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Productivity of Different Local Sheep Breeds Fed by Water Spinach Straw

Hamdani Maulana*, Endang Baliarti, and Astrid Listia Astrini

Laboratory of Meat, Draught, and Companion Animals, Department of Animal Production**,** Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta, 55281, Indonesia

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* Corresponding author:
Telp. +62 85211178503
E-mail:
hamdani.maulana@mail.ugm.ac.id

ABSTRACT

The decline in forage production during the dry season has an impact on the growth performance of livestock at the level of smallholder. The development of agricultural system by utilizing dried agricultural by-product is an alternative solution to the problem of limited feed during the dry season. Production of water spinach reaches 12,697 tons of dry matter/year and has potential to be used as a fiber sources for livestock. Studies on the use of water spinach straw (WSS) as feed for local sheep have not been widely carried out. This study was aimed to determine the productivity of Garut sheep (GS) and thin tailed sheep (TTS) fed water spinach straw. The results of this study were expected to provide information on the use of dry WSS as a substitute for forage for local sheep for fattening purposes. GS (n = 26) and TTS (n = 27) with an age of 8-12 months and body weight ranging from 10-20 kg were feedlots for 42 days. Sheep are kept intensively in colony pens (4-5 head/pen) with an approaching of body size and body weight. Feeding is done every morning and evening. Drinking water is always available. WSS is given ad libitum and the concentrate is given increasing periodically according to the treatment phase, Starter (1-14 days), Grower (15-28 days), and Finisher (29-42 days). Data were analyzed using One way ANOVA, operated by SPSS 20.0 program. The results showed that GS and TTS had no significant differences in productivity (gain, average daily gain, feed conversion ratio, feed cost, and feed cost per gain) (P>0.05). GS and TTS had the highest gain in the starter phase (2.04±1.08kg and 1.99±1.02kg, respectively) then decreased in the grower phase (1.46±0.83 kg and 1, respectively. 55±0.77 kg) and the finisher (1.61±0.77 kg and 1.59±0.74 kg, respectively). Based on the results obtained, it can be concluded that the GS and TTS had good productivity when fed by WSS as basal feed.

Keywords: Garut sheep, Productivity, Thin Tailed sheep, Water spinach straw

Introduction

Sheep is one of the livestock commodities that has great potential as fiber source. The consumption of lamb in Indonesia continues to increase every year. This is followed by a growing national goat and sheep population. National consumption of lamb in 2017 reached 0.052 kg/capita/year (increase from 2014). The increase in meat consumption has spurred an increase in the livestock population so that in 2019 the sheep population reached 18 million with an increase of 3.66% from the previous year (Badan Pusat Statistik, 2019). However, sheep development in Indonesia is still constrained by several aspects, including feed and raising management which is still varied and not optimal. Until now, the majority of sheep farming is still carried out by smallholder farmers (around 95%) (Noor and Hidayat, 2017).
The majority of production sheep are aimed for savings. So that the maintenance system applied is still conventional. The application of technology in livestock raising for business efficiency has not become a priority so the profit obtained is not optimal. Especially for feeding, small farmers still rely on the forage in the area around the farm as the main feed resource (Pertiwi *et al.*, 2018; Prabowo *et al.*, 2018). This raising technical has an impact on livestock productivity which is varied and not optimal. The decline in livestock productivity will mainly occur during the dry season for livestock raised conventionally (Sulaksana, 2008; Nasution *et al.*, 2010). Livestock productivity decreases during the dry season due to low forage production during the dry season (Maulana, 2019).

The development of agricultural system by utilizing dried agricultural waste is an alternative solution to the problem of limited feed during the dry season. Indonesia has agricultural waste with good quality and long shelf life as a substitute for fiber sources for livestock. One of the agricultural wastes that could potentially be used as an alternative feed source for fiber is water spinach straw. Production of water spinach straw is quite abundant in East Java (production reaches 12,697

tons of dry matter/year). Water spinach straw is a feed ingredient fiber source (class 1) which can be an alternative forage for livestock (Dahlan *et al.*, 2013; Fibriansyah, 2018).

Water spinach straw has good palatability for 2 local Indonesian sheep, such as Garut sheep and Thin-tailed sheep. Garut sheep have a physiological response and normal behavior towards giving water spinach straw as a basal feed (Fibriansyah, 2018) while the thin-tailed sheep fed with water spinach straw is able to restore body weight after transportation (Nelvita *et al.*, 2013). Research comparing the productivity of Garut sheep and thin-tailed sheep with feeding water spinach straw has not been done before. Even though these two local sheep breeds are often used in fattening. The productivity of local sheep is influenced by these breeds (Fahmi, 2013). This study aims to determine the productivity of local sheep (Garut and thin-tailed) fed water spinach straw. The results of this study are expected to provide information about the use of water spinach straw as feed for local sheep on a fattening program. This research is also one of the development of agricultural systems by utilizing local (agricultural) resources to overcome the livestock feed crisis during the dry season (livestock sector).

