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The Potential of Swamp Forage-Based Feeding to on the Qualities of Digestibility and Milk Production in Goat Etawa Crossbreed

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Abstract | This study aims to analyze some value of digestibility and milk production of crossbreed etawah goats based on swamp feed. In this study were used total of 24 goats, 2-2.5 years old, weighing about 35±2.15kg, and all samples lactation status. The goats were placed in four treatment groups. Each group was repeated six times, and each goat was placed in a cage. The treatment of the P0 group as the control variable was not using swamp forage (0% swamp forage), while the P1 group, P2 group, and P3 group was given with 10%, 15%, and 20% of swamp forage containing tannin of 0.28%, 2.04%, and 3.17%, respectively. This study pointed out that the average dry matter intake (DM) between the P2 group and P0, P1 and P3 groups showed was significantly different ($p < 0.05$). There were significant differences in average digestibility of organic matter and dry matter between the P1 group and other groups ($p < 0.05$). Compared with other groups, the digestibility of crude protein (CP) in treatment P3 group was significantly different ($p < 0.05$). Then, crude fiber digestibility between the P3 group, the P1 group and the P4 group were significantly different ($p < 0.05$), and the crude fiber digestibility between the P0 group and the P3 group was significantly different ($P < 0.05$). The total digestibility nutrients (TDN) between group P1 and others showed were significantly different ($p<0.05$). Total milk production among groups P1, P2, P3 showed that significantly different ($p<0.05$). In contrast, the average specific gravity was significantly different ($p<0.05$) between group P2 among with others. Also, the average percentage of crude fat (CF) and crude protein is very different ($P<0.05$) among the P0 and P1 groups, as well as among the P2 and P3 groups. In conclusion: In conclusion: swamp forage forage has the potential as an alternative feed for etawa cross-reed goats, while the use of swamp forage is suggested to range from 15%.

Keywords | Crossbreed Etawa goat, Digestibility, Milk Production, Milk quality, *Swamp* Forage

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INTRODUCTION

Efforts to utilize local forages are caried out to optimize and improve the efficiency of local animal feed. Swamp forage is abundant local feed but is not famously used as feed material for goats. The variety of swamp forage in South Kalimantan has more than 11 species of forage consists of *Belaran, Babatungan, Bundungan, Beberasan, Kumpai Batu, Kumpai Juluk, Kumpai, Kumpai Minyak, Kayamahan, Kasisap, Pipisangan.* The other swamp forages were *Purun Tikus and Kalakai* (Jaelani et al., 2018). Fahriyani and Eviyati (2008) reported that with a harvest system on average 2-3 times a week, dry swamp forage produces 44 tonnes/ha/year products. Furthermore, Fahriyani and Eviyati (2008) revealed that the botanical composition in the swamp consists of 70.95% of *Poaceae* biomass production, 28.81% of *Cyperaceae* biomass production, and 2.34% of other biomass production.

Swamp forage may have the potential as animal feed, although not all swamp forage is favored by livestock. Goats will choose what they like and are not poisonous. The combination of swamp grass and legumes that have a high percentage of crude protein is recommended because the protein percentages of tropical swamp grass are 4-9% (Jaelani et al., 2018). Whilst goat ration protein requirements reach 14-16% (NRC, 2007). One of the weaknesses of the swamp grass is a low content of protein. Nevertheless, the tannin content in swamp forage is quite large. This tannin can protect the protein from the rumen, reticulum, and omasum so that when the feed enters the abomasum little is damaged (Frutos et al., 2004). Besides, Jones et al. (1994) revealed that the function of tannin also acts as an anthelmintic.

There are several methods of feeding to goats, one of method are in fresh condition. This method has a bulky capacity and not efficient, because livestock will choose their preferences such as shoots, leaves, and soft stems, consequently the nutritional needs have not been met so that it needs to be given additional feed in the form of concentrate. Based on this phenomenon, the complete feeding of concentrate is the right solution. The form of complete feed can be made from crumbles, pellets, hay cube, food paste, large-diameter hay cylinders, but these forms are hardly affecting feed quality, palatability, storage time, digestibility, and biological value. The livestock feed quality is based on biological, chemical, and physical properties. The feed quality essentially looked at its chemical and biological properties so that the optimum digestibility of feed and feed integrity can be determined, thus the nutritional quality of feed is maintained (Aharoni et al., 1998)

The physical properties of feed Concentrates can act as a source of soluble carbohydrates, a source of glucose for raw materials for milk production, and as a source of protein escape degradation. When associated with the presence of tannin content in the feed, the smaller the particle size of the feed, the tannin pleased will be even greater because the surface area that is filled with tannin will be much greater than that of coarse feed. Based on these descriptions, the objective of this research was to evaluate if the potential of swamp forage on based feeding toward the qualities of milk production in goat etawa crossbreed.

