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Analysis of Milk Production and Quality of Friesian Holstein Cows Before and After Maintenance at the Maju Mapan Joint Business Group of Dairy Farmers in Malang

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ABSTRACT

This study aims to analyze the variations in milk production and milk quality at the Maju Mapan Joint Business Group of Dairy Farmers in Malang before and after the outbreak of foot-and-mouth disease (FMD) in dairy cows. This study used fresh cow milk from dairy farmers who were members of the Maju Mapan Joint Business Group of Dairy Farmers in Malang. Purposive sampling was used to select the respondents. Out of a total of 300 dairy farmers at the Maju Mapan Joint Business Group of Dairy Farmers, 30 dairy farmers were selected as respondents. A sample of 10% the dairy farmers was taken to determine milk production and quality by recording data on milk production. The data were analyzed using the normality test and paired t-test. The results suggested significant differences in milk production and milk quality before and after the FMD outbreak at the Maju Mapan Joint Business Group of Dairy Farmers in Malang.

Keyword: foot-and-mouth disease, milk production, milk quality, dairy cows

INTRODUCTION

Animal husbandry is a crucial aspect of the agricultural sector that must be developed and utilized optimally for human welfare. Farmed animals, including ruminants, poultry, and monogastric animals, are raised to meet human protein needs. Livestock products, such as meat, milk, and eggs, are essential sources of protein for human consumption. Dairy cattle, such as the Holstein Friesian breed from the Netherlands, are known for their high milk production. However, in Indonesia, only 23% of the milk demand is met by local production, with the rest being imported (Purwantini et al., 2021). The Holstein Friesian cows can optimally

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produce milk in their home country. Unfortunately, they are unable to do so in Indonesia due to several factors, including poor quality seeds, less nutritious feed, and inadequate management.

To support the productivity of dairy cows in terms of both quantity and quality, three factors are essential. The most crucial factor is feed (Kurniawan et al., 2023). According to Pasaribu et al. (2015) suggested that the amount of feed, drinking water, livestock age, cage area, and milking interval have a significant impact on milk production. Moreover, Sari et al. (2017) argued that the ability and skills of farmers can significantly impact dairy farming outcomes. Good farming knowledge enables farmers to manage stressful events in dairy farming and maintain the health of dairy cows to improve the quality of both production and reproduction.

Foot-and-mouth disease (FMD) is an infectious disease that affects animals with cloven hooves and is considered one of the most dangerous diseases in the world, especially in countries that import and export. FMD was first reported in Indonesia in 1887 in Malang. Subsequently, the disease spread to Sumatra, Java, Sulawesi, Kalimantan, Bali, and Nusa Tenggara islands. In 1962 FMD was reported in Bali due to the illegal entry of livestock from East Java. The outbreak was stopped in 1966. In 1983, FMD outbreaks were reported in Central and East Java, which quickly spread throughout Java within two weeks due to livestock movement and meat trade. To control the spread of FMD, two methods were employed, namely mass vaccination of susceptible animals and control of the movement of animals and animal products, especially those from infected areas. Vaccination was administered to over 95% of the animals suspected of being infected with FMD in Java. These control activities helped to reduce the number of FMD cases in Indonesia from 1974 to 1983. The eradication of the disease in Indonesia began with the achievement of free status in Bali in 1978, East Java in 1981, and South Sulawesi in 1983. Indonesia was declared FMD-free in 1986. To control FMD, policies were implemented to control the movement of livestock across borders, a livestock vaccination program was established, and biosecurity measures were strengthened in animal enclosures. In addition, the management of animal feed contaminated with FMD can be an alternative solution to meet the basic nutritional needs of livestock (Sumartono et al., 2023).

FMD is a disease with a high rate of morbidity, but a low rate of mortality. The transmission of the disease at the Maju Mapan Joint Business Group of Dairy Farmers began with the introduction of *blantik* (cattle traders) to the dairy farmers which resulted in FMD outbreak in the area. The quick spread of the disease was facilitated by the lack of biosecurity knowledge among smallholders. The severity of the FMD cases was exacerbated by the blockage of traffic and the failure to implement quarantines in the area. In addition, the lack of seriousness among various parties in handling FMD cases had an impact on the decline in milk production and milk quality produced by smallholdings affected by FMD. The FMD outbreak had a negative impact on the social economy of the

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community, particularly affecting dairy farmers who made up the majority of the Maju Mapan Joint Business Group of Dairy Farmers.

