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Energy Balance and Blood Metabolites Status of Local Sheep Based on *Indigofera* sp and Sproutbean Waste Ration

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ABSTRACT

This research was undertaken to evaluate energy utilization and blood metabolites status of male Indonesian local sheep involving nutrient balances and using urea space techniques for measurement body composition. Factorial randomized completely design was used in this study using 16 growing male local sheep. Factor A was breed which consisted of 8 Garut sheep (av.BW 14.90 kg) and 8 Jonggol sheep (av.BW 13.60 kg). Factor B was different ration which received of diet containing *Indigofera* sp. and sproutbean waste. The ration offered were pellets containing CP around 16% and energy 15.6 MJ GE/kg. Energy balance and blood metabolites studies were conducted during three-months trial. Intake, digestibility, urinary and metabolism variables were measured based on total collection method. Methane energy was measured by rusitec technique and methane gas production multiplied by calory equivalent value of methane. Energy retention (RE) was measured by urea space technique. Heat production was calculated from ME-RE. Plasma glucose, cholesterol and urea-N were measured by using spectrophotometry. Results showed that there were significant differences of energy intakes, digestibilities and metabolism among the rations. Animals fed with sproutbean waste ration has higher energy utilization compared to those fed *Indigofera* sp ration. There were no significant different for all blood metabolite variables among breed and its interaction between combination treatments. It is concluded that sproutbean waste in local sheep ration has higher energy utilization and daily gain than *Indigofera* sp.

Keywords: *Indigofera sp.*, local sheep, rusitec technique, sproutbean, urea space

ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi penggunaan energi dan status metabolit darah domba lokal Indonesia melalui pengukuran neraca energi dan metoda ruang urea untuk mengukur komposisi tubuh. Rancangan Acak lengkap pola faktorial digunakan pada penelitian ini selama tiga bulan dengan menggunakan 16 ekor domba tumbuh. Faktor pertama adalah bangsa (Garut dan Jonggol), sedangkan faktor kedua adalah perbedaan sumber serat yaitu *Indigofera* sp dan limbah toge. Ransum yang diberikan berupa pelet dengan kandungan protein 16% dan energi bruto 15,6 MJ GE/kg. Variabel yang diukur adalah konsumsi, kecernaan, koleksi urin dilakukan dengan metode koleksi total. Energi metana diukur dengan metode rusitec dan produksi gas metana dihitung dengan mengalikan nilai setara kalor untuk metana. Retensi energi dihitung dengan cara ruang urea. Produksi panas dihitung dari ME-RE. Plasma glukosa, kolesterol dan N-urea diukur dengan alat spektrofotometer menggunakan kit. Hasil menunjukkan bahwa ada perbedaan nyata dari konsumsi, kecernaan dan nilai metabolisme energi antar perlakuan, namun tidak ada interaksi antar perlakuan. Perlakuan dengan pemberian limbah toge menunjukkan nilai neraca energi yang lebih tinggi dibandingkan dengan pemberian *Indigofera* sp. Semua status metabolit darah sama antar perlakuan, dan tidak ada interaksi antar perlakuan. Disimpulkan bahwa pemanfaatan energi dan peningkatan berat badan pada domba lokal yang diberi limbah toge lebih baik dibandingkan dengan yang diberi *Indigofera* sp.

Kata kunci: domba lokal, *Indigofera* sp., limbah toge, ruang urea, teknik *rusitec*

PENDAHULUAN

Sheep production plays an important role within farming systems in the humid tropics of the developing countries as an income-generating activity and animal protein production. Problem with sheep production in tropical developing countries is limited by feed quality and unbalance of energy utilization caused by low quality of forages due to high temperature and humidity of environment. Lack of nutrient intake of ewes reared under the Tropical Rain Forest area caused high deadly birth rate and pregnant ewes (Astuti *et al.* 2009). High fiber ration for growing sheep under the traditional feeding system with high temperature environment will produce high heat production. One of tropical legumes which have 27% CP content and leaves production around 4 tons DM/ha is *Indigofera* sp. (Abdullah 2010). On the other hand, on traditional market waste such as sproutbean waste is one of feedstuff which have 13.65% CP and 65% TDN (Rahayu *et al.* 2011). Garut and local sheep (from crossing Jonggol ewes are indigenous crossbred of Indonesian thin tail sheep which are small in body size but well known for their prolificacy. Garut sheep is come from local area at district of southern part of West while Jonggol sheep is come from local area at district of nothern part of West Java, Indonesia. They have potential to produce carcass until 40% – 45% with low fat quality through good management feeding practices (Herman 2002; Wiryawan *et al*. 2009).

