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Research Paper

Milk Production and Quality of Etawa Crossbreed Dairy Goat at PT. Boncah Utama Tanah Datar

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ABSTRACT
This study aims to determine the milk production and quality of the etawa Crossbreed Dairy Goat (ECDG) at PT. Boncah Utama, Tanah Datar Regency. The study used 30-second lactating ECDG goats aged 2-2.5 years. 15 individuals were treated by calculating their protein and energy requirements. The feed given consisted of 60% forage and 40% concentrate, ration livestock needs were calculated based on 3% dry matter of body weight. The methods used were surveys and laboratory analysis. The types of data used are primary data and secondary data. The data analysis was carried out descriptively, namely, the arithmetic means and the standard deviation. The variables observed were milk production and quality (fat content, protein, total solid, solids non-fat, and total plate count). The results showed that the treatment had a significant effect on milk production and quality (P<0.05). The conclusion of this study is to feed quality and meet the needs of livestock and the application of milking sanitation affects the production and quality of milk produced.
KEYWORDS: *milk production, milk quality, Etawa*

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I. INTRODUCE

Goats are livestock that has functional values, namely livestock producing milk and meat. According to BPS (2011), the average increase in the goat population every year is 2.91 %/year and has the potential to be developed. Dairy goat is an alternative for milk-producing livestock as an effort to meet the needs of milk in Indonesia. The increasing public awareness of the importance of fresh milk has led to an increase in the demand/consumption of milk. The development of dairy goats in the livestock subsector can increase the livestock population in an area increasing milk production. One of the dairy goats that can be used for milk production is the Etawa Crossbreed Dairy Goat (ECDG). ECDG goat is the result of grading up between local goats, namely Local Goats and Etawa goats from India. ECDG goat has several advantages, namely as a meat and milk producer, ECDG goat milk production can reach 1.5-3 liters/day (Fitriyanto, Astuti, and Utami, 2013).

The production and quality of livestock milk can be seen from two aspects, namely in terms of quality and quantity. Several factors must be considered in the quality aspect, namely the production of milk for each livestock which is determined by the composition of milk and the live weight of the livestock, the higher the live weight, the greater the production, having good genetic potential so that the growth is also fast. Improving the quality of milk can be done by improving aspects of feed management and implementing milking sanitation. The feed is a source of energy and nutrients needed to produce quality milk. The quality of milk is an important aspect that must be considered so that milk that is produced and marketed is safe for consumption.

ECDG goats can be developed if they are supported by good management of livestock production and reproduction, trained human resources (HR), and the availability of feed. Therefore, it is necessary to improve aspects of feed management to increase milk production and quality. Besides, it is important to identify the factors that influence the production and quality of ECDG goat milk. This research was conducted to evaluate the production and quality aspects of ECDG goat milk at PT. Boncah Utama Kenagarian Barulak Tanah Datar Regency was to increase the production and quality of ECDG goat milk at PT. Boncah Utama needs to be improved on feed management and the implementation of milking sanitation.

II. METHOD

Research material

This study used 30-second lactating ECDG goats aged 2-2.5 years. For milk analysis used cage milk and then analyzed the quality of the milk which includes levels of fat, protein, total solid, solid non-fat, and total plate count. The composition and content of food substances for the ration can be seen in Table 1.

Table 1. Composition and Content of Food Substances for the Ration

Ingredient	Percentage of use
Gliricidia cepium (%)	15.00
Indigofera (%)	15.00
Ipomea batatas (%)	10.00
Tithonia diversifiola (%)	5.00
Odot (%)	15.00
Concentrate (%)	40.00
Total (%)	100
Nutritional content	
Dry matter (%)	46.79
Organic matter (%)	92.78
Crude protein (%)	15.14
Crude fiber (%)	17.06
Crude fat (%)	5.35
BETN (%)	55.23
TDN (%)	70.50

The equipment used in this research for proximate analysis is a set of sochlets, a set of distillation tools, an electric oven, a porcelain dish, a desiccator, an analytical scale, a dropper pipette, filter paper, a Kjeldahl flask, Erlenmeyer, hotplate. Measuring milk production and testing the quality of milk requires a liter, measuring cup, filter, petri dish, coolbox, milk can, lactose can, stationery, and documentation.

