Feed Intake and Milk Production Performance of Local Sultra Ettawa Crossbreed Goats Fed Ration Containing Soybean Oil Calcium Soap

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ABSTRACT
This study aimed to evaluate the effectiveness of using soybean oil calcium soap (CaS-soy) in the ration on the Ettawa crossbreed feed consumption performance. This study used 4 lactating Ettawa crossbreed goats from Southeast Sulawesi with weight ranging from 24-33 kg. The experimental design used was the Latin Square Design (LSD) with 4 treatments and 4 replications and held for 6 months. The treatments consisted of P1 (without CaS-soy (Control), P2 (concentrate containing 1.5% CaS-soy), P3 (concentrate containing 3.0% CaS-soy), and P4 (concentrate containing 4.5% CaS-soy. Parameters observed were; dry matter intake (DMI), organic matter intake (OMI), milk production and feed efficiency. The data obtained were analyzed using analysis of variance and continued with Duncan's Multiple Range Test on treatments that had a significant effect. The results showed that the provision of CaS-soy had a significant effect ($P<0.05$) on DMI, OMI, milk production and feed efficiency. The use of 1.5-4.5% CaS-soy can increase milk production. The conclusion of this study was that the supplementation of 4.5% CaS-soy showed better milk production and feed efficiency.

Keywords: *Ettawa crossbreed, CaS-soy, milk production.*

1. INTRODUCTION

Ettawa crossbreed goat is a type of dual-purpose goat, namely livestock that can produce meat and milk. Goat's milk has superior nutritional content, besides, the fat and protein in goat's milk are easier to digest and its vitamin B1 is higher than that of cow's milk. However, the problem that occurs in the community of goat breeders is the low production of goat milk. Therefore, to support the production performance of goats, it must be supported by better feeding in terms of quality and quantity according to the physiological needs of the livestock.

Feed greatly affects livestock productivity. The need for ruminant feed consists of forage containing high fiber as the main feed and concentrate as a fortifying feed. Concentrate as feed that is easily digested and contains nutrients that is good for livestock productivity. However, its administration should be limited because it is expensive and contains fatty acids, if given in excess it will interfere with the digestive process of feed in the rumen. Utilization of feed from agricultural and plantation industrial waste is an alternative to reduce feed costs incurred by farmers. In addition, the use of feed ingredients containing high energy density such as vegetable oil is expected to support livestock productivity.

The use of high energy density feed ingredients such as fats or vegetable oils continue to be developed in the beef cattle industry. Supplementation of vegetable oils with polyunsaturated fatty acids in the ration is not only aimed at increasing consumption and efficiency of energy use but is also expected to increase the content of polyunsaturated fatty acids (PUFA) in ruminant meat and milk products [1].

The use of vegetable oils as an energy source and PUFAs is faced with the negative effects of PUFA on microbes and the rumen ecosystem which can have implications for the production performance of ruminants. One method to reduce the negative impact of PUFA during the digestion process of soybean oil in ruminants is through modification of its administration with calcium soap technology [2]. The addition of feed ingredients containing high PUFA is expected to increase milk production performance and PUFA content in milk [3].

This study was conducted to evaluate the effectiveness of using soybean oil calcium soap (CaS-soy) in the ration on the production performance of lactation Ettawa crossbrees goats from Southeast Sulawesi.

2. MATERIALS AND METHODS

The research was carried out at the Laboratory of the Beef Cattle and Exotic Animals Unit and the Laboratory of Nutrition Science, Feed Technology, Faculty of Animal Husbandry, Halu Oleo University, Kendari. The materials used were 4 lactating Ettawa crossbreed goats from Southeast Sulawesi with weight ranging from 24-33 kg. The feed ingredients used consisted of forage (odot grass) and concentrate (cassava, fine rice bran, coconut cake, molasses, CaCO3, urea, pollard and CaS-soy) and fresh milk. The equipment used was a permanent goat pen consisting of 4 plots equipped with feed and drinking containers, feed mixer, chopper, reactor stirrer, measuring cup, porcelain cup, Erlenmeyer flask, fat flask, Soxhlet distillation apparatus, electric heater and desiccator.

The feed ingredients used consisted of 60% odot grass and 40% concentrate. The concentrate used consisted of the following ingredients: cassava, fine rice bran, coconut cake, molasses, CaCO3, urea and CaS-soy mixed using an electric-powered feed mixer with a capacity of 50 Kg. Mixing the feed was done first by starting with small portions of feed ingredients and followed by mixing large portions of feed ingredients. Mixing was done until evenly mixed.

