Physiological Status, Blood Profile and Body Composition of Sheep Fed with Ca-Saponified Lemuru Oil Coated by Herbs

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ABSTRACT

Indonesia is one of humid-tropical country with average daily temperature range from 22 - 35^{o}C with relative humidity around 85%. In this condition, animal has problem with body thermoregulation and utilization of energy budget. To solve the problem, nutritionist tries to reduce *heat increment* trough feeding management. This study was aimed to evaluate physiological status, blood profile and body composition of sheep fed with ca-saponified lemuru oil coated by herbs. Twenty thick tail sheep (av. BW 23 kg) were used in this experiment. The average room temperature during experiment was 22–33^{o}C with 83–92% relative humidity. All animals fed with concentrate contained 3% ca-saponified lemuru oil and king grass (1:1) *ad libitum*. Treatments were control diet without ca-saponified lemuru oil (R1); ca-saponified lemuru oil coated by curcumae (R2); ca-saponified lemuru oil coated by ginger (R3); ca-saponified lemuru oil coated by *Eugenia polyantha* (R4) and ca-saponified lemuru oil coated by *Pluchea indica* Less (R5). Design of this experiment was completely randomized design with four replications of each. The parameters observed were respiration rate, heart rate and body temperature, while from the blood profile were erythrocyte, haemoglobin, PCV, leucocytes and it differentiations. Using Urea space technique the body composition (body water, protein and fat) were calculated. Result showed that thick tail sheep reared in high temperature room fed with ca-saponified lemuru oil coated by herbs had not significance difference on body temperature, heart rate and respiration rate in all treatments. There was tendency to increase heart rate and respiration rate in the afternoon caused by environment temperature and the activity. The percentage of body composition was same in all treatments, but for total body fat and energy retained in treatments were lower than control. The parameters of blood profile showed that total leucocytes, netrophil and lymphocytes were significantly increased in herb treatments compared to control. It is concluded that supplementation of 3% ca-saponified lemuru oil coated by herb (curcuma, ginger, *Eugenia polyantha* and *Pluchea indica*) in thick tail sheep had better immune respond (higher leucocytes, lymphocytes and netrophil) and lower total body fat and energy retained.

Key words: Ca-saponified, lemuru oil, herbs, curcuma, leucocytes

INTRODUCTION

Lamb meat has high cholesterol which caused metabolic syndrome disease (atherosclerosis). This situation reduces demand of this product. On the other hand, sheep is one of favorite animal and usually reared as a saving animal. It is important to manage system in order to get good quality of meat without reduce the productivity. Feeding management can solve the problem through manipulation rumen fermentation. It was reported that meat cholesterol in sheep (80 mg%) was higher than in beef (74 mg%) and chicken broiler (73 mg%). Composition of lamb meat contained 18.6% protein, 12.94% of fat and 0.07% of cholesterol (Nutrition Glossary, 2005). Ruminant meat contains high saturated fatty acids (laurate, myristate, andpalmitate) that caused high cholesterol in the plasma (Grande, 1975).

Polyunsaturated fatty acids (PUFA) omega-3, in the fish oil can reduce risk of atherosclerosis (Iger, 2003). Substitution polysaturated fatty acid with polyunsaturated fatty acid could reduce total cholesterol, include LDL-cholesterol (Marsic and Yodice, 1992). Source PUFA, which high omega-3 is lemuru oil from lemuru fish.

Fat has higher energy content compared to carbohydrate and protein. As a feedstuff, fat resulted low heat increment in metabolism, so it is good add in animal ration of the tropical country to reduce heat stress. Specific problem in

tropical country is high humidity and environment temperature which caused decrease feed intake, difficulties to evaporate heat production and increase respiration rate. On the other hand, high forages intake caused high heat increment (Sudarman and Ito, 2000). In order to reduce the negative effect of high environment temperature, it is suggested to give fat in the ration. Fat addition in the ration will reduce heat increment but increase energy intake. Wachira *et al*. (2002) reported that fish oil could reduce dry matter intake in sheep. Palmquist and Jenkins (1980) reported that fatty acid in the rumen can reduce by supplement calcium, so the fat could not coupled rumen microorganism. Through the bypass rumen technique, fat can add until 5% without decreased digestibility fiber.

Sudarman *et al*. (2006) reported that utilization of 1.5% ca-saponified lemuru oil in ration could reduce meat cholesterol-LDL on sheep until 32 % and increased feed efficiency until 36%. Problem was the ration had bad smelt and caused decrease feed intake.