Experimental design

This research method is a survey method and direct observation in the field of lactating ECDG goats at PT. Boncah Utama. 15 individuals were treated by calculating their protein and energy requirements. The feed given consisted of 60% forage and 40% concentrate, livestock needs were calculated based on 3% BK from body weight. Besides, the calculation of milk production for ECDG goats that were not treated with rations was also carried out (control). The types of data used are primary data and secondary data. Primary data is data obtained directly during activities in the field and also through interviews. Secondary data, namely data obtained from recording during research, literature studies, related institutions, and research results relevant to the research problem.

Data analysis

Data on milk production among goats that were given ration treatment without treatment (control) were analyzed using the t-test with the following formula:

$$t \text{ count} = \frac{\overline{X}_1 - \overline{X}_2}{S_{x1-x2}} \qquad x_1 = \frac{(\sum x1)}{n} \qquad x_2 = \frac{(\sum x2)}{n}$$

$$Sx_1 - x_2 = \sqrt{\frac{2S^2}{n}} \qquad S^2 = \frac{(\sum X_1)^2 - \frac{(XY_1)^2}{n} + (\sum X_2)^2 - \frac{(XY_2)^2}{n}}{2\,(n-1)}$$

Information :

t : t value count

$\overline{x_1}$: Group average 1

$\overline{x_2}$: Group average 2

n : Number of samples
S : Combined standard deviation
Sx : Standard deviation

Research Implementation
The procedures in this study are:
1. Conducting observations/observations and direct interviews with breeders using a questionnaire.
2. Provision of additional feed in the form of forage and concentrate which is calculated according to livestock needs based on dry feed ingredients (3% BW).
3. Applying milking sanitation, that is, before milking, sanitation is carried out for livestock, milkers, and pens, udders and their surrounding areas are cleaned using a towel with warm water then lubricated the nipples, then the milking process can be carried out. After milking, teat dipping is done to prevent disease transmission.
4. Collecting milk production data and taking milk samples from 15 goats that were given feed treatment and 15 goats that did not receive feed treatment (control).
5. Milk production during lactation is measured by standardizing it to four months of lactation, according to Kirgessner (1982) the production of goat/sheep milk is four months.
6. Milk was analyzed as much as 500 ml. After the sample is obtained, the sample is put into a coolbox and then taken to the Veterinary Public Health Laboratory, Bukittinggi Veterinary Center for analysis of milk quality. Proximate analysis of feed was carried out at the Laboratory of Non-Ruminant Nutrition, Faculty of Animal Husbandry. Furthermore, descriptive data analysis was carried out.

Observed Variables
In this study, the observed variables were: fat content (%), protein (%), total solid (%), solid non fat (%), and Total Plate Count (TPC).

III. RESULTS AND DISCUSSION

Effect of Treatment on Milk Production
Average ECDG goat milk production results from research at PT. Boncah Utama, Tanah Datar District can be seen in Table 2.

Table 2. Average ECDG Goat Milk Production Results of Research at PT. Boncah Utama Regency Flatland

Parameter	Average milk production for four months of lactacion (l/head/day)	Average milk production (kg/ head/day)
Control milk production	0.733 ± 0.005^{a}	0.737 ± 0.005^{a}
Treatment milk production	1.251 ± 0.029^{b}	1.197 ± 0.028^{b}

Note: Superscripts with different letters in different columns show significantly different results ($P < 0.05$)

In Table 2, it can be seen that the average production of ECDG goat milk as a result of the study was 0.733 ± 0.005 liters / head / day or 0.737 ± 0.005 kg / head / day, while the average treatment milk production was 1.162 ± 0.027 liters / head / day or 1.197 ± 0.028 kg / head / day. The results of the t-test analysis showed that milk production between control and treatment goats showed significantly different results ($P < 0.05$). The milk production in the control was categorized as low compared to the treatment of milk production. The low milk production in the control is caused by the quality and quantity of forage feed that has not fulfilled the needs of goats. Adriani et al. (2004) argued that a quality feed provides higher nutrients to the blood and correlates with the process of milk synthesis in the udder gland secretory cells, which ultimately increases the production and quality of milk produced.