The research design used in this study was the Latin Square Design (RBSL) with 4 treatments and 4 replications. Parameters observed included: Dry Matter Intake (DMI), Organic Matter Intake (OMI), milk production and feed efficiency.

Data were analyzed by SPSS software. The treatment with significant effect was further tested with Duncan's test

4. RESULTS AND DISCUSSION

The results show that the application of concentrates containing various levels of CaS-soy in the feed has a significant effect (P<0.05) on the DMI, OMI, milk production, feed efficiency (Table 1).

Dry Matter Intake (DMI)

The use of CaS-soy at different levels has a significant effect (P<0.05) on the total DMI and DMI of forage, but it does not significantly affect the DMI of concentrate (Table 1).

The total DMI of feed shows that P1 is significantly different from P3 and P4, while P2 is not significantly different from P1. Total DMI of P1 (1.13 kg/head/day) is higher than P3 (1.05 kg/head/day) and P4 (1.05 kg/head/day). This shows that the supplementation of CaS-soy up to a level of 4.5% in the concentrate has not

Table 1. Production performance of lactating Ettawa crossbread from Southeast Sulawesi

Production performance	Treatment				P Value
	P1	P2	P3	P4	
Dry matter intake (% DM) (kg/head/day)					
Total Feed	1.13±0.18^{a}	1.06±0.18^{ab}	1.05±0.16^{b}	1.01±0.16^{b}	0.05
Forage	0.46±0.67^{a}	0.39±0.10^{b}	0.37±0.63^{b}	0.35±0.70^{b}	0.01
Concentrate	0.67±0.12	0.68±0.11	0.67±0.10	0.66±0.09	0.86
Organic matter intake (% DM) (kg/head/day)					
Total Feed	0.90±0.15^{a}	0.84±0.14^{ab}	0.83±0.13^{b}	0.80±0.13^{b}	0.05
Forage	0.38±0.05^{a}	0.32±0.08^{b}	0.31±0.05^{b}	0.28±0.05^{b}	0.01
Concentrate	0.52±0.10	0.52±0.09	0.52±0.09	0.51±0.08	0.92
Milk Production (kg/head/day)	0.34±0.22^{a}	0.40±0.22^{b}	0.45±0.25^{bc}	0.50±0.26^{c}	0.01
Feed Efficiency	4.16±2.46^{a}	5.26±2.70^{ab}	6.12±3.08^{bc}	6.78±3.07^{c}	0.01

Description: Different superscripts on the same line show significant differences (P<0.05): P1 (Concentrate without CaS-soy (control); P2 = concentrate containing 1.5% CaS-soy; P3 = concentrate containing 3.0% CaS-soy; P4 = concentrate containing 4.5% CaS-soy; DM = Dry Matter; OM = Organic Matter.

been able to increase the DMI for the research goats. This is in line with Harvatine and Allen [4] which states that the addition of unsaturated fatty acids can linearly reduce the DMI. The difference in the response of livestock to the addition of CaS-soy might be influenced by the nutrient content of the feed, especially the fat contained in vegetable oil or soybean oil. This also indicates that the provision of soybean oil as an energy source in the form of calcium soap (CaS-soy) seems to be quite effective in the presence of high PUFA in soybean oil so that it does not have a negative impact on the performance of the goats used in this study even though the DMI decreased. Salinas *et al*. [5] report that the addition of CaS-soy at different levels does not increase the DMI of experimental sheep. The DMI Salinas *et al*. [5] research with 1.5% SCa i.e. 212-270 (g/head/day), and decreases at the level of 3.0-4.5% SCa to 212-245 (g/head/day). Joseph [6] adds that calcium soap supplementation is able to improve the quality of the ration so that its consumption is small but it has much better contribution of energy nutrients so that it makes the livestock be physiologically full.

The highest total DMI is obtained in treatment P1 (1.13 kg/head/day) and the lowest total DMI is obtained in treatment P4 (1.01 kg/head/day). Adhani *et al*. [7] (2012) add that the level of livestock consumption is influenced by body weight, age, genetic factors, lactation period, feed and environmental factors (temperature, humidity and sunlight).

Organic Matter Intake (OMI)

The use of CaS-soy at different levels has a significant effect (P<0.05) on the total OMI and OM of forage, but it does not significantly affect the OMI of concentrated (Table 1).

