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The Effects of Linseed Supplementation in Ration on Milk Production and Quality of Lactating Ettawa Crossbreed Dairy Goats

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Abstract. The objective of this study was to evaluate the use of linseed in ration on milk production and quality of lactating Ettawa crossbreed dairy goat. Sixteen Ettawa crossbreed dairy goats were allotted according to completely randomized block design. The goats were distributed into 4 blocks according to the initial milk production and 4 treatments. The treatments consisted of basal ration consisted of 20% odot grass and 80% concentrate (T1), and ration consisted of 20% odot grass and 70% concentrate supplemented with 10% linseed (T2), 10% linseed protected with 10 g/kg formaldehyde (T3), or 10% linseed protected with 34 g/kg cinnamaldehyde (T4). The results showed that linseed supplementation had no effect on dry matter intake, milk production and quality including milk fat and protein content. The ratio of milk production and protein consumption was not affected by the treatment. It is concluded that linseed supplementation in the ration of lactating Ettawa Crossbreed dairy goats ration had no effect on dry matter intake, milk production and quality.

Keywords: *Linseed Supplementation, ration on milk, lactating ettawa, dairi goats*

1. Introduction

Improving the quality of milk as animal products that have high value to maintain human health is important. Selection of feedstuff quality is a main priority to support in improving animal products both milk and meat. Linseed (*Linum usitatissimum*) is one of the animal feeds that contain essential fatty acids such as omega-3 and omega-6 [1]. This fatty acid is needed to be transferred from feed into the fatty acid profile of animal products. Besides, Linseed is also a high protein source. The process of digestion in ruminants is different from the non-ruminants. Proteins that enter the rumen will be degraded by rumen microbes to ammonia (N-NH₃) which will be used by rumen microbes for growth. [2] reported that physical protection against urea using oil in a ratio of 1: 2 with molasses would result in slow-released of ammonia which would ultimately optimize rumen microbial synthesis.

Besides that, fat will go through bio-hydrogenation in the rumen and convert unsaturated fatty acids into saturated fatty acids, that will be transferred into animal products both milk and meat. Feed that are high in protein and unsaturated fats must be protected to maintain the quality of protein and essential fatty acids in feed. According to [3], the use of formaldehyde as an agent for protein protection is quite effective as much as 1% of dry matter (DM) of feed. Furthermore, it was stated that protein protection using formaldehyde would also keep fat from the biohydrogenation process in the



rumen. The optimal performance of an animal is supported by many factors including feed and management. Both of these factors are controlled by genetic factors that cannot be improved except by cross-breeding. The study of feed aspects is very important considering the cost of feed that has the highest cost in the animal business. Currently, the feeding program for industrial farming is directed at improving the quality of animal products not only for improving the quantity. Milk and meat products are expected to be high in essential fatty acids, especially omega-3 and omega-6, high in protein and low in cholesterol.

In addition, it needs to consider a combination of feedstuffs with physicochemical differences between feed ingredients. Previous studies [4], [5], [6], [7] have examined synchronization between feedstuffs as a reflection of synchronization between nutrients in optimizing rumen microbial synthesis. Based on the fulfillment of nutrient needs for animals depending on the optimal or not the rumen microbial synthesis which will provide 40-80% of the total protein requirements for animals. So the remaining 20-40% of the remaining opportunity for protein needs comes from proteins that pass the microbial degradation in the rumen (Rumen Undegradable Protein = RUP). As has been taken into account in fulfilling nutrient requirements in lactating dairy cows, at the same level of production and milk fat content, the increase in milk protein levels is achieved by the addition of RUP in the ration [4]. The use of onggok with nutrient supplementation to increase rumen microbial synthesis can improve the rumen environment can increase total digestible nutrients or total digestible nutrients (TDN) of the rations.