The feed for the control ECDG goat is not sufficient for daily needs and is still low in terms of quantity, although in terms of feed quality it is good. Based on the results of research and feed analysis, it was found that the crude protein content of the feed was 15.14% DM. Feeding management in the research location does not pay attention to the quality and quantity of feed needed by livestock.

Milk production is also influenced by the process of releasing milk (milk let down). Milk let down is the process of releasing milk from the alveolus and small ducts which is influenced by the hormone oxytocin. The stimulation occurs in the udder and nipples during milking, then travels through the spinal cord (in the spinal cord) in the hypothalamus to the brain, part of the posterior pars glandapituary. These stimuli secrete the hormone oxytocin into the bloodstream and are carried to the target organ, namely the udder. The hormone oxytocin will cause the myoepithelial cells in the alveoli to contract, pressing the milk out into the udder cistern.

The production of goat milk from the research results is not much different from Andriani's research (2013) which is 0.756 kg/head/day. Meanwhile, research by Astuti et al. (2017) production of ECDG goat milk ranges from 1,144-1,315 kg/head/day.

Effect of Treatment on Milk Quality

Testing the quality of goat milk includes fat content, protein content, total solid, solids non-fat, and Total Plate Count (TPC). The results of the ECDG goat milk quality test at PT. Boncah Utama can be seen in Table 3.

Table 3. Quality of ECDG Goat Milk Research Results at PT. Boncah Utama

No	Parameter	Results	
		Control	Treatment
1	Fat (%)	6.77^{a}	7.54^{b}
2	Protein (%)	3.80^{a}	3.92^{b}
3	Total Solid (%)	15.09^{a}	15.81^{b}
4	Solid Non Fat (SNF-%)	8.20^{a}	8.37^{b}
5	Total Plate Count (TPC) (CFU/ml)	2.3×10^{6a}	1.3×10^{5b}

Note: Superscripts with different letters in different columns and rows show significantly different results (P <0.05)

Based on the results of the diversity analysis, it was found that the treatment had a significantly different effect (P <0.05) on the quality of ECDG goat milk. The fat content of the goat's milk as a result of the study was 6.77%, while the treated goat's milk was 7.54%. The results of the analysis of diversity showed that the treatment gave significantly different differences (P <0.05) to the levels of milk fat. This is influenced by the amount of forage feeding which is sufficient and varied and concentrates that meet the needs of livestock. According to (Zurriyati et al., 2011) the increase in milk fat content is influenced by forage feed, which is a source of ration acetate, the more acetate production, the higher the fatty acid synthesis. Milk fat is the most sensitive component of changes in forage feed.

Forage feed undergoes a fermentative process in the rumen with the help of rumen microbes, then VFA will be produced consisting of acetate, propionate, and butyrate. The precursor to forming fatty acids that will be converted into milk fat in udder secretion cells is acetate. The more acetate production, the higher the fatty acid synthesis and can increase the milk fat content. Mutamimah et al. (2013) argued that milk fat content was influenced by acetate from forage, while acetic acid precursors came from crude fiber fermented in the rumen so that it turned into VFAs consisting of acetate, butyrate, and propionate. Acetic acid then enters udder secretion cells and becomes milk fat (Musnandar, 2011).

The high-fat content of ECDG goat's milk was also influenced by the month of lactation of ECDG goats. The condition of the livestock in the study entered the second lactation month. Praharani et al. (2015) stated that milk fat increased in the second month of lactation and increased in the following months until the dry period. In addition to the month of lactation, milk fat content is also influenced by the milking interval, where after milking udder will synthesize milk. The longer the pressure on the udder will increase, the milk synthesis lasts for 6-8 hours, then the cistern gland will be filled with milk and the entire lumen. Ace and Wahyuningsih (2010), Kurniawan et al. (2012) suggested that the milking interval affects the quality of the milk, the shorter the milking distance, the higher the fat content.

The milk fat content in this study was higher than Budi's (2002) research, namely goat's milk fat of 6 ± 0.05%. According to the TAS standard (2008), the fat content of fresh goat milk is 3.25-3.5%, while the milk fat content for the good category is> 3.5-4% and premium > 4%. The results of the study are not much different from Zain's (2013) research on Umban Sari and Alam Raya farms, namely 6.27% and 7.60%. The results of this milk quality analysis are relatively the same as Setyaningsih et al. (2013) found that goat milk fat content was 6.5–7.3%, Adriani et al. (2014) reported that the fat content of ECDG goat's milk was 6.83%.

