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The Effect of Micro Organic Mineral Supplementation on Feed Consumption, Milk Production and Milk Quality of Jawarandu Dairy Goats

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Abstract. This experiment aimed to determine the effect of organic mineral supplementation (Zn and Cu) on the milk production and milk quality for Jawarandu dairy goat. The experiment was held from February-April 2022 in Mulia Farm, Negrisakti, Pesawaran District. Experimental design used was Block Randomized Design (BRD) into 4 treatment and 3 groups. The treatments were level of R0: Basal Ration; R0: Basal Ration; R1: Basal Ration + Zn-Lysine 20 ppm, Cu-Lysine 5ppm; R2: Basal Ration + Zn-Lysine 40 ppm, Cu-Lysine 10ppm; R3: Basal Ration + (Zn-Lysine 60 ppm, Cu-Lysine 15ppm). Parameter absorbed include milk production, milk density and lactose. The data obtained is tabulated and then analyzed with analysis of variance (ANOVA). Based on the result of the study organic mineral supplementation on goat ration had no effect (P>0.05) on milk production and milk quality.

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INTRODUCTION

The development of dairy goat farming in Indonesia over the last 10 years has shown a positive trend, both in terms of the number of commercially managed dairy goat farms and the goat population kept in each business unit [1]. The population of goats in Indonesia in 2013 was recorded at 18,576,192 heads. The distribution of the population is still concentrated on the island of Java, namely 9,066,835 individuals, each in East Java 2,951,463 individuals, Central Java 3,990,544 individuals, and West Java 2,124,828 individuals.

Goat milk makes a significant contribution to the development of the dairy goat business in Indonesia. The demand for goat's milk is quite high, especially from people who live in urban areas. Consumers believe that goat's milk can help overcome health problems, such as heart and digestive diseases [2]. However, goat milk production is still low at 1-1.2 liters/head/day. With the low milk production of dairy goats, efforts can be made to provide quality feed. Most of the precursors for the synthesis of milk in the udder gland come from the blood which is very dependent on the quality of the feed and the absorption process in the body. It has been shown that quality feed that provides blood nutrition provides higher blood nutrition and is correlated with the process of milk synthesis in the secretory cells of the udder gland. The cost of feed is the largest production cost in the livestock business, reaching 60-80% of the total production cost. One solution in increasing and maintaining livestock productivity is to maximize the supply of complementary materials such as minerals, vitamins, amino acids, and additional fatty acids.

Minerals for ruminants are used to meet needs. Micro minerals are minerals that are needed in very small amounts. Nine elements that are considered essential to date are Cr, Co, Cu, J, Fe, Mn, Mo, Se and Zn. The addition of micro minerals into feed can improve the quality of nutrients in feed which is useful in optimizing productivity and helping to increase livestock growth [3]. This study aims to determine the effect of micro-organic mineral supplementation in feed on dairy goat milk production and milk quality.

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MATERIAL AND METHOD

Sample

This research was conducted at the Mulia Farm dairy goat farm which is located in Negeri Sakti Village, Gedong Tataan District, Pesawaran District, Lampung Province. Milk quality analysis was carried out at the Production Laboratory of the Department of Animal Husbandry, Faculty of Agriculture, University of Lampung.

The materials used in this study were 12 Jawarandu goats. Milk samples were taken on the 37th day after rearing. The ration used consisted of forage and concentrate consisting of tofu dregs, cassava pulp, chopped cassava, oil palm cake, molasses and salt. The supplementation used was organic micro minerals (Zn and Cu), lysine and aquadest.

Research Design

The experimental design used in this study was a Randomized Block Design (RBD) based on the type and weight of livestock which consisted of three groups. Grouping based on body weight, Group I = ±32-37 kg; Group II = ±39-45 kg; Group III = ± 47-53 kg. Each group consisted of 4 Jawarandu goats with 3 replications so that the number of goats needed was twelve. The basic ration used in this study consisted of pile, chopped cassava, oil palm cake, bran, molasses, salt. The treatments provided are as follows:

R0 = Basal Ration (pile, chopped cassava, oil palm cake, bran, molasses, salt);
R1 = Basal Ration + (Zn-Lysine 20 ppm, Cu- Lysine 5ppm);
R2 = Basal Ration + (Zn- Lysine 40 ppm, Cu Lysine 10ppm);
R3 = Basal Ration + (Zn- Lysine 60 ppm, Cu-Lysine 15ppm).

Procedures Manufacture of the mineral Zn Lisinat

$2\ Lys\ (HCL)_2 + ZnSO_4 \rightarrow Zn(Lys(HCL)_2) + SO42^-$

Preparation of solution I (Zn- Lysine) by mixing 43.82 g of lysine with distilled water into a measuring cup up to 100 ml. Preparation of solution II, by mixing 16.14 g of ZnSO4 with distilled water into a measuring cup up to 100 ml, then stirred until homogeneous. Then solution I was mixed with solution II.

