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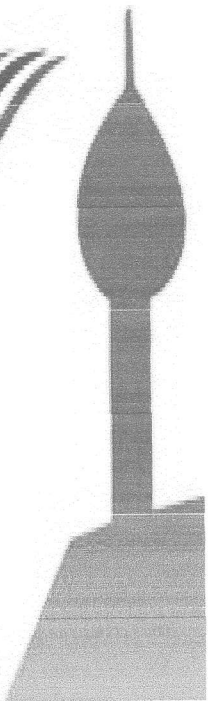
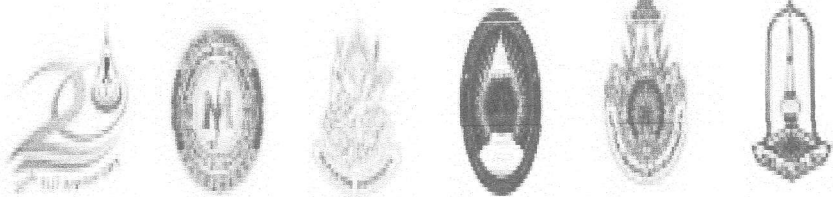
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-OP2003-

Blood metabolite status and immune response of indigenous sheep related to saponin intake

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Abstract

Saponin is a secondary compound which found some tropical browse plants. It is widely known that saponin may be triggered immune response in animals. The aim of the current study was to evaluate the effect of saponin contents in the tropical browse plants on blood metabolite and immune responses in indigenous sheep. Sixteen male growing sheep (average BW of 20 kg) were fed four experimental diets in Completely Randomized Design. The experimental treatments were combined with seventy percentage of native grass and thirty percentage of each the tropical browse plants (*Gliricidia sepium* (GS), *Moringa oleifera* (MO) and *Artocarpus heterophyllus* (AH)), while the diets contained only native grass was served as control. Dry matter, protein and saponin intake were observed. Blood metabolites including total protein, albumin, globulin and immunoglobulin-G were determined using ELISA. Phagocytosis and clearance test were done by challenged *Staphylococcus aureus* using total plate count method and evaluated descriptively. Dry matter and protein intake were significantly increased ($P < 0.05$) in sheep fed with GS and AH. Feeding AH was showed the highest intake of saponin. The experimental treatment did not affect the albumin and globulin concentrations in the serum, whereas the levels of total protein in the serum were significantly higher in animals fed MO and AH. The highest Immunoglobulin-G level was observed in animal fed MO which was saponin intake at the values $15 \text{ g h}^{-1} \text{d}^{-1}$. Phagocytosis capacity (360/50 cell) and clearance test (2.8 cfu/ml) challenge by *Staphylococcus aureus* bacteria also supported that the saponin intake in the ration containing *Moringa oleifera* could improve immune response for the indigenous sheep. The results suggest that supplementation of *Moringa oleifera* in the diet with $0.75 \text{ g kg}^{-1} \text{BW}^{-1}$ saponin intake can be used to maintain blood metabolites and healthy status of indigenous sheep.

Keywords: immune response, blood metabolites, indigenous, phagocytosis, clearance test

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Introduction

In most parts of humid tropical countries, browse may constitute an important fodder component to meet the maintenance requirements of ruminants, especially for farmers who practice extensive or semi-intensive farming. A number of browse plants (include legumes and herbs) may also contain chemical compounds, protein, fiber, mineral and vitamin concentrations adequate for the maintenance requirement of grazing animals (Aganga and Mosase, 2001). Problem with tropical browse plants is that they have high content of secondary compound like saponin. The secondary compound present in plants provide protection against predators, pathogens and invaders because of their antimicrobial activity. Saponin which have active compound, in such doze, can stimulate immune response of the animals through increase the antibody. Offering these plants in regulated amounts as supplements to grass diet (Reynolds and Adediran, 1988) may yield better intake, utilization, improve blood metabolites and healthy status. Saponin content in lerak (*Sapindus rarak*) can modify lipid metabolism, hematological status and improved of cattle performance by improving daily gain and health status (Astuti, et al., 2008). Hence, *in vivo* studies that address nutrient intakes, blood metabolites and subsequently on growth and health, would be best used to evaluate the feeding values of plants rich in uncharacterized secondary compound.

