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EVALUATION OF THE USE OF MINERAL-PLUS ON PRODUCTION PERFORMANCE AND MILK QUALITY OF FRIESIAN HOLSTEIN CROSSBREED DAIRY COWS

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ABSTRACT

Complementary feed or feed supplement is a feed ingredient that is added to animal feed to complement the nutritional content of feed in meeting the needs of livestock. Feed supplements are additional feed ingredients intended to add nutrients to animal feed, where the added nutrients are digested or help the digestive process. This study aims to evaluate the use of mineral-plus as a feed mixture for dairy cows on the appearance of milk production and quality.

The used material with carried out on 30 lactating cows 1-3. 250 ml milk samples from the morning and evening milking of each cow were analyzed for milk quality analyzed with a Milk scan tool. The mineral added to the concentrate feed is 2% with the mineral composition in the form of a mixture of several macro, micro and herbal. The variables observed included feed consumption, milk production and quality (specific gravity, fat content, protein content, total solid content and pH value) of PFH dairy cows and the data were analyzed using descriptive statistical methods. The results showed that the average consumption of forage feed was 48.83 kg/head/day and concentrate was 13.42 kg/head/day. The average high milk production is 35.46 liters/head/day. The average quality of milk which includes fat content is 6.39%, SNF content is 8.13%, total solid is 14.48%, specific gravity is 1.0233, protein content is 4.57%, lactose content is 3.97 % and the pH value of milk is 6.48.This study shows that cow's milk production and quality is at a very high level above the average production of Friesian Holstein crossbreed cows.

Keywords: minerals, milk production and quality, Friesian Holstein (PFH) crossbreed cattle

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INTRODUCTION

Dairy farming is one of the economic drivers in rural areas considering that this farm is able to provide jobs for livestock farmers. Dairy cows are the main source of milk which has high nutritional value. More than 80% of national milk needs rely on imports due to the low milk production of existing dairy cows with an average milk production of no more than 10-12 liters/head/day (Tatra et al., 2015). This happens because of the low quality of genetics and the feed given, whereas the production and quality of cow's milk is strongly influenced by feed. Feeds with appropriate nutritional content for lactating dairy cows will support improvements in the amount of milk production and quality. Therefore, increasing the ability of milk production in dairy cows can be done by improving the quality of feed. Supplements in feed are needed to improve the digestive process and absorption of nutrients and this can be done by adding mineral content in it. The combination of macro and micro minerals in mineral Feed Supplements can improve the appearance of milk production and quality in dairy cows.

Basically, livestock need minerals in small quantities. Yet they are very important for physiological processes and growth. Minerals are one of the nutritional components that play an important role in the growth, health, production, reproduction and immunity of animals. Based on the amount needed by livestock, minerals are divided into macro and micro minerals. Macro minerals such as calcium (Ca), phosphorus (P) and potassium (K) are important elements in physiological and metabolic activities of the body, while micro minerals such as manganese (Mn), copper (Cu), zinc (Zn), cobalt (Co), iodine (I) and selenium (Se) support the activity of enzymes and hormones in the body. Cattle with subclinical mineral deficiency may experience a decrease in the average growth rate of 0.1 kg/head/day, reproductive ability below the optimum level and decreased resistance to disease. Cattle with clinical mineral deficiency can be diagnosed based on visible symptoms, such as emaciation, loss of appetite, and miscarriage of pregnant cattle.

Several minerals are needed for the metabolism of nutrients (proteins, fats and carbohydrates). The higher the protein feed consumed by livestock, the higher the protein content of the milk. This is in accordance with the statement of Prayitno (2002) which revealed that feed protein that undergoes metabolic processes in the body is useful for the process of protein synthesis and milk lactose. Suhendra et al. (2015) explained that consumption of dietary fiber will increase VFA as an energy source and carbon framework for protein formation. Sources of protein for ruminants can come from feed protein or Non Protein Nitrogen (NPN). Firmansyah (2012) added that peptides, plasma proteins and free amino acids are the main ingredients for forming milk protein sourced from blood. These three ingredients are synthesized in the mammary glands to produce milk proteins, especially casein, beta lacto globulin and alpha lactalbumin which are 90-95% of milk protein producers, while blood serum albumin, immunoglobulin and gamma casein are

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directly absorbed from the blood without undergoing any changes. Plasma protein is the building block of milk. The purpose of this study was to evaluate the effect of mineral addition in concentrate feed on feed consumption, production, and milk quality of PFH cows.