Goat milk protein content at PT. Boncah Utama is 3.80% while the protein content of goat's milk which is given additional ration treatment is 3.92%. The results of the diversity analysis showed that the treatment had a significantly different effect (P <0.05) on milk protein content. The protein content of milk is influenced by the type of feed given. Forage and concentrate feed were able to produce higher levels of ECDG milk protein compared to those without concentrate feed. Good quality feed tends to increase the non-fat solid content in milk. Protein is one of the non-fat solid components (dry ingredients without fat) (Zurriyati et al., 2011).

Oktarina et al. (2004) stated that an increase in protein content in feed would increase the breeding rate and population of rumen microbes so that the ability to digest feed would be greater. High digestibility results in more nutrient intake which will be used for livestock growth. However, the addition of protein is not matched by giving sufficient TDN will not increase digestibility.

The protein content of the research results is by the standard of fresh milk according to SNI (1998) and TAS (2008), with a minimum protein content value of 2.8% and> 3.7% for premium grade fresh goat milk. However, it is lower than the results of the study of Zurriyati et al. (2011), namely the protein content of goat milk with ECDG of 4.29%. Zain (2013) states that the protein content of fresh goat milk in Umban Sari and

Alam Raya farms is 7.53% and 7.03%, respectively. While the protein content in the study of Ratya et al. (2017) was 3.8% and 3.9%, respectively.

Total solid fresh goat milk at PT. Boncah Utama was 15.09% while the total solid of goat's milk given additional ration treatment was 15.81% (Table 3). The results of the analysis of diversity showed that the treatment gave a significant difference ($P < 0.05$) to the total solid milk. Based on the results of the analysis of the quality of milk, it was found that the total solid dick was 15.09% with the results of the analysis of each component, namely the fat content of 6.77%, 3.92% protein, and 3.83% lactose. While the quality of milk in the treatment obtained a total solid 15.81% with the results of its component analysis, namely 7.54% fat content, 3.89% protein, and 3.94% lactose. The high total solid indicates that the quality of PE goat's milk is good. Mardalena (2008) states that short milking intervals will increase the dry matter content of milk.

The high total solidity in the study was caused by the quality of forage feed in the form of legumes including Gamal and Indigofera. Legumes have a high crude protein value so that the crude protein in the ration increases. Good quality feed will affect the total solid milk, so the quality of milk is largely determined by feed. Apart from the feed, the total solid is also influenced by the level of lactation because of the total solid increases with the month of lactation.

The total solid value of the study results was higher than the results of the study by Haeinlein et al. (2006) which is 12-13%, then Utari et al. (2012) stated that goat's milk has a total solid content of 13.90%.

Solid Non-Fat (SNF) consists of lactose, protein, minerals, and vitamins. Based on the results of the analysis of milk quality, it was obtained 8.20% solid non-fat milk for control goats, while the SNF treatment obtained was 8.37%. The results of the analysis of diversity showed that the treatment provided a significant difference ($P < 0.05$) on the solid non-fat. Non-fat solid levels in milk are influenced by levels of protein and lactose. By the opinion of Zurriyati et al. (2011) and Mitamimah et al. (2013) stated that the higher the protein and lactose, the higher the lean dry matter in milk. This indicates that the feed consumed shows a positive effect on solid non-fat levels.

Besides, the addition of concentrate in the feed also affects the levels of solid non-fat goat milk. Non-fat solid levels can be maintained by adding protein feed sources (Sukarini, 2006). Zain (2013) argues that the combination of forage and concentrate feed can produce a higher protein content of ECDG goat's milk compared to ECDG goats without being fed concentrate feed. The higher the protein content in the feed, the higher the protein content secreted into the milk. The source of protein in feed usually comes from concentrates. Increasing the availability of amino acids in the feed will increase milk protein synthesis (Zaidemarmo et al., 2016).