The aim of this study was to evaluate the blood metabolites status and immune responses of indigenous sheep fed native grass mixed with tropical browse plants which containing high levels of saponin. Those tropical browse plants contained saponin (*Moringa oleifera*, *Gliricidia sepium* and *Artocarpus heterophyllus*) which usually offered to the animals mixed with native grass should be evaluated for feeding practice management. The experiments designed in the present study was used to obtained scientific bases on existing farmers practices in using tropical browse plants (legume and herbs) in improvement of small ruminant nutrition strategies.

Materials and Methods

Sixteen male of growing sheep (av. BW 20 kg) were divided into four treatments and maintained in individual cages. The treatments were 100% native grass as control group; 70% native grass plus 30% *Gliricidia sepium* (GS); 70% native grass plus 30% *Moringa oleifera* (MO) and 70% native grass plus 30% *Artocarpus heterophyllus* (AH). Concentration of saponin was determined by method of Hiai et al.(1976) and found in grass, *Gliricidia sepium*, *Moringa oleifera* and *Artocarpus heterophyllus* were 2.30%; 4.91%; 4.65% and 5.97%, respectively.

A one-week feed adaptation period was allowed before measurement of daily intakes (DM, protein and saponin). Therefore nutrient intakes were measured for 7 weeks and conclude by blood sampling. During the last day of the experimental perios., blood samples were taken from the jugular vein. Immediately, the sample were measured blood metabolites concentrations such as total protein, albumin and globulin using general procedure of KIT diagnosis, while Immunoglobulin-G level was analysed using ELISA method. A set of *in vitro* blood test for immunity responses, phagocytosis capacity (Wibawan and Lammler, 1994) and clearance test were clarified using total plate count method (ISO 21528-1:2000) by challenged with *Stapilococcus aureus* bacteria (10^8 cfu/ml). All data were analyzed using Completely Randomized Design with four treatments and four replications, except phagocytosis and clearance test data. Duncan Multiple Range Test was used to separate treatment mean (Steel and Torrie, 2003). Significant differences between treatments were considered when $P < 0.05$.

Results and Discussion

Result showed that during two months feeding-trial, dry matter and protein intakes of ration containing *Gliricidia sepium* and *Artocarpus heterophyllus* were showed the highest compare to two other treatments ($P < 0.05$). Meanwhile, the highest consumption of saponin was observed in the animal fed the ration containing *Artocarpus heterophyllus* ($P < 0.05$). The lowest protein (41 g/d) and saponin consumptions were found in control ration ($P < 0.05$). Normally, protein requirement for local growing sheep (10-20 kg of BW) is around more than 75 - 135 g h⁻¹.d⁻¹ (Harjanto et al. 1993). The animals which only give total native grass were suffered from the protein deficiency, because of very low protein intake. Supplementation with 30% of *Gliricidia sepium* and *Artocarpus heterophyllus* in the ration resulted in an increased total dry matter intake around 20% and 19%, respectively. Dry matter intake (DMI) for 10-20 kg of local sheep was around 500 - 1000 g h⁻¹ d⁻¹, or for about 4% - 5% of BW (Tomaszewska et al. 1993; Astuti and Sastradipradja (1999). This study also showed that dry matter intake of sheep were started from 500 - 610 g h⁻¹ d⁻¹, or was about 4.5% of BW.

Supplementation with 30 % of *Moringa oleifera* in sheep ration resulted 54 g protein intake and saponin intake was around 15 g h⁻¹ d⁻¹ or equal with 0.75 g h⁻¹ d⁻¹ (average 20 kg BW). The situation cause increased of serum protein and immunoglobulin-G significantly. Serum protein and immunoglobulin-G were indicator of healthy status.

Table 1. Intake and blood metabolite parameters (\pm SD) of sheep fed with tropical forages.

Parameters	Control	GS	MO	AH
<i>Intake:</i>				
Dry matter (g/d)	506 \pm 28 ^b	610 \pm 17 ^a	501 \pm 0.64 ^b	604 \pm 24 ^a
Crude protein (g/d)	41 \pm 2.37 ^d	72 \pm 2.52 ^a	54 \pm 0.15 ^c	62 \pm 3.15 ^b
Saponin (g/d)	11 \pm 0.66 ^d	18 \pm 0.86 ^b	15 \pm 0.25 ^c	20 \pm 1.80 ^a
<i>Blood metabolites:</i>				
Total protein (mg%)	6.4 \pm 0.02 ^{ab}	6.2 \pm 0.20 ^b	7.0 \pm 0.56 ^a	7.27 \pm 0.17 ^a
Albumin (mg%)	42.8 \pm 2.5	44.45 \pm 0.90	48.92 \pm 3.89	46.87 \pm 3.15
Globulin (mg%)	50.40 \pm 1.10	49.91 \pm 0.76	52.01 \pm 2.70	49.57 \pm 1.67
IgG (mg%)	807 \pm 14 ^c	890 \pm 19 ^b	923 \pm 6 ^a	881 \pm 19 ^b

Means in the same row followed by different letters are significantly different ($P < 0.05$).