MATERIALS AND METHODS

The research was organized on the Laboratory of Nutrition and Feed Technology at Islamic University of Kalimantan MAB Banjarmasin. A total of 24 female goats aged 2-2.5 years, weigh about 35±2.15 kg, and all samples lactation status was divided into four groups consists of six goats per group. The standard feeding without swamp forages *(Heleocharis dulcis* Burm and *Stenochlaena palustris)* (0% tannin), was given to group P0, the standard feeding with 10% swamp forage (0.28% tannin) was given to group P1, the standard feeding with 15% swamp forage (2.04% tannin), was given to P2, and The standard feeding with 20% swamp forage (3.17% tannin) was given to group P3. The study was designed following feed standards from the National Research Council (NRC, 2007). All goats are fed according to swamp forage treatment. except for control treatment, all goats were given Purun Tikus (*Heleocharis dulcis* Burm) and Kalakai (*Stenochlaena palustris*) and given concentrate. All goats were raised under a similar cut and carry system on the swamp forage variety and supplemented with concentrate which was given 1 kg head^{-1}.day^{-1}

The study was conducted for 28 days and the adjustment period was 7 days. On day 8, Sample feces and milk was started collected. The collection of fecal samples was carried out every day in the morning, while the milking was done every day twice in the morning and evening. Feces are taken 20% of the total feces, then dried, grounded, and mixed until uniform. According to AOAC (2005), feed and fecal samples are analyzed to determine dry matter (DM), crude protein (CP), crude fiber (CF), tannin content, extract ether (EE), and ash. The method of Van Soest et al. (1994) was used to evaluate the neutral detergent fiber (NDF) and acid detergent fiber (ADF) of feed and feces. The consumption of dry matter (feed intake) was evaluated according to Malik et al. (2019). Besides, the content of dry matter and organic matter in the ingredients is analyzed. Analyze goat milk samples to determine milk yield, specific gravity, fat content, protein content, *Salmonella aureus* content, and total plate count (TPC) were adopted from Sukmawati (2018).

Statistical analysis

Bartlett's test is used to check its data adherence. The homogeneous data was reviewed using an analysis of variance (ANOVA). A significant difference in treatment continued by using Duncan Multi Range Test (Steel and Torrie, 1993). The difference in treatment is rated as significant if $p<0.05$.

RESULTS AND DISCUSSION

The results of the study about the consumption of dry matter, digestibility of dry matter, digestibility of organic, digestibility of protein, digestibility of fiber, and total digestible were shown in Table 1. The average consumption of dry matter was significantly different ($P<0.05$) between group P3 and other groups. Whereas, the average percentages of digestibility of dry matter were significantly different ($P<0.05$) between group P2 and other groups. The percentages of the digestibility of organic were significant

Table 1: Consumption of dry matter, and some of the value of digestability in Goats ettawa crossbreed

Parameters	Treatments			
	P0	P1	P2	P3
consumption of dry matter (g/head/d)	486±12,31[a]	428±13,41[a]	536±11,67[b]	476±12,33[a]
Digestibility of dry matter (%)	72,41±0,02[ab]	70,12±0,03[a]	74,65±0,02[b]	74,19±0,03[b]
Digestibility of organic matter (%)	72,37±1,47[b]	68,18±1,23[a]	73,08±1,67[b]	74,85±1,28[b]
Digestibility of crude protein (%)	68,52±3,38[a]	67,33±2,6[a]	68,16±3,14[a]	69,62±3,27[b]
Digestibility of crude fiber (%)	65,32±1,4[a]	67,14±1,5[b]	69,21±2,2[c]	65,58±1,3[a]
Total digestible nutrient (TDN) (%)	78,61±1,25[b]	76,12±0,82[a]	79,37±1,04[b]	78,62±0,93[b]

[A,b] Values in the same column with different superscripts indicate significant difference at P<0.05,

Table 2: Production and quality of goat milk etawa crossbreed given the treatment of adding swamp forage

