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The Determination of Nutrient Intake on Productivity and Potential Methane Emission of Fat-Tailed Sheep Fed Odot Grass as a Source of Crude Fibre

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ABSTRACT

The purposes of this study were to examine the determination of crude protein (CP), Crude Fibre (Cfi) and total digestible nutrients (TDN) on the productivity and potential methane emission of fat-tailed sheep (FTS) fed Odot grass (*Pennisetum purpureum cv.* Mott) as a source of crude fibre. The materials used were 15 male FTS with an initial body weight (BW) 19.5 kg ± 0.61 (CV = 0.59). The feed consisted of 28.57% Odot grass, 14.29% coffee peel, 4.28% rice bran, 7.86% pollard, 21.43% cassava, 21.43% corn cobs and 2% molasses. Sheep were reared intensively in pens for 30 days. Feed and water were provided ad libitum. The parameters in this study were dry matter intake (DMI), CP intake, Cfi intake, TDN, FTS productivity, and the determination of nutrient intake on FTS productivity and methane output. The data were analysed using correlation regression analysis. The results showed that the DMI was 956.67 g/day, CP intake was 119.31 g/day, Cfi intake was 256,22 g/day, TDN intake was 634.54 g/day, ADG 102,03 g/day and FCR of 10.1 g feed/g ADG. Potential methane emission of FTS-fed Odot grass as a source of fibre was 59.49 litres/day. DMI, CP and TDN have a positive correlation with methane emission (r=0.77). Cfi intake consumption is very closely related to methane output (r=1). Based on the results of the study, to increase FTS ADGs of 100 g required DM 4.76% BW, CP requirement was 120.8 g/100 gADG and TDN requirement was 642.4 g/100gADG, Cfi requirement was 259.40g/100gADG with methane emission of 60.26 litres.

Keywords: fat-tail sheep, Odot, methane

INTRODUCTION

Productivity is the most important factor in increasing the profitability of livestock businesses (Montelli et al., 2019). In addition, feed is the main cost of sheep production (Lima et al., 2017). Feed conversion becomes a measure to determine how efficient the feed is to increase productivity. The product, in this case, is body weight gain (Montelli et al., 2019). The results of the study by Luthfi et al. (2022) showed that the higher the feed consumption, the higher productivity and the lower the feed conversion value. Thin Tailed Sheep, which consumed 1,516 g/day (7.9% BW) of feed, had a conversion value 6.8. The results of research by Jayanegara et al. (2017) show that the DMI of local sheep in Indonesia is 3.8%. Feed requirements for productivity can be influenced by physiological conditions, feed quality and DMI (Jayanegara et al., 2017; Luthfi et al., 2022; Riaz et al., 2014). On the other hand, the amount of feed consumed and the composition of the feed have a significant effect on methane emission (Hristov et al., 2013; Martin et al., 2010).

Methane emission results from fermentation in the rumen (Martin et al., 2010); (Made et al., 2011). Methane emission is released through belching, gas (farting) and feces. Currently, livestock contributes 16% of methane gas emissions in the atmosphere (Samal and Dash, 2021). Methane emission is strongly influenced by nutrients and the amount of feed consumed by livestock (Nur et al., 2015). Therefore, several feed strategies, such as increasing forage quality, are expected to reduce methane production.

Odot grass or mini elephant grass (*Pennisetum purpureum cv. Mott*) is a superior feed source of fibre feed that Indonesian farmers have widely developed (Santosa et al., 2012; Wati et al., 2018). Odot grass has good palatability and digestibility (Willyan et al., 2007). Odot grass also has good quality because it has a protein content of 13.94% (Sirait et al., 2014); however, the crude fibre content in Odot is also high, namely 32.35% (Wati et al., 2018). This study aimed to examine the determination of nutrient intake on FTS productivity and potential methane emission of FTS-fed Odot grass as a source of fibre.

MATERIALS AND METHOD

The materials used were 15 male FTS with an initial BW of 19.5 kg ± 0.61 (CV = 0.59). The feed used in the study contained 12% CP and 65% TDN.