MATERIALS AND METHODS

This study used a survey method where observations were made on 30 lactating cows 1 – 3. The data identified included feed consumption, milk production of each cow and milk quality (specific gravity, fat content, protein content and total solids) of milk. Minerals were added to the concentrate feed as much as 2% with the mineral composition presented in Table 1. The nutritional content of the concentrate feed was as follows: Dry matter 88.67%; protein 18.23%; fat 5.13%; crude fiber 20.58%; ME 3,930 kcal.

Table 1: Composition of Minerals added in Concentrated Feed

P	147,000 mg	Fe	7,700 mg
Ca	285,000 mg	Io	65 mg
K	200 mg	Co	25 mg
Cu	1,800 mg	Se	30 mg
Zn	7,500 mg	Vit A	300,000 mg
Mn	7,500 mg	Vit D	60,000 mg
Mg	5,000 mg	Vit E	200 IU
Herbal : *Curcuma zanthorrhiza*and*Curcuma longa*			

Tools: 250 ml mlik sample in the plastic bottles used for milk sampling, Lactodensimeter to calculate specific gravity of milk, Milkscan to measure milk quality (protein, fat and TS content of milk).

Data analysis

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The data analyzed included the milk production of each lactating cow, the consumption of cow's feed, and the quality of the milk (specific gravity, fat content, protein content and total solid).

RESULTS AND DISCUSSION

Average Feed Consumption

The results showed that there were differences in the provision of forage and concentrate fodder at the time of feeding, namely in the morning and evening. The total forage feeding was 48.83 kg/head/day, with details: the average feed consumption rate was 24.9 Kg in the morning and the average feeding was 23.93 Kg in the afternoon. The total concentrate feed was 13.42 kg/head/day with details in the morning of 6.96 Kg/head/day and in the afternoon with an average of 6.46 kg/head/day, so that the average amount of concentrate feed given was 6.71 kg/head/day. The consumption of forage feed and fortification of the results of this study was higher than the findings of Khotimah (2011) which stated that the daily feeding of dairy cows was water (80 -150 liters), forage (35 kg), and concentrate (additional feed) of 12 kg. This greatly affects the productivity of dairy cows, especially for milk production. This difference is due to internal factors and external factors. Internal factors are all processes that take place in the body of livestock. External factors are factors that come from outside the animal's body such as the environment, feed, and livestock care.

Average Milk Production

The research showed that average milk production in the morning was 22.13 liters/head/day and an average of 13.33 liters/head in the afternoon with a total production of 35.46 liters/head/day. This study demonstrated a higher number than the ones conducted by Utomo and Pertiwi (2010) and Mariyono and Priyanti (2008) which informed that the average milk production of dairy cows in the country reached around 10 liters/head/day, while dairy cows fed rice straw and elephant grass were able to produce milk at an average of 10.87 liters/head/day and 11.11 liters/head/day.There are several factors that influence cow's milk production, namely genetic and environmental factors. Genetic factors include the nation and heredity, while the environment is the quality of the animal feed provided (Makin, 2011). In addition to improving feed, treatment must also be considered, namely the frequency of feeding has the possibility of increasing milk production (Siregar, 2001). According to Retnani et al (2014) the increase in milk production is due to mineral assistance which functions to enrich low nutritional value in feed with premixes that contain various vitamins, micro minerals, macro minerals and probiotics needed by livestock to produce milk. This is supported by Akhdiat et al (2021), who found that the addition of minerals affects the milk production of Friesien Holstein cows in the amount of 19.41 liters/head/day.

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Average Milk Quality

Milk is a natural suspension between water and dissolved substances in it, including fat, protein and lactose. Milk contains 3.45% fat, 3.20% protein and 4.60% lactose. The quality of milk is determined based on the constituent components of milk, which consist of fat content of protein, lactose, vitamins, and minerals or called Total Solid (TS). While Solid non fat (SNF) is a component of milk other than water and fat or dry matter without milk fat which depends on the content of protein, lactose and fat. Milk fat and milk protein levels were negatively correlated with milk production. The average milk quality data is presented in Table 2.