Materials and Methods

The study was conducted for 2 months (November-December 2019) at a sheep farm at Ngetiran, Sariharjo, Ngaglik, Sleman Regency, Yogyakarta Special Region using 2 local sheep breeds, Garut (n=15) and thin-tailed sheep (n=15). Ewes aged 8-12 months with initial bodyweight 10-15 kg. Ewes were kept intensively and fed by concentrate and water spinach straw (*Ipomea reptans*) (Table 1).

Ewes were raised for 42 days with a feedlot system and kept intensively in different colony pens (4-5 head/pen) based on body size and bodyweight. Feeding was done every morning and evening. Water was always available. Water spinach straw was given ad libitum and the concentrate was given increasing periodically according to the treatment phase (Table 2). Treatment is divided into 3 phases, namely Starter (1-14 days), Grower (15-28 days), and Finisher (29-42 days).

Measurement of feed intake is carried out for 7 days at each maintenance phase on all feed types (water spinach straw and concentrate). The tool used in measuring feed intake was a digital scale brand SF-400 with a capacity of 7 kg with a sensitivity of 1 g. The parameters observed included dry matter intake.

The weighing of livestock is carried out using the Sonic A12-E digital livestock scale with a sensitivity of 0.1 kg. The weighing was carried out 4 times during the maintenance period, on pre-treatment (days 0), starter period (days 14), grower period (days 28), and finisher period (days 42).

Livestock performance based on feed intake and gain during treatment. Livestock performance include *Average Daily Gain* (ADG), *feed conversion ratio* (FCR), *feed cost* (FC), dan *feed cost per gain* (FC/G) was measuring using the following equations:

$$\text{ADG (gram/day)} = \frac{\text{gain (gram)}}{\text{times (days)}}$$

$$\text{FCR} = \frac{\text{feed intake (gram/day)}}{\text{average daily gain (gram/day)}}$$

$$\text{FC (Rp/day)} = \text{feed intake (g/day)} \times \text{feed cost (Rp/kg)}$$

$$\text{FC/G (Rp/kg)} = \frac{\text{feed cost (Rp/day)}}{\text{average daily gain (gram/day)}}$$

Data of ADG, FCR, FC, and FC/G were analyzed using One way ANOVA operated by SPSS 20.0 program.

Results and Discussion

Feed consumption

The dry matter intake (DMI) of GS and TTS fed by water spinach straw was not significant at all periods and in total treatment (P>0.05) (Table 3). GS and TTS had DMI 253.95±28.17 and 250.72±33.55 g/day, respectively in the starter period. Meanwhile, during the Grower and Finisher period, DMI increased to 585-614 g/day (Table 3). This result shows that livestock needs an adaptation period in consuming water spinach

Table 1. Nutrient content of water spinach straw and concentrate

Nutrient content	Feedstuff	
	Concentrate	Water spinach straw[a]
Dry matter (%)	88.81	84
Crude protein (%)	19.77	5-6
Crude fat (%)	6.66	2-3
Crude fiber (%)	10.16	20-26
Total digestible nutrient (%)[b]	74.54	37.42

[a] (Dahlan *et al*., 2013; Nurfitria *et al*., 2018).
[b] Calculating with TDN equation (Hartadi *et al*., 2019).

Table 2. Amount of feed on each maintenance phase

Type of feed	Treatment phase		
	Starter (days 1-14)	*Grower* (days 15-28)	*Finisher* (days 29-42)
Concentrate (kg)	0.9	2.1	2.3
Water spinach straw	*Ad libitum*	*Ad libitum*	*Ad libitum*

Table 3. Feed consumption of Garut sheep and Thin Tailed sheep for fattening treatments feeding by water spinach straw as basal feed

Parameters	Breeds	
	Garut Sheep	Thin-tailed sheep
Starter		
DMI (g/day)^{ns}	253.95±28.17	250.72±33.55
DMI/LWM (g/LW^{0,75}) ^{ns}	0.21±0.02	0.021±0.03
Grower		
DMI (g/day)^{ns}	585.31±64.48	599.99±86.29
DMI/LWM (g/LW^{0,75}) ^{ns}	0.44±0.05	0.45±0.07
Finisher		
DMI (g/day)^{ns}	595.44±62.13	614.81±89.76
DMI/LWM (g/LW^{0,75}) ^{ns}	0.41±0.04	0.43±0.07
Total		
DMI (g/day)^{ns}	478.23±51.26	488.52±67.35
DMI/LWM (g/LW^{0,75}) ^{ns}	0.35±0.04	0.36±0.05

^{ns} = nonsignificant different (P>0.05)
DMI = dry matter intake.
DMI/LWM = dry matter intake/liveweight metabolic.

straw. Adaptation of sheep to new feed will take at least 12 days (Farenzena *et al.,* 2017).