Herbs have good effect to palatability. *Curcumae domestica*, *Zingiber officinale* Rosc., *Eugenia polyantha and Pluchea indica* Less are some herbs that has specific smelt and good taste. The secondary compound of *Eugenia polyantha* is eugenol, citral and methylchavicol, while secondary compound of *Zingiber officinale* is fellandren, kamfer, borneol, zingiberin, zingiberol, gigerol, zingeron, vitamin A, B1, C and the secondary compound of *Curcumin domestica* is turmeron, zingiberen; turmerol, fellandren, (Asiamaya, 2006). The secondary compound of *Pluchea indica* is some amino acids such as leusin, isoleusin, triptofan, treonin, vitamin A and C (Asiamaya, 2003). In order to increase feed intake, ca-saponified lemuru oil has coated with those herbs. Percentage of herbs on lemuru oil should be determined for reducing side effect of the herbs.

This research was aimed to evaluate the effect of supplementation kind of herbs to ca-saponified lemuru oil (*Curcumae*, *ginger, Eugenia polyantha and Pluchea indica* Less) on physiological status, blood profile and body composition using urea space method in thick tail growing sheep.

MATERIALS AND METHODS

Twenty male thick tail growing sheep (av. 25 kg BW) were used in this experiment. Animal were fed concentrate contained Ca-saponified lemuru oil coated by kinds of herbs and water served *ad libitum* in all time. Ration was consist of concentrate and native grass 1:1. Concentrate (87.5% DM) supplemented with 3% of ca-saponified lemuru oil coated by herb. Ca-saponified lemuru oil was made by double decomposition method (Jenkin dan Palmquist, 1984). Before the ingredient mix with other feedstuff, the herbs were added around 10% into ca-saponified lemuru to coat the fat in order to reduce the strong smelt. The formulation ration consisted of palm kernel meal, coconut meal, cassava meal, pollard, molasses, urea, soy bean meal and trace minerals. Composition of proximate analysis was 16% crude protein, 5% of extract ether, 10% crude fiber and totally has 70% TDN. Using a completely randomized design, four treatments with five replications were arranged as:

R1 = control ration without lemuru oil
R2 = ration supplemented with 3% ca-saponified lemuru oil coated by curcumae
R3 = ration supplemented with 3% ca-saponified lemuru oil coated by ginger
R4 = ration supplemented with 3% ca-saponified lemuru oil coated by *Eugenia*
R5 = ration supplemented with 3% ca-saponified lemuru oil coated by *Pluchea*

During two months experiment the physiology parameters like daily heart rates, respiration and body temperature were evaluated morning, at noon and afternoon.

Prior to and the last week of the experimental period, each sheep was sampled the blood in order to evaluate the profile of blood (erythrocyte, haemoglobin, PCV, leucocytes and its differentiation) and continued injected with 130 mg urea/kg metabolic body size (MBS) dissolved in sterile saline (200 g.ltr $^{-1}$) through jugular vein within one minute, and times was recorded at the beginning and the end of injection. Jugular vein was flush with 3 ml of heparinized saline after urea injection. The actual quantity of urea injected was determined gravimetrically by weighing syringes before and after injection. Blood samples were obtained before injection and 12 minutes after the mean injection time. The zero time samples were analyzed for hematology parameters while the rest was separated by centrifugation of blood at 10.000 x g for 10 minutes to get plasma for urea-N by KIT method. Urea space was calculated by dividing the dose of urea N injected with the change in plasma urea –N before and after 12 minutes injection, following the equation as described by Bartle *et al*. (1983), while body

protein and fat were calculated following Panaretto and Till (1963), and body water according to Rule *et al*. (1986).

All formulas were expressed as following:
Urea Space (%) =

$$\frac{\text{Dose of urea-N urea injected (mg)}}{\text{Change in plasma urea-N (mg\%)x 10 x Live Weight (LW)}}$$

Body Water (%) = 59,1 + 0,22 X US (%) – 0.04 LW
Body Protein(%) = 0,265 X BW (%) -0,47
Body Fat (%) = 98 – 1,32 X BW (%)

The hematology parameters were measured as mention by Sastradipradja *et al*. (1991). The significance of difference between means were compared using Duncan Multiple range test after ANOVA using program Minitab/SPSS release 6.1 version.

RESULTS AND DISCUSSION

The data on physiological status are presented in Table 1. There was no significance difference of body temperature, respiration rate and pulse in all treatments. Supplemtation of 3% herbs in the ca-saponified lemuru oil resulted increasing of respiration and heart rate, especially at noon and afternoon. Increasing of pulse and respiration rates at that time had correlation with daily activities and environmental temperature. This data were similar with body temperature, 38.5^{o}C, in the morning and 39.30^{o}C in the afternoon that reported previously (Astuti and Sastradipradja, 2000).