Table 2: Average Milk Quality of Research Results

Cow Number	Fat(%)	SNF(%)	TS(%)	Density	Lactose(%)	Protein(%)	pH
1	07.43	07.81	15.24	1.0239	04.39	02.95	6.2
2	08.08	07.69	15.77	1.0229	04.32	02.90	6.3
3	06.75	07.97	14.72	1.0251	04.48	03.01	6.4
4	06.09	08.04	14.13	1.0259	04.52	03.04	6.4
5	06.23	08.02	14.25	1.0258	04.51	03.03	6.4
6	04.86	08.25	13.11	1.0278	04.64	03.13	6.3
7	04,92	08.28	13.20	1.0279	04.66	03.14	6.4
8	05.28	08.19	13.47	1.0272	04.61	03.10	6.4
9	04.66	08.29	12.95	1.0281	04.66	03.14	6.4
10	05.51	08.14	13.65	1.0269	04.58	03.08	6.4
11	04.53	08.29	12.82	I.0282	04.66	03.14	6.8
12	05.29	08.48	13.76	1.0283	04.77	03.21	6.5
13	05.25	08.50	13.75	1.0284	04.78	03.22	6.3
14	06.54	08.29	14.83	1.0265	04.66	03.13	6.5
15	05.75	08.42	14.17	1.0277	04.75	30.18	6.4
16	06.75	08.53	15.28	1.0273	04.79	03.22	6.5

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17	05.19	08.78	13.97	1.0295	04.93	03.32	6.3
18	06.26	08.62	14.88	1.0279	04.84	03.25	6.4
19	09.14	07.70	16.84	1.0221	04.33	02.89	6.4
20	09.87	07.54	17.41	1.0209	04.24	02.83	6.5
21	06.81	07.96	14.77	1.0250	04.48	03.01	6.4
22	05.64	08.14	13.78	1.0267	04.58	03.08	6.6
23	07.80	07.98	15.78	1.0243	04.49	03.01	6.5
24	08.22	07.91	16.13	1.0237	04.45	02.98	6.7
25	08.33	07.85	16.18	1.0233	04.41	02.95	6.7
26	06.16	08.09	14.25	1.0261	04.55	03.06	6.5
27	09.96	07.23	17.19	1.0197	04.07	02.72	6.7
28	04.75	08.15	12.90	1.0275	04.59	03.09	6.6
29	02.74	08.72	11.46	1.0314	04.90	03.31	6.8
30	05.74	08.11	13.85	1.0811	04.56	03.07	6.7
Average	6.39	8.13	14.48	1.02335	4.57	3.97	6.48

Milk Fat Content

Based on the data in table 2, it can be seen that the average fat content of the afternoon milking is 6.39% with a range of 2.74 - 9.87%, while the average fat content of the morning milking is 6.32% with a range of 3.29-10.46%. The amount of milk fat content produced from the study was higher than the SNI (2011) standard, which was 4.20%. This difference arises because some of the minerals in the supplement are able to help the digestion of crude fiber which will be converted into acetic acid. Acetic acid is the main precursor for the formation of milk fat. Livestock need Zn minerals to help the body's metabolic processes because this substance functions as a catalyst that can activate microbes in digesting feed and produce digestive enzymes, so that the rumen fermentation process becomes more efficient and rumen metabolic products (VFA) increase. VFA is a source of energy for ruminants (Arimbi, 2004). Zn supplementation was able to increase the population of bacteria in the rumen considering that bacteria require very high Zn, namely 100-120 mg/kg which can optimize the activity of bacteria in producing digestive enzymes. Furthermore, the fermentation process in the rumen becomes

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more efficient and the products of rumen metabolism (VFA) will increase and in the end there will be more available nutrients. The mineral Zn also functions as an alkaline metalloenzyme phosphatase (AFA), an enzyme that plays a role in providing energy in the form of ATP. This energy is very important for livestock to maximize various metabolic processes, including the biosynthesis of milk fat.

Total Content of Solid Milk

The results of this study indicate the average total solid (TS) of milk produced is 14.42% and this amount is higher than the minimum limit contained in the SNI (3141.1:2011) which is 7.8%. This finding is also higher than the results of Laryska and Nurhajat (2013) where the TS content in milk ranges from 12.10%, solid non-fat (SNF) or dry matter without fat is at least 3.20%, and fat content (fat) ranged from 3.45%. This happens because the dry matter content of nonfat milk in the study is higher than the SNI standard (2011). It was emphasized by Zurriyati et al (2011) that total solid (TS) or dry matter is a component of milk which includes fat, protein, lactose, ash, while water is not included in the TS component.