The non-fat solid value in this study is by the TAS standard (2008), namely 8.25%. The Food and Drug Administration (FDA) emphasizes that the non-fat solid standard in fresh milk is 8.72% of total milk solids and 3.67% in it is a protein (USDA, 2003). The results of the study were not much different from those of Ratya et al. (2017) which stated that PE goat milk solid non-fat 7.6-7.9%. However, the results of the study were lower when compared to Rizqan (2018) solid non-fat ECDG goat milk, namely 9.40 ± 0.13% by feeding the oil palm industry waste and Paitan plants.

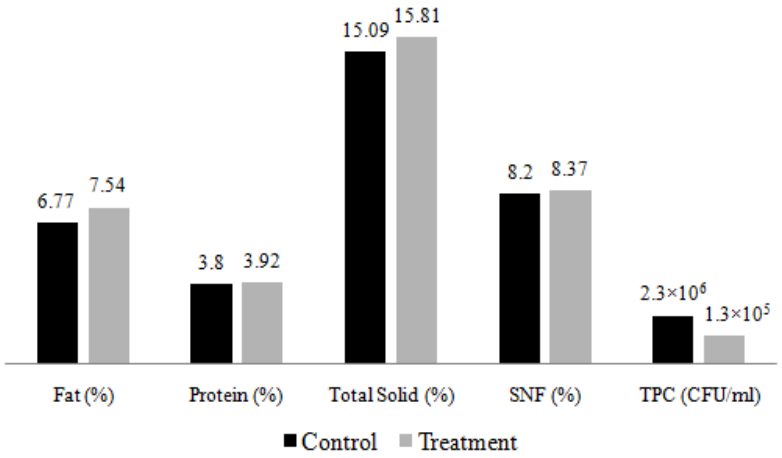
Based on the results of the calculation of Total Plate Count (TPC) of milk at the study site, the TPC of control milk was $2.3x10^6$ CFU / ml while the TPC of milk in the treatment was given additional rations was $1.3x10^5$ CFU / ml (Table 3). The results of the analysis of diversity showed that the treatment provided a significant difference ($P < 0.05$) on the TPC number of goat milk bacteria. This shows that the high total bacteria in the control compared to the treatment was caused by the milking process which had not implemented Good Milking Practice (GMP).

TPC can provide an overview of the overall microbiological condition of the microorganisms contained in the product (fresh goat's milk) including bacteria, molds, and yeasts (Walstra et al., 2006). Djaafar and Rahayu (2007) argue that milk spoils quickly due to the microbial content in the milk. Milking equipment is a source of contamination if not cleaned properly. Microbial contamination in milk begins at the beginning of milking because the microbes that are around the udder are carried away by the milk. By the opinion of Gustiani (2009) that bacterial contamination begins after the milk comes out of the udder, the milk will be contaminated immediately after it comes out of the milk glands by microorganisms originating from the nipple duct. The number of bacteria will increase in longer milk pathways (Millogo et al., 2010).

Examination of the microbiological quality of milk-based on the TPC value is an important factor, when fresh milk is processed into other processed products to produce good quality products and has a long shelf life, this microbiological test becomes an important parameter for the suitability of milk that is accepted by the community as a foodstuff. ASUH (Budiyono, 2009). TPC can provide an overview of the overall microbiological condition of the microorganisms contained in milk (Zain 2013).

The results of the research on the treatment have met the standards set in SNI 01-3141-1998 for fresh milk, namely $1x10^6$ or 6 log10 CFU/ml and Thai Agricultural Standard (TAS, 2008) for standard fresh goat milk class of $2x10^5$ or 5.30 log10 CFU/ml.

The quality of goat's milk obtained can be seen in the graph below.



Graph: Quality of Goat Milk Research Results at PT. Boncah Utama, Tanah Datar District

IV. CONCLUSION

In general, the production and quality of milk in the dairy goat farm at PT. Boncah Utama is classified as good. However, milk production and quality can be improved by meeting feed needs and improving the milking system. The quality of fresh goat milk is based on the test of fat, protein, total solid, solid non-fat at PT. Boncah Utama has met the standards of fresh milk according to SNI 01-31411998 and the Thai Agricultural Standard on fresh goat milk. However, the total plate count in milk is still high because farmers have not fully implemented GMP (Good Milking Practice). Therefore, the authors suggest that the application of GMP can be implemented so that the total milk bacteria meet the predetermined standards.

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