GS = *Gliricidia sepium*; MO = *Moringa oleifera*; AH = *Artocarpus heterophyllus*.

DM, CP and saponin were analysed at Bogor Research Centre (2009)

All experimental diets did not affect on the concentrations of serum albumin and globulin. The total serum protein concentration in *Moringa oleifera* and *Artocarpus heterophyllus* rations were significantly higher ($P < 0.05$) than the control and *Gliricidia sepium* treatments. The concentrations of immunoglobulin-G were significantly increased ($P < 0.05$) after supplementation of the plants. The highest value was found in the sheep fed *Moringa oleifera* treatment (Table 1). All values were within the physiological ranges (Sasser et al., 1985; Tizard, 1988). In the current study, the consumed high protein in *Gliricidia sepium* treatment did not relate to the total serum protein level. Mathius (1991) reported that secondary compound of *Gliricidia sepium* (i.e. prussic acid and coumarin) might disturbed of nutrient utilization. However, the supplemented 30% *Moringa oleifera* in the ration, with 0.75 g.kg.BW⁻¹.d⁻¹ saponin intake could improve protein and immunoglobulin-G serum concentration.

Tabel 2. Data of phagocytosis capacity and clearance test (cfu/ml).

Parameters	Control	GS	MO	AH
Phagocyt cap./50cell	347±13	340±7	360±10	320±14
Clearance test (cfu/ml)	4.05	3.36	2.8	3.35

Data *in vitro* study of phagocytosis capacity and clearance test using sheep serum according to the treatments result that ration containing *Moringa oleifera* had better potential to improve immune response, descriptively. The *Moringa oleifera* treatment showed that capacity of phagocytosis to the *Stapilococcus aureus* bacteria was 360/50 cell, means that leucocyte from the treatment could phagocyte 360 of bacteria. However in the same treatment, the result of clearance test was 2.8 cfu/ml, this means the lowest growth colony of bacteria was happened in *Moringa oleifera* treatment. Capacity of phagocytosis is defined by total bacteria cell which is swollen by 50 cell of leucocyte. Clearance test is one of method to evaluate bacteria growth by count the colony between control and treatment test. The lower amount of bacteria colony growth, the best treatment we get. Ration containing *Moringa oleifera* with a certain doze of saponin (0.75 ppm) tenden have good effect to the animal immune response as expressed by high of Immunoglobulin-G and protein serum concentration and also supported by data of phagocytosis and clearance test. Astuti et al. (2008) reported that sheep raised under the tropical forest management fed by sole grass only had low concentration of total protein. It is recommended that sheep need some tropical browse plant in their ration.

Conclusions

Supplementation of 30% *Moringa oleifera* in the ration with 0.75 ppm of saponin intake was the best choice for improving serum protein and immunoglobulin-G of indigenous sheep.

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References

- Aganga, A.A. and K.W. Mosase. 2001. Tannin content, nutritive value and dry matter digestibility of *Lonchocarpus capassa*, *Ziziphus mucronata*, *Sclerocarya birrea*, *Orkia acuminata* and *Rhus lancea* seed, Anim. Feed Sci. Technol. 91: 107–113.
- Astuti, D.A. and D. Sastradipradja. 1999. Energy metabolism in relation to grazing activity in growing priangan sheep as affected by rations. Indonesian J. Trop. Agric. Vol. 3
- Astuti, D.A., D.R. Ekastuti, Marwah and Suryani. 2008. Blood profil and hematological status of local sheep under the rain forest area Walat-Sukabumi. J. Ilmu Ternak UNSYAH. Vol. 1: 2008.
- Harjanto, B. and A. Djajanegara. 1993. Nutrient requirement for small ruminant in Indonesia. Animal Research centre, Bogor.
- ISO 21528-1. "Microbiology of food animal feeding stuffs-Horizontal method for the detection and enumeration of enterobacteriaceae" 2000.
- Mathius, W. 1991. *Gliricidia sepium* as a feedstuff for the ruminant. Wartazoa 1(4): 19-23.