Specific Gravity of Milk

The data shows that the average specific gravity of milk is higher than that of the afternoon milk, which is 1.02516 g/ml in the morning and the average density of milk for the afternoon milk is 1.02335 g/ml. Different milking intervals affect the value of the specific gravity (SG) of milk, so theSG value in the morning milking is higher due to the long lag time from morning to afternoon and evening to morning. This average does not meet the minimum standard requirements of SNI (2011), which is 27.0. According to Utami et al. (2013), the specific gravity of milk is influenced by the dissolved content in milk where the more compounds contained in milk, the density of milk will also increase. Furthermore, according to Sukarini (2006) the specific gravity of milk will be influenced by dry matter and milk fat content. In line with this statement, Legowo (2002) also suggests that the specific gravity of milk depends on the fat content in milk. Fat content has a negative effect on the specific gravity of milk. The lower the fat contained in milk, the higher the SG of the milk, conversely the higher the fat contained in the milk, the lower the SG of the milk.

Milk Lactose Level

The lactose content of milk can be measured using the Nelson method which was discovered by Fiona Frais from England in 1972 (Benerjee, 1982). The results of the study showed that the average percent value for lactose content was 4.17% to 4.93% and even reached 5.01. The average lactose content of the first and second day of milk was : 4.63%. Based on table 4 and table 5, the lactose content of milk ranges from 3.94 to 4.09%, which is above the normal range

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based on SNI (2011), which is in the range of 3.7 to 4.0%. Lactose content from the data above looks slightly higher than the established SNI standard, the higher the lactose content, the better the milk produced. Lactose in milk is one of the factors that affect the amount of cow's milk production. This is due to the water-binding nature of lactose, therefore the more lactose that is synthesized, the higher the milk production (Santosa et al., 2009). If the level of lactose increases, the osmotic pressure of the blood also increases, so that a lot of water is transferred from the lumen of the alveoli to maintain the osmotic pressure of the milk in order to balance the osmotic pressure of the blood (Utomo and Miranti, 2010). The level of lactose in milk is also influenced by feed consumption, a high content of propionic acid (C3) in feed can increase lactose levels in milk because propionic acid is converted into glucose and glucose is the main precursor for milk lactose formation.

Milk Protein Level

Based on Table 4 and Table 5, the average protein content of milk produced in the study was 2.95%, which is higher than the minimum limit contained in SNI (3141.1:2011) which is 2.8%. The results of this study are also higher than the results of research conducted by Firmansyah (2012) who found that the average protein content of the morning milking in Cilumber Lembang village was 2.89% while the afternoon milking was 2.88%. This is due to the addition of several minerals and probiotics and herbs in the added minerals. Mineral Zn is a mineral needed by livestock to help the body's metabolic processes. Zn mineral functions as a catalyst that activates microbes in digesting feed and produces digestive enzymes, including for the formation of milk protein derived from amino acids in feed.

pH of Milk

The results showed that the average pH of Holstein Fries dairy cow's milk on the first day, which was taken from a sample of 30 lactating cows, was 6.4. The average number of calculated pH in the normal range according to the SNI standard is 6.3 - 6.75. The main cause of pH changes in milk is microbial activity that produces acid (Bylund 1995). The longer the storage of milk, the average degree of acidity (pH) decreases which indicates that the level of acidity in milk is increasing. Superior mineral has sodium bicarbonate mineral content which has an impact in regulating acidity. This is in accordance with the opinion of Septadiana (2014) which states that sodium bicarbonate is one of the buffer compounds in milk. Fresh milk is amphoteric, meaning that it can be both acidic and basic at the same time.

The results of the analysis of variance in the amount of pH in Holstein Fries dairy cow's milk showed that concentrate feed mixed with superior minerals could stabilize the pH value or acidity of Holstein Fries dairy cow's milk. The pH value is related to lactose content, the pH value is caused by the feed mixed with superior minerals given. The results of this study are

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similar to the results of research by Ace & Wahyuningsih2 (010), AlZahal et al., (2014) and Mutaqin et al., (2017).) namely by adding PFM (Protein, Fat, Mineral) and DFM (Direct Fed Microbial) to support fiber digestion in the rumen of dairy cows where the results of this study showed a pH value between 6.4 - 6.5.

CONCLUSIONS AND SUGGESTION

Conclusions

This study concluded that:

1. The addition of mineral supplements to feed was able to increase milk production by an average of 35.46 liters/head/day, this number is higher than the results of other studies.

2. Milk quality; which includes fat content, Total Solid, lactose content, specific gravity, protein content and pH value of MILK; from this research is classified as good, above the standard set by SNI.

Suggestion

It is necessary to add a mineral supplement of 2% to the concentrate feed of PFH dairy cows in order to increase milk production and quality,.

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