation rate in rumen and has a large particle size, thus, the feed passage was slower and protein was converted into ammonia. Ammonia production which is not balance by VFA production caused ammonia conversion into urea nitrogen [9].

The protein levels affected (P<0.05) urea nitrogen at 2 and 4 hours after feeding. Lambs fed 13% protein has lower urea nitrogen than 15%. These study suggests that increasing protein level from 13 to 15% inefficient utilization of protein feed. Increased feed protein levels cause rumen microbes not able to utilize feed proteins properly. This because the increasing crude protein is imbalance with increasing TDN in feed [15].

3.4. Hematocrit
There was no interaction between levels and sources of protein on hematocrit (Table 2). The average blood hematocrit level in study sheep was 45.08%. The amount of hematocrit around 27 - 50% [16]. This can be interpreted that the protein combination used for the formation of PCV/eritrocyte in the studied lambs could be fulfilled its nutritional needs, both in lambs fed 13% or 15% protein levels, as well as lambs fed by soybean or fish meal.

4. Conclusion
Feeding 13% protein level with fish meal was more efficient in digestive system for Thin-tailed lambs compared 15% protein level with soybean meal. This efficiency can be proven by blood glucose and nitrogen urea levels.

References
[1] Supratman H, Setiyatwan H, Budinuryanto D C and Fitriani A 2016 J. Ilmu Ternak 16 31–5
[2] Prima A, Luthfi N, Rianto E and Purnomoadi A 2016 (Bangkok: LERDSILP PRINTING) pp 298–301
[3] Goñi I, García-Diz L, Mañas E and Saura-Calixto F 1996 Food Chem. 56 445–9
[4] Roseler D K, Ferguson J D, Sniffen C J and Herrema J 1993 Cows J. Dairy Sci. 76 525–34
[5] Steel R G D and Torrie J H 1993 (London: McGraw Hill International Book Company)
[6] Luthfi N, Lestari C M S and Purnomoadi A 2014 J. Indones. Trop. Anim. Agric. 39 152–8
[7] Yuwono P, Teleni E and Haryoko I 2003 Anim. Prod. 5 63–8
[8] Tahuk P K, Budhi S P S, Panjono and Baliarti E 2018 J. Indones. Trop. Anim. Agric. 43 43–53
[9] Akhsan F, Nuswantara L K and Achmadi J 2015 J. Indones. Trop. Anim. Agric. 40 153–8
[10] Carvalho M C, Soeparno and Ngadiyono N 2010 415–22
[11] Sitompul S A A D T I D B K S S I 2004 Tek. Pertan. 9 33–7
[12] Suthama N and Wibawa P J 2018 s J. Indones. Trop. Anim. Agric. 43 169–76
[13] Marczuk J, Brodzki P, Brodzki A and Kurek 2018 Pol. J. Vet. Sci. 21 149–56
[14] Sani F F, Nuswantara L K, Pangestu E, Wahyono F and Achmadi J 2016 J. Indones. Trop. Anim. Agric. 41 28–36
[15] Restitrisnani V, Purnomoadi A and Rianto E 2013 Ts J. Indones. Trop. Anim. Agric. 38 163–70
[16] Windberger U, Grohmann K, Goll A, Plasenzotti R and Losert U 2005 Clin. Hemorheol. Microcirc. 32 191–7