OMI of P1 (0.90 kg/head/day) is significantly higher (P<0.05) than P3 (0.80 kg/head/day) and P4 (0.83 kg/head/day), but it is not significantly different from P2 (0.84 kg /head/day). Total OMI ranges from 0.80-0.90 kg/head/day. The OMI seems to be decreasing along with the decline in DMI because the amount of DMI is closely related to the amount of OMI. This is in line with the opinion of Sutardi [8] that OM is closely related to DM, because OM is part of DM, if the level of DMI of animal feed is low, it is followed by a low level of OMI and vice versa.

The low DMI and OMI for lactating crossbreed goat feed along with the increase in CaS-soy can be understood because the use of CaS-soy aims not only to improve the quality of the PUFA content of livestock products but also to increase energy efficiency. This is because the energy density possessed by the feed ingredients contains very high oil/fat.

Milk Production

The use of different levels of CaS-soy significantly affects (P<0.05) goat's milk production (Table 1).

Milk production at P4 (0.50 kg/head/day) is significantly higher (P<0.05) than P1 (0.34 kg/head/day) and P2 (0.40 kg/head/day), but it is not significantly different from P3 (0.45 kg/head/day). This indicates that the use of CaS-soy up to 4.5% in concentrate could increase milk production of lactating Ettawa crossbreed goats from Southeast Sulawesi.

Milk production in this study (333-486 ml/head/day) is higher than Ramadhan *et al*. [9] with the same forage composition (60% forage: 40% concentrate) which is 340 ml/head/day. Mardalena *et al*. [10] report that Ettawa goats fed basal diet produce milk 440 ml/day. This is presumably because in both research by Ramadhan *et al*. [9] and Mardalena *et al*. [10] did not use CaS-soy in feed. The other thing shows that the administration of CaS-soy in concentrate can increase the milk production of lactating Ettawa crossbreed from Southeast Sulawesi.

Wina *et al.* [11] report that feeding with the addition of oil or fat can provide additional energy to lactating cows so that milk production is maintained and does not decrease as fast as the control treatment. The average milk production for 4 months is produced by dairy cows fed Ca-FA which is higher than the control cows (11,410 vs 10,740 ml/day). Maeng *et al*. [12] state that the addition of 3% calcium fat into dairy cattle feed cause milk production increasing from 18,880 ml/day to 22,480 ml/day. Similar results were reported by Reis *et al*. [13] who obtained higher milk yield (37,800 ml/day) in cows given calcium fat PUFA compared to control cows. Meanwhile, the administration of higher fat calcium (4%) in cross cattle results in higher milk production than the control [14].

Milk production in this study is much lower than Asminaya [15] which use conventional feed namely 1283.81 ml/head/day and the standard for Ettawa crossbreed goat milk production is 1000-1,500 ml/day [16]. This is due to the poor grade of Ettawa crossbreed goats accompanied by body posture and small udder shape. Mardalena *et al.* [10] state that physiological conditions affect the productivity of dairy goats, especially the amount and quality of milk.

Feed Efficiency

The use of various levels of CaS-soy in concentrate has a significant effect (P<0.05) on the feed efficiency. Table 1 shows that the efficiency of milk production in each treatment tends to increase as the CaS-soy level (from 4.16 to 6.78).

The feed efficiency value of P4 (6.78) is significantly higher than P1 (4.16) and P2 (5.26), but it is not significantly different from P3 (6.12). This shows that the use of CaS-soy up to 4.5% can increase the feed efficiency.

The highest value of milk production efficiency is obtained at treatment P4 (6.78) and the lowest at P1 (4.16). From a quantitative perspective, the results of

this study are lower than those of Adriani *et al*. [17] i.e 57.9-76.6. This means that the supplementation of CaS-soy in feed can improve the value of feed efficiency to the level of 4.5%.

The best feed efficiency in this study is seen at P4 (4.5% CaS-soy in concentrate) because it could produce higher milk production (0.5 kg/head/day) with the lowest DMI (1.01 kg/head/day).

Feed efficiency is a measure of converting nutrients into livestock production. Maulfair *et al*. [18] report that feed efficiency (sometimes called milk efficiency or DMI) is a simple thing to measure or determine the relative ability of livestock to convert feed nutrients into milk or milk components. Several factors that affect production efficiency are milk production, nutritional content of feed and the ability of livestock to digest feed. The efficiency of milk production is the calorie milk produced divided by the feed (TDN) consumed, milk production (liters) is recorded every time, time of milking (every morning and evening) [19].

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