There is a paucity of information on energy utilization of sheep in the humid tropics feeding management system, especially on global warming situation. Hence *in vivo* studies that address to evaluate energy utilization and blood metabolites status on growing Indonesia local sheep based on local resources feedstuff would be best done to support animal's survival and production performance. The objective of the study was to measure energy balance of two kinds local breed (Garut and Jonggol sheep) fed with two kinds of rations (*Indigofera* sp. and sproutbean waste) involving total collection, RUSITEC and urea space technique.

METODE

Eight Garut and eight Jonggol male sheep with av.BW 14 ± 0.6 kg were used for three months. The animals were randomly allotted into two rations with contained 30% of *Indigofera* sp and 30% of sproutbean waste. The rations offered were pellets containing CP 16% and gross energy 15.6 MJ GE/kg. A one-month feed adaptation period for the growing sheep was allowed and followed by daily intakes and DM evaluation, before energy balance were measured at the end of this experiment using metabolic cages. Blood samples were drawn from the jugular vein to directly measure of blood metabolites concentrations such as glucose, cholesterol and urea-N by using general procedure of KIT diagnosis, a week before total collection. Urea space measurement with modification (Rule *et al*. 1986) were used to calculate percentage of total body protein and fat. Animal were weighing once a month and the ADG was used to calculate total body protein and fat. Total energy retention (RE) was calculated from total body protein and fat using the heat of combustion values 23.85 and 38.50 kJ/g of body protein and fat, respectively. Methane production (ml/h/d) from the RUSITEC tehnique was used to calculate energy loss from ruminal methane production. Urinary energy loss (UE) as urinary-N times 34 kJ/g N. Energy expenditure or heat production was calculated as the difference between ME and RE.

A Completely Randomized Design with factorial 2x2 and four replications was adopted. Factor A was two breeds (Garut and Jonggol sheep) while factor B was two rations (30% of *Indigofera* sp. and 30% of bean sprout waste, in the ration). The significance of difference between means was compared using Duncan Multiple Range Test (Steel and Torrie 1986).

RESULTS AND DISCUSSION

Results showed that sproutbean waste ration improved DM, CP, CF and fat consumption ($p<0.05$) which 914; 173; 255 and 38 g/h/d (Table 1), respectively, and there were no significant different due to kinds of local sheep and its interaction between treatments. Pellet containing 30% sproutbean waste has significant higher of nutrient consumption. The total DM consumption was around 4% of BW. The palatability of sproutbean waste ration was better than *Indigofera* sp. ration. Overall the nutrient

Tabel 1 Nutrient consumption of local sheep fed with different rations

Nutrient Consumption (g/h/d)		*Indigofera*	Sproutbean waste	Mean
DM	Jonggol	689±13	860±11	775±8
	Garut	643,44±11	967±9	805±8
	Mean	666±7^{b}	913±3^{a}	
CP	Jonggol	143±5	163±5	153±5
	Garut	133±4	183±3	158±4
	Mean	138±8^{b}	173±8^{a}	
CF	Jonggol	121±4	240±9	181±4
	Garut	113±3	270±2	191±4
	Mean	117±5^{b}	255±6^{a}	
Fat	Jonggol	24±2	36±3	30±2
	Garut	23±1	40±4	32±2
	Mean	23±1^{b}	38±2^{a}	

DM= dry matter; CP = crude protein; CF = crude fiber. Values in the same row with differing letter superscripts, differ significantly at $p<0.05$