Table 1. Nutrient content of feedstuff

Ingredients	Composition	DM	Ash	EE	Cfi	CP	NFE	TDN
	(%)							
Odot grass	28.57	72.68	16.3	2.7	38.2	14.35	28.45	41.50
Pollard	7.86	88	0.67	2.1	7.4	16.9	72.93	84.31
Cassava	21.43	83.8	5.3	1.3	14.9	7.8	70.7	77.48
Coffee peel	14.29	90.66	2.47	1.15	30.69	21.91	43.78	66.53
Rice bran	4.28	89.6	20.74	3.1	8.5	11.9	55.76	64.62
Corn cops	21.43	89.65	0.8	1.5	2.1	5.62	89.98	88.20
Molasses	1.43	18.4	1.93	0.08	0.25	4	93.74	87.82

Analysed by: Biochemistry Laboratory, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta.
* Total Digestible Nutrients: Calculation based on the formula model by Hartadi et al. (1990).

The feed consisted of 28.57% Odot grass, 14.29% coffee peel, 4.28% rice bran, 7.86% pollard, 21.43% cassava, 21.43% corn cobs and 2% molasses. Sheep were reared intensively in pens for 30 days. Feed and water were provided ad libitum. The parameters in this study were dry matter intake (DMI), CP intake, Cfi intake, TDN, FTS productivity, and the determination of nutrient intake on FTS productivity and methane output.

Measurements of DMI, CP intake, TDN, ADG, and feed conversion referred to Luthfi et al. (2022). Potential methane output was calculated using the estimation formula by Shibata et al. (1993) as follows:

$$Y= -17,766+42,793X-0,849X^2$$

Y = Methane emission (CH_4) (litre/day)
X = DMI (kg/day)

The relationship between nutrient intake and methane output on FTS productivity was analysed using correlation analysis. The coefficient values obtained referred to the Steel & Torrie (1960) guidelines, namely: very low (0.00-0.199), low (0.200-0.399), moderate (0.400-0.599), strong (0.60-0.799) and very strong (0.80-1.00).

RESULTS AND DISCUSSIONS

The results of the study are presented in Table 2. The DMI of FTS-fed Odot grass as a source of fibre was 994.5 g/day (4.76% of BW). Crude protein intake, Cfi Intake and TDN were 119.31 g/day, 256.22 g/day and 669.61 g/day, respectively. Feed conversion in this study was 10.7.

Dry matter intake in this study was higher than that of a review by Jayanegara et al. (2017) which showed that local sheep in Indonesia could consume 2.86% - 3.91% of feed. This result was due to differences in the nutrient content of the feed used. D'Mello (2000) stated that the amount

Table 2. Nutrient intakes, productivity, potential methane emission of fat-tailed sheep

Parameter	**Average**	**Min**	**Max**	**Std**
Initial BW (kg)	19.53	18.60	20.50	0.64
Final BW (kg)	22.31	21.30	23.25	0.64
Average BW (kg)	20.92	19.95	21.88	0.63
ADG (g)	0.10	0.09	0.13	0.01
DMI (g)	994.65	956.67	1067.67	27.32
DMI (%)	4.76	4.51	5.18	0.18
CP intake (gBK)	119.31	114.81	128.14	3.25
TDN (gBK)	669.61	639.74	720.86	20.31
Cfi intake (gBK)	256.22	246.43	275.03	7.04
FCR	10.07	8.19	11.04	0.63
CP requirements / 100 g ADG	120.79	98.30	132.44	7.46
TDN requirements / 100 g ADG	677.87	552.99	745.10	42.39
Cfi requirements / 100 g ADG	259.40	210.98	284.27	16.15
CP-TDN ratio	5.61	5.40	5.67	0.06
Potential methane emission (liter/d)	59.49	57.93	62.49	0.06
Methane emission/100 g ADG	60.26	47.94	66.20	3.98

of feed consumption was to meet nutrient requirements so that when nutrient requirements were fulfilled, the sheep would stop consuming feed. The protein content in this study was 12% lower than that of a review by Jayanegara et al. (2017), namely 14.26%, so to meet their nutrient requirements, the FTS in this study consumed higher feed.

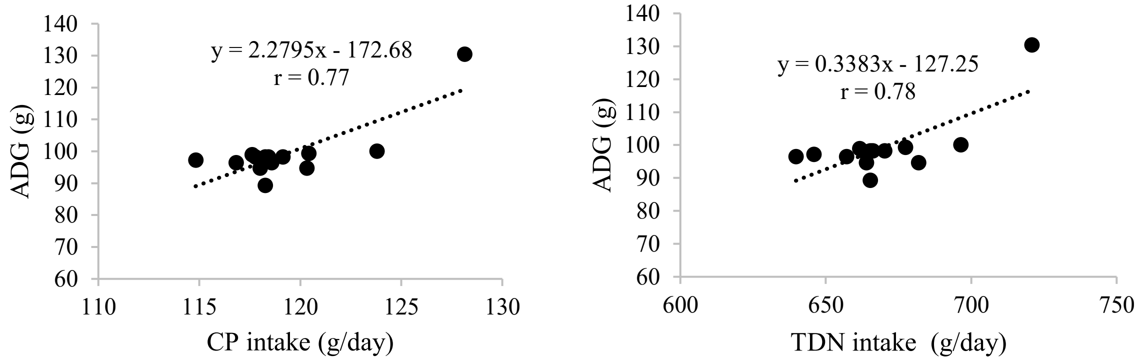

Figure 1. The relationship between CP and TDN intake on productivity.