The DMI and DMI/LWM in this study were lower when compared to the results of other studies which reported that the DMI of local sheep fed concentrate and forage (CP 14%) was 1,013 g/day (Aslimah, 2014) and DMI/LWM of Thin-tailed sheep fed fermented complete feed (CP 12%) was 0.57 – 0.88 g/LW$^{0.75}$ (Kamalidin *et al.*, 2012). The low DMI and DMI/LWM could be due to the palatability of water spinach straw and concentrate for sheep. Moreover, the high TDN and CP concentrates used in this study could be the reason for the low feed intake due to feed efficiency. Feed with high TDN and CP will increase feed efficiency (lower DM) (Mawati *et al.*, 2013; Salah *et al.*, 2015).

Sheep productivity

The results obtained showed that there was no significant (P>0.05) in the gain and ADG of GS and TTS used in this study. GS and TTS, an Indonesian local breed, have a good ADG in all fattening phase (starter, grower, and finisher) with a range of 102.46-130.43 grams/day. This result is higher than that reported by other studies that local sheep have ADG 76-106 grams/day (Septian *et al.*, 2018).

The highest gain and ADG of GS and TTS occurred in the starter phase, then decreased in the grower and finisher phases. This can be due to the compensatory growth of the livestock during the starter phase. Livestock that previously did not get good feed will be able to grow well when they get feed with high nutrient quality. In this study, before use in fattening treatment, all sheep only feeding by forage without the addition of concentrate, so that when given the concentrate with 19.77% PK content and 83.19% TDN (in this treatment), livestock would experience compensation growth. The use of feed with good nutrient content will increase feed efficiency and have an impact on optimal livestock productivity (Mawati *et al.*, 2013).

The compensation growth in the starter phase given the impact in better FCR values and feed cost per gain compared to the grower and finisher phases. Further research is needed on the

Table 4. Productivity of Garut Sheep and Thin-Tailed Sheep for fattening treatments feeding by water spinach straw as basal feed

Parameters	Breed	
	Garut Sheep	Thin-Tailed Sheep
Starter (0-14 days)		
ADG (g/day) ^{ns}	102.46±12.82	104.21±5.15
As fed consumption (g/day) ^{ns}	306.19±33.90	302.48±40.27
Feed conversion ratio ^{ns}	3.05±0.59	2.90±0.39
Feed cost (Rupiah/day) ^{ns}	1,358.60±146.58	1,353±168.16
Feed cost per gain (Rupiah/kgBW) ^{ns}	13,511.74±2,577.92	13,018.10±2,147.34
Grower (15-28 days)		
ADG (g/day) ^{ns}	130.43±42.75	118.14±47.98
As fed consumption (g/day) ^{ns}	705.36±77.72	723.10±104.06
Feed conversion ratio ^{ns}	6.26±3.16	7.02±2.66
Feed cost (Rupiah/day) ^{ns}	3,104.60±342.62	3,185.80±462.68
Feed cost per gain (Rupiah/kgBW) ^{ns}	27,529.20±13,907.45	30,943.67±11,726.69
Finisher (29-42 days)		
ADG (g/day) ^{ns}	130.39±42.71	118.19±47.98
As fed consumption (g/day) ^{ns}	717.75±74.93	741.11±108.23
Feed conversion ratio ^{ns}	6.37±3.23	7.19±2.74
Feed cost (Rupiah/day) ^{ns}	3,171.13±333.24	3,274.53±482.28
Feed cost per gain (Rupiah/kgBW) ^{ns}	28,152.60±14,269.48	31,799.53±12,115.14
Total (0-42 days)		
ADG (g/day) ^{ns}	121.61±29.47	113.90±32.99
As fed consumption (g/day) ^{ns}	576.44±61.78	588.89±81.25
Feed conversion ratio ^{ns}	5.23±2.11	5.71±1.81
Feed cost (Rupiah/days) ^{ns}	2,544.80±272.73	2,604.80±363.15
Feed cost per gain (Rupiah/kgBW)^{ns}	22,248.13±6,684.58	24,443.74±6,709.73

ADG = Averages daily gain
^{ns} = nonsignificant different (P>0.05).

nutrient digestibility of livestock in each phase of fattening to complement the results of this study. Based on the results of the study, information was also obtained that GS and TTS sheep had low feed cost per gain (FC/G), 22,248 and 24,443 rupiah/kg body weight, respectively. A lower FC/G value will give the farmer a bigger advantage. The low FC/G is due to the low feed cost. Water spinach straw is an agricultural by-product that has good nutrients and abundant availability, so it has a cheap price (Dahlan *et al.*, 2013; Fibriansyah, 2018).

In this study, the performances of GS and TTS were not significantly different for all measured production parameters. Research by (Purnamasari *et al.*, 2020) showed no difference in physiological responses in Garut sheep and Thin-tailed sheep fed by the same diet. This shows that GS and TTS have the same adaptability to feed so have the same performance too. This inline with (Basalamah, 2013), which shows that the productivity of Garut sheep and thin-tailed sheep (ADG and FCR) is not influenced by the breed.

Conclusions

Based on the results obtained, it can be concluded that the Garut Sheep and Thin Tailed Sheep had good productivity when fed by water spinach straw as basal feed.

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