Based on the reality of the importance of the role of the RUP in ruminant, it is necessary to apply the protein protection technology for animal feed for protein needs to be done. Various types of protection methods have been studied, but this study will study safe protection without leaving residues that have adverse effects on animals and consumers of meat and dairy products. The use of various protective techniques will have different effects on the feed ingredients of protein sources with the content and quality of protein in the feed. In addition, the use of heating techniques can reduce the level of dietary protein solubility in the rumen. While the use of fat at a certain level kept protein so that the protein will be resistant to degradation by rumen microbes. Linseed is an animal feed that is rich in essential fatty acids namely omega 3 and omega 6 fatty acids. As stated [5] that linseed the extrusion (pressing) is rich in α linoleic acid (ALA). According to [6] reported that the use of linseed oil increased the content of unsaturated fatty acids (unsaturated fatty acids) and reduce saturated fatty acids (saturated fatty acids). Furthermore, it is recommended to use the whole linseed compared to the use linseed seed oil in the lactating dairy cattle ration.

Feeding on dairy cows containing whole linseed, linseed pressed (extruding) or micronizing has 5 advantages, namely 1) increasing the content of alpha-linolenic acid (ALA), 2) increasing the content of conjugated linoleic acid (CLA), 3) decreasing the ratio of omega-6 / omega-3, 4) decreases overall saturated fatty acid (SFA) content and 5) increases the proportion of stearic acid when relativized with SFA [7]. Furthermore, it was stated that the improvement of milk fat profile provided additional nutritional value in terms of a good sensory test and a healthier fat profile. Flaxseed which is protected with formaldehyde with a sufficient dose that is recommended did not interfere with normal metabolism in the rumen and did not interfere with the measured production parameters[8]. Furthermore, it was concluded that protection by using formaldehyde on flaxseed with a fairly good dose can provide by-pass fat to increase C18: 2 and C18: 3 in fat milk cow.

This study was designed to examine the effects of various methods of protecting linseed feed ingredients containing high protein and essential fatty acids (unsaturated fatty acids). The objective of this study was to evaluate the use of linseed in ration on milk production and quality of lactating Ettawa crossbreed dairy goat.

2. Materials and Method

This research was performed at the Dairy Goat Farm in Gemolong for 4 months. Analysis of the experiment was done at the Laboratory of Animal Nutrition and Feed Science, Faculty of Agriculture

UNS, Animal Product Technology Laboratory, Faculty of Animal Husbandry UGM, and Food and Chemical Laboratory UGM, Yogyakarta.

Sixteen Ettawa crossbreed goats were divided into 4 treatments. The body weight of the ranged is from 30 to 40kg and they were in the first lactation. The ration consisted of forage and concentrate with a ratio of 20: 80 (dry matter%). The ration was given with the standard of giving based on dry matter requirements (DM) that is equal to 3-6% of body weight. The grass used was Odot grass. The chemical composition of ration is shown in Table 1.

Table 1. Chemical composition of ration

Ingredients	DM, %	CP, %	CF, %	EE, %	Ash, %	NFE, %
Odor grass	11.96	9.13	29.63	1.37	19.94	39.93
Concentrates	87.56	10.88	13.51	3.14	10.03	61.94
Linseed	93.33	21.08	10.98	17.98	3.38	46.67

The study was done in a feeding trial technique. The treatment was given at a feeding frequency of 2 times per day and the adaptation period for 2 (two) weeks and was stopped when the consumption of goat's feed was constant and adaptation process was finished.

Feed intake or feed consumption is measured every day by reducing the amount of feed and the residue of the ration for 24 hours. Measurement of milk production is measured in 2 times milking, morning and evening in liter. Milk quality samples were analyzed every 3 days at the end of the period and one period during 28 days.

The chemical composition of milk is measured by appropriate methods, such as water content by the [8], protein (Lowry), fat and lactose [9]. Total solid (TS) measurement using the following equation: $1.23(\text{fat, \%}) + 2.71(100) (\text{BJ}-1)/\text{BJ}$ and solid nonfat (SNF) is calculated by reducing the total solid and fat content ($\text{SNF} = \text{TS, \%} - \text{fat, \%}$).

Tables 2. Ration formulation of experimental rations

Ingredients	Treatments			
	T1	T2	T3	T4
Odor grass, %	20	20	20	0
Concentrate, %	80	70	70	0
Linseed, %	0	10	10	10
Total, %	100	100	100	100

The data obtained were analyzed by analysis of variance in accordance with the design used. If it is significantly different, further tests were done with DMRT and Orthogonal Contrast Significance [10].