Tabel 2 Energy balance of local sheep fed with different rations

Energy (MJ/d)		*Indigofera*	Sproutbean waste	Mean
EI	Jonggol	11.31±0.15	14.24±0.11	12.77±0.13
	Garut	10.55±0.01	16.94±0.30	13.28±0.16
	Mean	10.93±0.08[b]	15.13±0.30[a]	
EF	Jonggol	3.72±0.001	4.03±0.002	3.88±0.001
	Garut	2.75±0.001	4.24±0.002	3.50±0.001
	Mean	3.24±0.001	4.14±0.002	
DE	Jonggol	7.58±0.09	10.21±0,02	8.89±0.06
	Garut	7.79±0.02	11.77±0.02	9.78±0.02
	Mean	7.69±0.05[b]	10.99±0.02[a]	
E-CH4	Jonggol	1.13±0.002	1.42±0.001	1.28±0.001
	Garut	1.05±0.001	1.60±0.002	1.33±0.001
	Mean	1.09±0.001[b]	1.51±0.001[a]	
EU	Jonggol	0.03±0	0.02±0	0.025±0
	Garut	0.02±0	0.02±0	0.02±0
	Mean	0.025±	0.02±0	
ME	Jonggol	6.43±0.02	8.76±0.03	7.59±0.03
	Garut	6.72±0.04	10.15±0.01	8.43±0.02
	Mean	6.57±0.03[b]	9.45±0.02[a]	
EE	Jonggol	5.62±0.02	7.98±0.01	6.80±0.02
	Garut	6.15±0.04	9.02±0.02	7.58±0.03
	Mean	5.88±0.03[b]	8.50±0.02[a]	
RE	Jonggol	0.81±0.001	0.78±0.001	0.79±0.001
	Garut	0.57±0.002	1.13±0.002	0.85±0.002
	Mean	0.69±0.002[b]	0.95±0.002[a]	

EI= energy intake ;DE= digestibility of energy; ME= metabolizable of energy ; EE= energy expenditure ; RE= retained energy. Values in a row differing letter superscripts, differ significantly at p<0.05

consumption of local sheep has matched with their requirement for growing. Tomaszweska *et al.* (1993) reported that DM requirement for growing sheep is around 4% to 5% of BW with protein requirement is 52.50 g/h/d. This data was equal with reported before that Jonggol sheep reared under the tropical forages could consume 4% DM of BW (Astuti *et al.* 2011). There were no significant consumption due to the different kind of local sheep.

Energy balance of local sheep fed with different rations were shown at Table 2. Data of energy intakes, digestibility, methane production, ME, expenditure and retained in sheep fed sparoutbean waste ration showed significantly higher than those fed *Indigofera* sp. (p<0.05), and there was no interaction between treatments. Average DE and ME were around 70% and 60%, respectively. The fact all RE values were positive, it means that those animals were grew well without any negative energy balance in all treatments. The highest RE value was found in sheep fed sproutbean waste ration. This data was lower than with RE value (1.31 MJ/d) in growing local goat fed ad libitum of concentrate as reported by Astuti *et al.* (2000).

There were no significant differences of body water and protein and its interaction between different local

Tabel 3 Body composition and blood metabolites of local sheep fed with different rations

Parameters		*Indigofera*	Sproutbean waste	Mean
Body water (%)	Jonggol	71.10±5	70.67±2	70.89±4
	Garut	71,47±5	68.03±1	69.75±3
	Mean	71.28±5	69.35±2	
Body protein (%)	Jonggol	18.16±1	18.26±1	18.21±1
	Garut	18.25±3	17.56±1	17.91±2
	Mean	18.21±2	17.91±1	
Body fat (%)	Jonggol	4.15±0.1	4.71±0.2	4.43±0.1
	Garut	3.66±0.2	8.19±0.5	5.93±0.4
	Mean	3.90±0.1[b]	6.45±0.4[a]	
ADG (g/d)	Jonggol	136±9	127±5	131±7
	Garut	99±2	153±6	126±4
	Mean	117±6[b]	140±5[a]	
Glucose (mg/dL)	Jonggol	77.95±2	88.06±4	83.01±3
	Garut	85.89±2.5	71.78±1.50	78.84±2
	Mean	81.92±2.25	79.92±2.75	
Cholesterol (mg/dL)	Jonggol	77.18±1.11	68.46±2.11	72.82±1.36
	Garut	58.97±0.50	81.28±2	70.13±2.25
	Mean	68.08±0.80	74.87±2.05	
BUN	Jonggol	73.31±5.50	56.63±3.50	64.97±4.50
	Garut	71.78±1.60	55.67±0.80	55.83±0.12
	Mean	64.65±3.60	56.15±2.15	

ADG = average daily gain; BUN = blood urea-N. Values in a row differing letter superscripts, differ significantly at p<0.05

sheep fed with different of rations (Table 3). Therefore, the ADG of sheep fed with sproutbean waste was the higher compared to other treatments. As a consequence, the percentage of body fat was also higher compared to *Indigofera* ration. It was reported by Astuti *et al*. (1999; 2009) that percentage of fat in growing local sheep was range from 9% to 20%, depend on age, physiological status and diet.

CONCLUSIONS

The ration containing sproutbean waste is better than *Indigofera* for local Indonesian sheep (Jonggol and Garut) with positive energy utilization and higher ADG during growing periode

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