MATERIALS AND METHODS

In this study, hypothesis testing using the paired t-test was conducted by comparing milk volume and quality before and after the FMD outbreak at the Maju Mapan Joint Business Group of Dairy Farmers.

The paired t-test is a parametric test used to compare two datasets. It is designed for comparative testing to determine if there is a difference between paired two groups. However, the test is only applicable to similar variable scales

This study compared the volume and quality of milk from dairy cows at the Maju Mapan Joint Business Group of Dairy Farmers before and after FMD. The paired t-test was used as a method of hypothesis testing for paired data. In this test, the research subject was subjected to two different treatments, that is, the first treatment and the second treatment of this study. SPSS for Windows was used to test differences between the two datasets. Milk quality was observed using the Lactoscan milk analyzer, while milk production was measured using a liter meter. In addition, milk specific gravity was used as a component to measure milk quality.

RESULTS AND DISCUSSION

The results of statistical analysis of milk production are presented in Table 1. The results suggested that FMD had a significant impact on milk volume ($p < 0.05$). Before the FMD outbreak, the Maju Mapan Joint Business Group of Dairy Farmers produced an average of 19.46 liters per day, totaling 583.97 liters per month. After the FMD outbreak, the average daily milk production decreased to 15.22 liters, totaling 456.71 liters per month, representing a 22% decrease in milk production. This number is lower than that of the United Kingdom that experienced a 25% decrease in milk production of Holstein Friesian cows due to FMD (Ferrari et al., 2014).

Table 1. Results of Paired Sample t-Test of Milk Volume at The Maju Mapan Joint Business Group Dairy Farmers

Milk volume	Average	t count	t table	Sig	α = 5%
Milk volume before FMD	583.97	5.712	2.04523	0.000	0.05
Milk volume after FMD	456.71				

Source: Data processing results (2022) Notes:
Significantly different ($p < 0.05$)

Furthermore, the results of statistical analysis of milk specific gravity are presented in Table 2. The results suggested that FMD had a significant impact on milk specific gravity ($p < 0.05$). Before the FMD outbreak, the average specific gravity of

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milk produced by the Maju Mapan Joint Business Group of Dairy Farmers was 1.0230 g/ml. After the FMD outbreak, the average specific gravity of milk decreased to 1.0227 g/ml.

Table 2. Results of Paired Sample t-Test of Milk Specific Gravity at The Maju Mapan Joint Business Group of Dairy Farmers

Specific gravity of milk	Average	t count	t table	Sig	α = 5%
Specific gravity of milk before FMD	1.0230	3.364	2.04523	0.002	0.05
Specific gravity of milk after FMD	1.0227				

Source: Data processing results (2022)
Notes: Significantly different ($p < 0.05$)

The results of this study suggested that FMD, which was prevalent in cows at the Maju Mapan Joint Business Group of Dairy Farmers, caused a decrease in milk production. Zali *et al*. (2022) described the clinical symptoms of FMD in Bukek Village, including high fever in cows reaching 41°C, chills, anorexia, drastic decrease in milk production, loss of body weight, loss of body temperature control, myocarditis, and miscarriage in young animals, swelling of the mandibular lymphoglandula, hypersalivation, blisters, and erosions around the mouth, muzzle, nose, tongue, gums, hooves, and udders. In addition, calves born to FMD-infected cows are at a high risk of mortality. Those who drink their milk may also die. FMD also affects calcium absorption, which can further affect milk production. The impact of FMD at the Maju Mapan Joint Business Group of Dairy Farmers was felt by the community, especially dairy farmers, because they relied on dairy farming as their primary source of income and livelihood. However, due to a lack of human resources and knowledge related to FMD outbreaks, the virus spread quickly. Moreover, the community lacked information about the prevention and handling of FMD outbreaks. This was attributed to a lack of internet access in the hilly area. As a result, farmers overlooked the importance of quarantine and were unaware that adult animals had a higher chance of survival than young animals because they were more resistant to disease. Most diseases in cattle are caused by viral or bacterial infections, as well as poor feeding practices. To prevent this, it is crucial to pay attention to their nutritional intake from both forages and concentrate feeds, as well as maintaining the cleanliness of cages, environment, and equipment (Sudrajat et al., 2022).