Manufacture of the mineral Cu Lysinate

$2\ Lys\ (HCL)_2 + CuSO_4 \rightarrow Cu(Lys(HCL)_2) + SO_4^{2-}$

Preparation of solution I (Zn-Lysine) by mixing 43.82 g of lysine with distilled water into a measuring cup up to 100 ml. Preparation of solution II, by mixing 16.00 g of CuSO4 with distilled water into a measuring cup up to 100 ml, then stirred until homogeneous. Then solution I was mixed with solution II.

Methods and Analysis

Feed consumption is calculated by calculating the feed given minus the remaining feed. Milk production was measured in the morning and evening milking and data collection was carried out for 30 days. The quality of goat's milk was analyzed using a Lactoscan milk analyzer. Research data were analyzed using analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Effect of Treatment on Feed Consumption

TABLE 1. Feed consumption and milk production of Jawarandu goats with organic mineral supplementation treatment

Parameter	Grup	Treatment			
		R0	**R1**	**R2**	**R3**
Feed consumptions (g/head/day)	K1	1710.2	1961.9	2052.5	2008.7

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Parameter	Grup	Treatment			
		R0	R1	R2	R3
	K2	2262.5	2131.5	2384.3	2494.5
	K3	2544.0	2940.0	2632.2	2639.9
	Amount	6516.7	7033.4	7069.0	7143.1
	Average	2172.2 ± 242.2	2344.5 ± 522.7	2356.3 ± 290.9	2381.0 ± 330.5
Milk production (ml/ head/day)	K1	382,8	462.0	378.0	394.7
	K2	483,0	426.0	653.0	482.3
	K3	127,0	150.0	382.3	410.7
	Amount	1139.9	1038.0	1413.3	1287.7
	Average	330,0 ± 183.6	346.0 ± 170.7	471.1 ± 157.5	429.2 ± 46.6

The average ration consumption in treatment R0, R1, R2 and R3 were 2172.2 ± 242.2, respectively; 2344.5 ± 522.7; 2356.3 ± 290.9 and 2381.0 ± 330.5 g/head/day. The average consumption of treatment rations can be seen in Table 1. The results of the analysis (ANOVA) showed no significant effect on feed consumption. The highest consumption was at R3 which was 2381.0 (g/head/day). The average DM feed consumption in the study was higher than research [4], namely in Bligon or Jawarandu goats with a body weight of 30.25 kg at 17.35 and reinforcing feed 52%, DM consumption was around 1780-2330 g/head/day.

This is presumably because the average body weight in the R3 treatment was heavier than the R0, R1 and R2 treatments so that the dry matter consumption was more. According to [5] that consumption is significantly influenced by body weight of treated cattle. The use of feed in dairy goats will be prioritized for milk production, because the high metabolic activity of the udder gland requires an adequate supply of nutrients. The amount of feed consumed will affect the amount of other nutrients consumed, so the more feed consumed will increase the consumption of other nutrients in the feed.

[6] argues that goat consumption will be influenced by the energy and protein content of the feed. The higher the nutrient content (energy or protein), the less feed is consumed, this is because livestock needs have been met. However, in addition to the nutritional content of the feed, the palatability of the feed also affects the consumption of goat rations. The palatability of the ration affects the consumption of the ration where the palatability is influenced by the texture, smell, color, and taste of the feed. According to [7], dry matter consumption of feed can be influenced by the ability of the rumen to accommodate dry matter, where the faster the feed material leaves the rumen, the more feed enters or is consumed. The effect of feeding with the addition of organic micro minerals (Zn and Cu) in the feed showed no significant effect on milk production.

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Effect of Treatment on Milk Production

The average milk production of Jawarandu dairy goats observed in the treatment R0, R1, R2 and R3 was 330; 346; 471.1 and 429.2 ml/head/day. The results of the study of milk production with different feedings can be seen in Table 1. Based on the results of the study, it was shown that the administration of organic minerals had no significant effect on the milk production of Jawarandu goats. Milk production from the four treatments was said to be still below the normal production of Jawarandu goat's milk. Jawarandu goat milk production according to [8] on average can produce 1-1.5 liters of milk/head/day.

High milk production was caused by goats receiving additional supplementation treatment. This results in a higher supply of energy and amino acids for milk synthesis. While the low milk production in the control treatment was due to the rations given not meeting good milk production standards. The high milk production is influenced by feed. The role of feed on milk production has a very large effect on milk production because lactating dairy cows have increased metabolic activity of udder gland cells to synthesize milk. This is in accordance with the opinion of [9] that the level of milk production in dairy cows is influenced by factors, namely age, size and weight of the mother, growth, number of children born per birth and environmental temperature. According to [10], the productivity of dairy goats or the ability to produce products in the form of milk, both quality and quantity is influenced by factors including environmental factors by 70%, while genetic factors only affect about 30%.

Organic micro mineral supplementation Zn- Lysine 40 ppm, Cu- Lysine 10ppm above recommended by [11] showed the best results for the production of Jawarandu goat milk. This is because the consumption of these minerals increases metabolism in the rumen, especially in the synthesis of propionic acid, butyrate, which is a precursor of milk formation in the mammary glands. The results of this study are in line with the research of [12] and [13] that

appropriate micro organic mineral supplementation increases milk production as a result of increased metabolism of saturated fatty acids, resulting in increased levels of milk precursors.

