

Early Fattening Lamb Could Mitigate Methane Production- an Example of Climate Smart Livestock Farming System in Indonesia

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Abstract

Ruminants, with a presence of rumen in their digestive tract, will produce methane during his life. Therefore, shortening the rearing period to produce a meat or milk is an alternative to reduce methane emissions. In Indonesia, in the last decades the tendency to slaughter the sheep at young age (around 5 months old) is increasing. This tendency is due to the young sheep (lamb) provide a tender meat and low in fat, as well as a faster in economical return. This study was aimed to evaluate whether shortening (and early age) fattening can reduce methane emissions. Sixteen data from two experimental sheep, each 8 heads of young sheep (aged 3 months old; initial weight 14.32 $\pm$ 1.25 kg), and 8 mature sheep (aged 12 m.o.; initial weight 20.65 $\pm$ 1.89 kg) were used in this study. They were fed the pelleted diet formulated to give at least CP 12% and TDN 60% ad libitum. The results showed that the dry matter intake of young sheep was higher than mature sheep (1.33 vs. 1.08 kg), as well as daily gain (156 vs. 83 g/d) and the methane production (41.4 vs 36.0 L/d), or methane production per kg daily gain (269 vs 434 L/kg body weight gain), although the production of methane per DMI was similar (32.0 vs 33.5 L/kg DMI). With assumption that sheep commonly weaned at 2 months old at body weight of 10 kg, and was slaughter at 22 kg of body weight, it could be calculated that shortening (and early age) fattening could reduce totally 1,984 L per head and 10 months shortened.

1. Introduction

The demand on lamb meat in Indonesia was increasing as shown by the growing of lamb used culinary or restaurant. Traditionally, it called *Balibu*, abbreviation of *Domba Lima Bulan* – an Indonesian words that literally means five months old sheep. This growing is caused by the quality of the lamb meat that is more tender and –the the important thing is- low in fat and low cholesterol due to the consideration of consumers on healthy meat. The meat characteristics can be obtained from the flesh of young animals. Ponnampalam et al. (2007) [1] reported that young sheep carcass have a higher lean meat and lower fat content than the carcass from old sheep. Moreover, [2] reported that the meat of sheep slaughtered at the age of 8 months was tenderer than of 10 months.

This condition is economically interesting to fasten the economical return and in improving the benefit of farmer. Traditionally, Indonesian sheep is slaughtered at mature weight (26.7 - 31.3 kg) at 15 months old with growth rate of 60.8 - 75.6 g/d [3]. Specifically, pre-weaning sheep grew faster than mature ones [4] as shown by the ADG of the age categories 0–3, 3–6, 6–12 and older than 12 months were 96.5, 77.9, 52.7 and 34.7 g/d, respectively. Another study showed that sheep gained around 120 g/d by allowing high levels of energy intake [5]. But, the most interesting is on methane



mitigation that possibly occurred due to the shortened lifetime to reach the slaughter weight. Therefore, this study was aimed to evaluate the possibly of methane mitigation by this sheep production system.

2. Materials and Methods

This study used sixteen data from two experimental sheep, each 8 heads of young sheep (aged 3 months old; initial weight 14.32 $\pm$ 1.25 kg), and 8 mature sheep (aged 12 m.o.; initial weight 20.65 $\pm$ 1.89 kg). Those young and mature sheep were fed pelleted diet formulated to give (at least) CP 12% and TDN 60% ad libitum. All sheep were adapted to their diets for a month prior to data collection periods.

Parameters measured were dry matter intake (DMI) and methane production as well as body weight gain. The DMI was measured by weighing the feed given and the residual, and was calculated in 100% dry matter base. Dry matter was measured by oven-dried feed (and residuals) samples at 135 C for two hours. Methane emission was measured using facemask method [6] for two days (2x24 h) using a mask which is connected to a methane analyzer (Horiba Ltd., Japan) and airflow meter. Methane emissions were recorded automatically by IBM PC for 10 minutes at 3 hours intervals. The results obtained are converted into weight units (1 liter CH₄ equal to 0.716 g CH₄; [7]. Bodyweight gain was calculated by subtracted initial body weight to the final body weight after 10 weeks rearing period. The data were analyzed using t-test.

3. Results and Discussion

The dry matter intake, body weight gain and methane production (daily, per kg DMI, per kg daily body weight gain; BWG) are presented in Table 1. Dry matter intake in young sheep was higher ($P<0.05$) than in mature either in kg (1.33 vs 1.076 kg) or in percentage of body weight (6.23 vs 4.41%BW). These DMI lead to body weight gain of young was higher than of mature (156 vs 83 g/d; $P<0.05$). The level of DMI observed in this study was higher than normally found in rural raising system (around 3-4%BW), and it might be pointed to a pelleted diet used in this study. Pelleted diets may have a positive effect on increasing feed intake [8]. But, another two reasons could be considered, first is due to the fast and higher body weight gain in lamb than of sheep, and the second it may indicated that lamb has a better adaptation to pelleted feeding since both lamb and sheep were just purchased from the farmers prior to the study.

The methane production in this study was linearly correlated to DMI. Daily methane production in young sheep was higher than of mature (41.45 vs 36.05 L/d; $P<0.05$), even though the methane production per DMI was similar (32.04 vs 33.51 L/kg DMI). Moreover, those phenomena lead to the methane production per kg body weight gain in young was fewer than the mature (269 vs 434 L/kg BWG; $P<0.05$). The methane production per kg body weight gain in young sheep was lower than the result from Garut sheep [9] given napier grass ad libitum and concentrate feeding at 2%BW resulted BWG 0.11 kg per day, being 440 L/kgBWG. This result also better than of buffalo fed with napier grass supplemented with soy-sauce cake (1%BW) which is given BWG 0.45 kg per day [10] being 413 L/kg BWG, but still higher than 177 L/kg BWG reported from Brahman cattle fed high grain [11] in tropical regions.

Table 1. The dry matter intake, body weight gain and methane production (daily, per kg DMI, per kg daily gain) in young and mature sheep

	Young (Lamb)	Mature (Sheep)	Sign.
Initial age, month	3	12	
Number of animal, head	8	8	
Initial body weight, kg	14.32 $\pm$ 1.25	20.65 $\pm$ 1.89	*
Dry matter intake, kg/d	1.33	1.08	*
Daily BW gain, g/d	156	83	*
Methane production			
L CH ₄ /d	41.45	36.05	*
L CH ₄ /kgDMI	32.04	33.51	ns
L CH ₄ /kgBWG	269.08	434.37	*

ns) not significant; *) significant at 5%

Based on practical, early age fattening sheep is slaughtered less than 5 months old, while the conventional raising systems is slaughtered at 15 months, so it can be calculated that early fattening system may reduce 10 months raising day. With assumption that sheep commonly weaned at 2 months old with body weight of 10 kg, and slaughter weight is 22 kg, by using the data of methane production per kg body weight gain, it could be estimated to reduce totally 1,984 L per head in sheep lifetime, or equal to 38% reduction. This value is very promising since the Indonesian government targeted to cut emission for 20%.

4. Conclusion

This study concluded that early fattening lamb could be considered as an alternative method to reduce methane emission, and it could be calculated to give 38% reduction.

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