Parameter	Treatments			
	P0	P1	P2	P3
Milk Production (g.head^{-1}d^{-1})	586±2.4[ab]	531±2,6[a]	645±1,8[b]	637±2,2[b]
Specivic Gravity (g/cm^3)	1,070±0,002[a]	1,050±0,002[a]	1,090±0,001[b]	1,060±0,002[a]
Crude fat (%)	4,84±0,43[a]	4,69±0,43[a]	5,62±0,37[b]	5,24±0,74[b]
Crude Protein (%)	4,62±0,1[a]	4,44±0,1[a]	6,17±0,2[b]	7,20±0,2[b]
Salmonella aureus (CFU.g^{-1})	< 1,0 x 10^0	< 1,0 x 10^0	< 1,0 x 10^0	< 1,0 x 10^0
Total Plate Count (CFU.g^{-1})	5,3 x $10^{0\,a}$	9,0 x $10^{0\,a}$	2,9 x $10^{3\,b}$	3,8 x $10^{4\,c}$

[a,b,c] Values in the same column with different superscripts indicate significant difference at P<0.05,

ly different (P<0.05) between group P2 and other groups. The percentages of digestibility of protein were significantly different (P<0.05) between group P4 and other groups. Then, percentages of digestibility of fiber were significantly different (P<0.05) between group P4 and group P2 and P3, whereas, was significantly different (P<0.05) between group P1 and group P4. The total digestible was significantly different (P<0.05) between group P2 and other groups.

The others parameters of this research were milk qualities including milk production, specific gravity, contain crude fat, crude protein, total plate counts, and contain *Salmonella aureus*. The average milk production between the P0 group and other groups showed a significant difference (p<0.05). Considering that the average proportion between the P2 group and other groups is significantly different (p <0.05). Also, the average percentages of crude fat and crude protein between the P0, P1 group, and the P2, P3 group were significantly different (p <0.05), while the total plate number between the P2 group and the other groups was significantly different (p <0.05) see Table 2.

Based on statistical analysis showed that the average consumption of dry matter, digestibility of dry matter, fiber digestibility, and total digestible nutrients occurred in group P2 (Table 1). This shows that the trend in the provision of swamp forage at the level of 15% containing 3.17% tannin has an optimal effect when compared to group P3. The research results were supported by Frutos et al. (2004), who pointed out that the provision of forage with high tannins will affect the palatability of the feed, the slowdown of digestion, and the development of conditioned aversion. A decrease in palatability may be due to a reaction among tannins and the salivary mucoproteins, or a direct reaction with tastebuds because most swamp forages are high in tannins and protein, found in its saliva (McLeod, 1974; Robbins et al., 1987; Austin et al., 1989; McArthur et al., 1995; Foley et al., 1999). Furthermore, Van Soest (1994) and Frutos et al. (2004) reported that tannins usually have more negative effects on animal digestion, or they cannot be degraded by digestive enzymes.

On the other hand, the results of this research about the digestibility of protein were slightly higher in group 4 compared to other groups. This indicated that higher tannin contents in this group (4.21 ml/100mL) would affect the digestibility. Furthermore, many researchers report that the reduction in digestion rate is related to the degradation of tannins, which is the devaluation of the degradable part and the reduction in degradation rate (Aharoni et al. (1998); Bhatta et al. (2012); Frutos et al. (2000); Hervás et al., 2000). Makkar (2003), Jayanegara and Palupi (2010), Mueller and McAllan (1992) revealed that the reduction of rumen protein degradation may be the most important. Another parameter of this study was to assess the quality of milk production in crossbreed etawa goats. Based on the data statistics, milk production, crude fat, specific gravity, and total plate count in group 3 were showed higher than the other group. This is because the provision of swamp

forage at 15% (3.17 of tannins) turns out to have a good impact on milk quality, and total milk production and contained of fat. The results of these studies were still unclear about the physiological mechanism. It is suspected that 15% of the administration still has a positive impact on milk production and its quality. At doses above 15%, it has a negative impact (Table 2), this is in accordance with the viewpoint of Jones et al. (1994), Nsahlai et al. (1995), and Makkar (2003) have observed and suggested that the addition of a feed formula with a high tannin content based on fiber will reduce microbial activity in the rumen. Furthermore, Stevenson et al. (2010), Ramadhan et al. (2013), and Alam et al. (2007) pointed out that if the tannin content is high, these compounds can form reversible complexes with dietary nutrients. These nutrients include physical carbohydrate polymers, proteins, and minerals located in plant cell walls (Ahnert et al., 2015; Smith et al., 2005; Min et al., 2003). This can limit their degradation and absorption.

CONCLUSION

Based on the results of these studies, it can be concluded that use swamp forage has the potential as an alternative feed for etawa cross-breed goats, while the use of swamp forage is suggested to range from 15%.

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CONFLICT OF INTEREST

All researchers stated consciously that they had no conflict of interest in this study.

AUTHORS CONTRIBUTION

Achmad Jaelani has compiled the experimental design, Abd Malik coordinated the feeding trial research, and Gt Ni' mah has collected data and performed the statistical analysis.

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