Figure 1 shows that CP and TDN intake positively and strongly correlates to FTS productivity (P<0.05) with r = 0.77 and 0.78, respectively. The higher the consumption of CP and TDN, the higher the ADG that can be achieved. From the equation above, to increase 100 g of ADG, at least 20 kg of FTS required a CP of 120.79 g and a TDN of 677.87 g/day. This result was higher than that of Jayanegara et al. (2017), which showed that FTS with BW of 20 kg required a TDN of 382 g/day and a CP of 93 g/day to increase to 100 g ADG. This difference in results was due to the presence of high crude fibre in the Odot grass. High-fibre feed can increase heat production, the energy needed to carry out digestive processes, and energy output, and ultimately increase total energy requirements in ruminants (Salah et al., 2014). On the other hand, the increased consumption of high-fibre feed at FTS due to the Odot grass given impacts the potential for methane output. This was supported by the results shown in Figure 2.

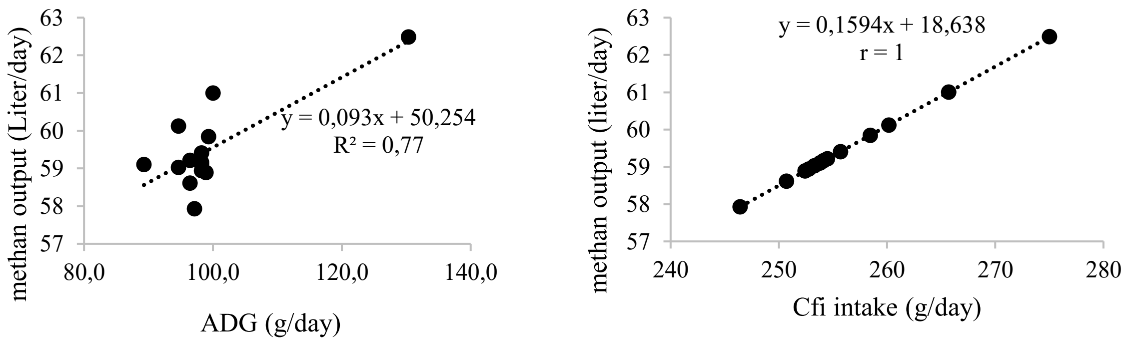

Figure 2. Correlation between Cfi intake, ADG and methane output

The results showed that Cfi intake had a positive and strong correlation with the potential methane emission (P<0.05) with a value of r = 1. Figure 2 shows that an increase in methane production would accompany any increase in Cfi consumption. Based on the equation above, consumption of Cfi as much as 256.22 g/day could emit as much as 59.49 litres/day of methane (42.46 g/day). Samal and Dash (2021) stated that the higher the crude fibre content in the feed, the lower the feed rate. This allows the higher crude fibre to be fermented in the rumen to produce higher acetate: propionate ratios and methane production.

The same result was also shown in the relationship between productivity and methane output (P<0.05) with a value of r = 077. An increase in methane production would accompany every increase in ADG. At least every 100 gADG of FTS could produce as much as 60.26 liters/day of methane. The results of this study were higher than that of Aprilliza et al. (2019), which showed that with every increase of 100 gADG, the methane reached 43.58 litres per day. The difference in this study was due to the high consumption of crude fibre in FTS in this study.

CONCLUSION

Dry matter, Cfi, and TDN intake in this study positively and strongly correlate with productivity and methane output (r=0.77). Cfi intake also in this study has a strong correlation with methane output (r=1). Based on the study's results, increasing the ADG of fat-tailed sheep by as much as 100 g required a DMI of 4.76% BW. The results also show that FTS required CP as much as 120.8 g/100g ADG and, TDN as much as 642.4 g/100g ADG, CFi as much as 259.40/100g ADG with a methane output of 60.26 litres.

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