This study found that the dairy cows affected by FMD produced significantly less milk. This is consistent with the findings of Ranjan et al. (2016) that cows affected by FMD refused to eat, became lame, and produce up to 80% less milk. Livestock affected by FMD also required a

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long recovery time, which lead to economic losses. Therefore, it is important to properly treat the livestock to accelerate their recovery. Even if the livestock that have been declared free of FMD, milk production will not increase immediately.

Feeding large amounts of concentrate feeds does not increase milk production. Milk production and quality of cows are factors that affect the nutrient requirements of dairy cows, one of which is minerals. Cow require minerals for rumen microbial requirements. In the early lactation stage, cows begin to lose minerals. Milk production increases as the nutrient requirements increase (Imran et al., 2017). Livestock affected by FMD experience unstable physiological condition. Therefore, the Maju Mapan Joint Business Group of Dairy Farmers provided special FMD recovery feed to support the recovery of dairy cows affected by FMD. This feed contained calcium, phosphorus, and high calories with nutrient contents of 9% crude protein, 7% crude fat, 12% moisture content, and 85% total digestible nutrient. Miarsono et al. (2021) suggested that the ingredients of animal feed contain varying concentrations of nutrients. The fulfillment of the nutrients is crucial for livestock, especially dairy cows, to produce high quality milk. Meeting the nutritional needs of dairy cows is a determining factor for the success of dairy farms. Balarumugan et al. (2017) found that mineral deficiencies in dairy cows can lead to poor reproduction. Therefore, Ranjan et al. (2016) suggested that providing recovery feed to cattle affected by FMD for 21 days can increase milk production to 100% by day 32 to 35, while cows not provided with recovery feed only increased milk production to 50%. Ankit and Dipali (2017) suggested that provide the necessary mineral components is crucial for improving reproduction in dairy cows.

This study found that in the morning the specific gravity of milk produced by the Maju Mapan Joint Business Group of Dairy Farmers was 1.0230, while in the afternoon it was 1.220 at a temperature above 31^{o}C. These results are still below the minimum standard of SNI 3141-01:2011 for fresh milk, which is 1.0270 g/mL at a temperature of 27.5^{o}C. The specific gravity of milk is an indicator of its concentration. Sudarwanto et al. (2020) identified several factors that can affect the specific gravity of milk, including water addition, milk fat content, feed dry matter, and lean dry matter. An increase in lean dry matter can increase the specific gravity. In contrast, an increase in fat content can decrease the specific gravity. In other words, milk quality improves with an increase in the specific gravity due to the concentrated nutrient content of milk with low water content (Wulandari et al., 2017).

The results suggested that after the FMD outbreak, the specific gravity of milk decreased. Factors that affect changes in milk specific gravity are protein, fat globules, lactose, and salt. These components affect milk specific gravity by increasing mineral, protein, and lactose, while decreasing fat (Ostan et al., 2016). In addition, the specific gravity decreased after FMD due to farmers adding water to milk. This occurs because milk production decreased and farmers compensated by adding water to increase volume. However, Wirjatmadja et al. (2020) suggested that the specific gravity of milk decreases with the addition of water.

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CONCLUSION

The average daily milk volume at the Maju Mapan Joint Business Group of Dairy Farmers decreased from 20.06 liters before FMD to 19.46 liters after FMD, resulting in a decrease of 22%. This decrease was found to be statistically significant ($p < 0.05$). In addition, the specific gravity of milk decreased from 1.0230 g/ml before FMD to 1.0227 g/ml after FMD. This decrease was also found to be statistically significant ($p < 0.05$).

APPROVAL OF ETHICAL COMMISSION

Ethical clearance was not required for this study because fresh milk samples were used. The samples were collected from Holstein Frisian cows in Malang, East Java.

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