Table 1. Physiologis status of sheep fed with ca-saponified lemuru oil coated by herbs

Parameters	R1	R2	R3	R4	R5
Body temperature (^{o}C)					
Morning	38.7	38.7	38.4	38.5	38.6
Noon	38.9	38.8	38.8	38.7	38.9
Afternoon	39.1	39	39	39	39
Heart rate: beat/min					
Morning	97	94	90	97	96
Noon	102	100	91	98	96
Afternoon	115	105	100	113	103
Respiration: /min					
Morning	29	30	32	30	31
Noon	49	63	61	60	58
Afternoon	52	53	54	43	48

Note: R1, R2, R3, R4 and R5 were control, curcumae, ginger, *Eugenia and Pluchea indica Pluchea indica*, respectively.

Table 2. Blood profile of sheep fed with ca-saponified lemuru oil coated by herbs

Parameters	R1	R2	R3	R4	R5
Erythrocyte (10 ^{6}/mm3)	10.6±1.01	10.4±0.70	10.7±099	9.1±1.1	9.7±0.37
Haemoglobine	9.1±0.70	8.67±0.58	8.7±0.51	8.5±0.40	7± 0.90
PCV	26±2	29±4	29±2.6	28.5±2.5	28±1.5
Leucocyte (10^{3}/mm3)	8±0.3^{b}	9.5±0.09^{a}	8.4±0.01^{ab}	8.9±0.37^{a}	9±0.22^{a}
Lymphocyte	41.75±15^{b}	52.75±13^{a}	37±11^{b}	39.5±7^{b}	35.25±5^{b}
Netrophyls	45±15^{b}	49.5±9.7^{a}	56±11.5^{a}	50±5.85^{a}	53±15^{a}

Note: R1, R2, R3, R4 and R5 were control, curcumae, ginger, Eugenia *and Pluchea indica*, respectively. Superscript with different notation in th same colom was significance (P<0.05).

Table 3. Body composition of sheep fed with ca-saponified lemuru oil coated by herbs

55Parameters	R1	R2	R3	R4	R5
Body water (%)	57.7	57.8	57.8	57.9	57.8
Body fat (%)	21.8	21.7	21.7	21.6	21.7
Total body fat (kg)	7.62^{a}	7.34^{b}	7.35^{b}	6.90^{b}	7.32^{b}
Body protein (%)	14.8	14.8	14.9	14.9	14.9
Total body protein (kg)	5.18	5.03	5.03	4.76	5.01
Energy retained (kJ)	424.21^{a}	410.04^{b}	409.83^{b}	385.68^{b}	408.44^{b}

Note: R1, R2, R3, R4 and R5 were control, curcumae, ginger, Eugenia *and Pluchea indica*, respectively. Superscript with different notation in the same colom was significance (P<0.05).

Blood profile data of erithrocytes, hemoglobines and PCV were same in all treatments and in the range of normal condition. The normal value of hemoglobine is 10 – 12 mg%, PCV is 28 – 32% and erithrocyte is 6-9 x 10^6/mm3 (Guyton and Hall, 1997). Total erythrocyte will decrease following the age. Data of erithrocyte in this experiment was higher than data reported previously (erithrocyte was 4 x 10^6/mm3 and emoglobine was 6.7 mg%) in local sheep under the forest area with low quality diet (Astuti *et al*., 2009). Leucocytes, lymphocytes and netrophyl were significantly difference caused by treatments ($P<0.05$). Herbs (dominantly curcumae) on ca-saponified lemuru oil increased number of lecocytes, lymphocytes and netrophyls. It is known that leucocyte and lymphocytes has imune effect on body condition.

There was no significance difference in body water using urea space technique, the same situation holds for body protein and boby fat. This experiment has data of body water around 57%, while body fat and body protein were 21.8% and 14.9%, respectively. The values of percentage body water and body protein in this study were lower than data reported previously in growing priangan sheep (Astuti and Sastradipradja, 1999). The body water and body protein of growing priangan sheep were around 68% and 16.80%, while body fat was 9.78%. Local sheep with high fat and low body water and protein showed that these animal were older than growing priangan sheep. There is close correlation between age and body composition. Fat percentage will increase following the age, while body water and protein will decrease in older animal.

Total body fat (kg) and energy retained (kJ) in herb treatments were lower than those of control ($P<0.05$). Herbs with secondary compound tended to decrease fat deposition on body composition. It was similar with previously data that curcumae could reduce fat-cholesterol (Sudarman, 2006).

CONCLUSIONS

Supplementation of 3% ca-saponified lemuru oil coated by herb (curcumae, ginger, *Eugenia polyantha* and *Pluchea indica*) in thick tail sheep had better immune respon (higher leucocytes, lymphocytes and netrophyls) and lower total body fat and energy retained.

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