Tables 3. Nutrient content of experimental rations (dry matter basis)

Ingredients	Treatments			
	T1	T2	T3	T4
Crude Protein, %	10.53	11.55	11.55	11.55
Extract Ether, %	2.79	4.26	4.26	4.26
Crude Fat, %	16.73	16.48	16.48	16.48
Ash, %	16.01	15.94	15.94	15.94
Nitrogen Free Extract, %	57.54	56.01	56.01	56.01

3. Result and Discussion

Feed consumption calculated in dry matter (DM) is often referred to as dry matter intake (DMI). Basically feed consumption is an important factor that determines the availability of nutrients for health and animal products. Accurate and correct estimation of DMI is important for preparing ration formulations and can prevent underfeeding or overfeeding and support the efficient use of nutrients for animal. Underfeeding can result in limited nutrients for production and then affect the health of animal. While overfeeding will increase the cost of feed and excessive excretion of nutrients into the environment. In addition, excess nutrients can have toxic effects for animal and harm health because of the imbalance of nutrients in the animal body.

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Table 4. Feed intake and milk production of lactating Ettawa crossbreed dairy goats

Variables	T1	T2	T3	T4
Feed intake, g/d	1335.95	1408.85	1330.29	1323.11
Protein intake, g/d	166.31	190.91	181.11	179.50
Milk yield, ml/d	446.00	541.50	563.50	488.50
Milk yield (4%FCM*), ml/d	732.09	736.72	678.15	655.37
Ratio milk yield/protein intake	3.08	2.83	3.10	2.70

*) 4% FCM: Fat Corrected Milk at 4% milk fat

The use of linseed in this study did not reduce palatability and did not reduce or accelerate the feed flow rate in the rate of passage of the goats. As a result of this condition, feed consumption between the goats did not provide a significantly different ($P > 0.05$). High and low ration consumption will ensure nutrient availability. The measurement of nutrient consumption, especially protein, can be seen in Table 1, that with the level of consumption that is not statistically different, there is no significant difference in protein consumption.

Table 5. Chemical composition of lactating Ettawa crossbreed dairy goats milk

Variables	Treatments			
	T1	T2	T3	T4
Density (BJ)	1.0278	1.0278	1.0275	1.028
Fat (%)	7.55	6.57	6.45	6.28
Protein (%)	3.23	3.55	3.11	3.14
Lactose (%)	4.61	4.33	4.64	4.68
Total Solid (%)	16.30 ^a	15.18 ^b	14.63 ^b	14.80 ^b
SNF (%)	8.75	8.61	8.44	8.52

^{a,b,c} average values followed by different superscripts show significant differences ($P < 0.05$)

The resulting milk production tended to increase with the use of both protected and unprotected linseed but did not show significant differences between the treatments applied. This is consistent with [11] feed consumption, milk production, fat, protein and milk SNF were not influenced by rations containing 0.5, 10 and 15% flaxseed protected with formaldehyde. According to [12] that feed is

responsible for protein, fat content but does not affect milk lactose. It can be explained that all four rations provided have the same potential in presenting nutrients for animals. This situation shows that the nutrients contained in the treatment ration are able to support optimal milk production. In contrast to the results, as reported by [13] that the use of protected protein at 8% level can increase the levels of protein, lactose and milk fat. If milk production compared to protein consumption can be used to evaluate protein quality. Basically, protein sources for ruminants come from microbial proteins and proteins that are not degraded in the rumen. Based on this, it can be explained that the nutrient content of the treatment ration is able to provide nutrients for the growth and development of rumen microbes. Protein content and composition of amino acids which make up microbial proteins are similar to the amino acid composition needed for protein synthesis in the body of livestock. Naturally, feed ingredients that contain high fat, the proteins contained therein will have difficult properties to be integrated with the rumen. Therefore, it is likely that this causes milk products produced is not significantly different between treatments. The ratio of milk production and protein consumption does not show any real differences. The ratio of these two parameters can be used to determine the amount of intake protein that can be used to synthesize milk. This will illustrate the protein quality of ration for each treatment. In addition, when viewed from the level of milk protein (Table 2) showed different levels of protein were not significant between treatments and control treatments.

4. Conclusion

In conclusion, the use of linseed in ration of lactating Ettawa crossbreed dairy goats tends to increase milk production and milk quality, but the result is not significantly different.

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