Provision of sufficient micro-minerals in the ration of lactating dairy goats can increase rumen microbial activity which in turn will increase the metabolism of the livestock itself so that there will be an increase in milk production [14]. Increased production and fat content of milk is closely related to the content of propionic acid and propionic acid bacteria such as *Bacterioides amylophilus* and *Succinomonas amylolitica*.

Effect of Treatment on Milk Quality

TABLE 2. The quality of Jawarandu goat's milk with organic mineral supplementation treatment

Parameter	Grup	Treatment			
		R0	**R1**	**R2**	**R3**
Fat	K1	8.13	6.99	4.65	6.02
	K2	9.19	4.99	9.25	7.17
	K3	6.19	5.78	4.70	6.68
	Amount	22.51	17.75	18.60	19.87
	Average	7.50	5.92	6.20	6.62
Protein	K1	3.96	3.95	3.83	3.66
	K2	3.95	3.69	3.80	3.80
	K3	3.85	3.91	3.72	4.05
	Amount	11.75	11.55	11.35	11.51
	Rata-Rata	3.92	3.85	3.78	3.84
Lactose	K1	3,71	3,65	3,73	3,55
	K2	3,69	3,67	3,71	3,69
	K3	3,64	3,69	3,71	3,82
	Amount	11,04	11,01	11,15	11,06
	Average	3,68	3,67	3,72	3,69
Salt	K1	0.59	0.60	0.59	0.56
	K2	0.59	0.57	0.56	0.58
	K3	0.59	0.65	0.57	0.62
	Amount	1.77	1.82	1.73	1.75
	Average	0.59	0.61	0.58	0.58
Density	K1	1.029	1.029	1.030	1.031
	K2	1.030	1.032	1.031	1.031
	K3	1.031	1.034	1.031	1.032
	Amount	3.090	3.095	3.092	3.094
	Average	1.030	1.032	1.031	1.031

The average quality of Jawarandu dairy goats observed in the treatment R0, R1, R2 and R3 is presented in Table 2. Based on the statistical analysis obtained in the study, it showed that micro mineral supplementation in the ration had no significant effect ($P < 0.05$) on milk quality (fat content, protein, lactose, salt, and density) between treatments R0, R1, R2 and R3.

The fat content in this study ranged from 5.92-7.5%. This fat content range is higher than the research by [15] which is 6.29-6.71%. This fat content is in accordance with SNI 3141.1 which is a minimum of 3.00 [16]. Micro mineral supplementation (Zn-Lysine and Cu-Lysine) had no significant effect on the fat content of Jawarandu goat milk in this study. Fat content is negatively correlated with milk production, so that this study resulted in low milk production and high fat content, although additional feed treatment did not affect milk fat content. In this study, high fat content was produced compared to other research results because during bioprocessing in the rumen there was an increase in acetic acid which was higher than propionic acid so that the fat content formed was higher even though there was no significant difference between treatments.

Protein levels in this study ranged from 3.78-3.92%. The range of protein levels is higher than that of [15] study, which is 3.41-3.47%. The higher the level of supplementary feeding, the higher the content of bioactive components in the feed so that it will have a positive effect on the nutritional components of milk. [17] that the use of organic Zn (Lysine-Zn-PUFA and Zn-proteinaceous) can improve bioprocesses in the rumen, digestibility of nutrients, protein metabolism, and animal appearance. Zn minerals play a very important role in protein synthesis by microbes by activating microbial enzymes [18]. In addition, Zn minerals also function as activators and components of several dehydrogenases, peptidases, and phosphatases that play a role in nucleic acid metabolism, protein synthesis, and carbohydrate metabolism [19].

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The lactose content in this study was lower than the results of the study by [20] of 04.10%. According to [21] lactose is a combination of glucose and galactose found in milk. [22] added that when compared to cow's milk, lactose in goat's milk is 0.2-0.5% lower. Factors that affect lactose levels are the content of feed given to livestock. Because low feed quality can affect the low levels of lactose in milk. According to [23] milk lactose comes from propionic acid from rumen fermentation from crude fiber feed.

The average density of milk ranged from 1.030 – 1.032 (Table 2). The average density is relatively the same as the research by [24] that the specific gravity of goat's milk is 1.027-1.035. [25] added that the specific gravity of goat's milk ranged from 1,029 to 1,042. The specific gravity of milk required in SNI 01-3141-2011 [16] is at least 1,027 so that it can be seen that the milk has met the requirements. Based on the analysis obtained in the study, it showed that micro organic mineral supplementation in the ration had no significant effect ($P<0.05$) on the specific gravity of Jawarandu goat's milk. However, the specific gravity of goat's milk that received added organic micro-minerals (R1, R2 and R3) in absolute terms tended to be higher than those without organic micro-minerals. This is because the specific gravity of milk is strongly influenced by the density of the components that make up milk such as protein, lactose and minerals.

CONCLUSION

The conclusion of this study was that the administration of organic micro-minerals (Zn and Cu) had no significant effect ($P>0.05$) on feed consumption, milk production and milk quality of Jawarandu dairy goats.

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