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Foot and Mouth Disease Impact on Milk Productivity and Quality in KUD Kertajaya, Kediri, Indonesia

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Abstract

One of the impacts of foot and mouth disease (FMD) on the dairy farming sector is decreasing the quantity and quality of milk production. This study aimed to determine the impact of FMD by observing the productivity and quality of fresh milk during FMD outbreaks. Sampling was performed to obtain productivity data before and during the FMD outbreak using the cluster sampling method in five areas in KUD Kertajaya, Kediri, Indonesia. The lactoscan test was used to analyze the quality of fresh milk from 50 positive samples. Based on the statistical analysis using the paired parametric T-test, it was reported that there was a significant difference in milk productivity before and during the FMD outbreak ($p < 0,05$). The results of the Lactoscan test on 50 positive samples showed an average fat content of 4,43%, solid nonfat (SNF) content of 8,54%, specific gravity of 1,028, lactose content of 4,67%, total solids content of 12,97%, added water content of 1,44 and freezing point of -0,54°C. In conclusion, the milk of dairy cows during the FMD outbreak often displayed a quality value of milk that met SNI requirements, despite the fact that there was a major decline in productivity.

Keywords: dairy farm, foot and mouth disease, fresh milk, Lactoscan

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INTRODUCTION

The commercial sector of dairy farming can supply the Indonesian population's food and economic demands. In order to produce milk with the highest quality and quantity possible, breeders concentrate on managing dairy cattle upkeep. The biosecurity of the shed can influence both the amount and quality of milk. Potentially lower animal production yields and financial losses could result from the presence of infectious illnesses brought on by inadequate biosecurity. Foot and mouth disease (FMD) is an infectious disease that is currently endemic to livestock with cloven hooves, such as dairy cows. Its clinical signs include the production of vesicles in the mouth, legs, and udder, as well as fever, hypersalivation, anorexia, and extreme weakness (Tadesse *et al*., 2020).

A reduction in the milk volume delivered during a single milking is one way that FMD might affect breastfeeding dairy cows and restrict milk production. Since the virus is present in the mammary gland, there is a drop in milk production. According to Armson *et al*. (2020), the FMD virus can multiply in cow mammary glands, which will affect the quantity and quality of milk available for human consumption.

As a result, actions can be made to ascertain the productivity and quality of cow's milk positive for FMD infection by tracking production and evaluating the quality of samples taken from shelter posts. The percentage difference between milk production before and after FMD infection can be calculated by comparing data on milk production before and after FMD infection. This issue can be done by recording production outcomes when cows are infected with FMD. The laboratory tests conducted by Lactoscan and the organoleptic observation method for evaluating milk quality can both yield precise results on sample quality based on a number of characteristics that serve as a benchmark for each test method (Larasati *et al*., 2021).

In particular, industrial parties that collaborate closely with KUD Kertajaya in the processing and distribution of milk to the general public can use the results of the Lactoscan test to evaluate the quality of milk as a reference in determining the purchase price by the holding post for milk deposited by farmers as well as setting standards for the quality of fresh milk. The Lactoscan test will yield more reliable findings than the organoleptic method, which involves smelling and observing the milk's physical characteristics to determine its quality (Colenutt *et al*., 2020).

To ascertain the productivity and quality of milk generated by livestock, it is crucial to record and analyze the milk produced by dairy cows before and after FMD infection. To compare production outcomes and milk quality for the upcoming time, data on milk production and quality are used as a cooperative archive. Additionally, keeping track of production data and testing it can be used to evaluate farmers in an effort to increase milk production and quality, as well as a community's economy, particularly dairy farmers KUD Kertajaya in Kediri during the FMD outbreak.

MATERIALS AND METHODS

Samples

In June–July 2022, this study was carried out. The KUD Kertajaya in Kediri Regency, Indonesia, served as the study's location. Due to the fact that the collection was done haphazardly by dairy farmers at multiple milk collection stations, data was collected utilizing the incidental sampling method. Dairy cows owned by KUD Kertajaya that were lactating during the time periods before and after the FMD outbreak met the inclusion criteria. In the meanwhile, the exclusion criteria like bulls, cows in dry stalls, cows who have been pregnant for longer than seven months, heifers, and calf populations.

Evaluation of Milk Quantity and Productivity

From a population of 250 cows, 70 were selected as quantitative test samples for milk productivity analysis and 50 were selected as qualitative milk test samples using Lactoscan based on several criteria in the sampling technique. Milk production volume was evaluated in the period before and during the FMD outbreak. Lactoscan reflected the following variables i.e., fat (%), solid nonfat (SNF) (%), specific gravity (g m/L), lactose (%), total solid (%), add water (%), and freeze point (°C).

Data Analysis

Data were analyzed using the T-test with a significance level of $p < 0,05$.

RESULTS AND DISCUSSION

A total of 70 samples, including those from Ringi Agung, Mulyorejo, Medowo, Sidomulyo, and Sidorejo, were confirmed as positive. Direct farmer interviews provided the cow's milk production per milking information, and the KUD Kertajaya archives held the cow's milk productivity data. Figure 1 shows comparisons of milk production from cows who tested positive for FMD. Milk productivity data from FMD-positive cows at KUD Kertajaya generally showed a decline in milk output when the cows became infected with the disease. From 30 lactating cows, Ringin Agung cluster reduced milk production by 62,21%. Dusun Mulyorejo also had a 48,67% reduction, followed by Medowo, 48,61%, Sidomulyo, 46,91%, and Sidorejo, 45,42%.

The parametric paired T-test revealed a significant difference in milk productivity between the FMD outbreak and the pre-epidemic period ($p = 0,046$). The average milk output in the five clusters was 658,5 L/day before the FMD outbreak, but it dropped to 302,2 L/day on average during the FMD outbreak (Table 1).

50 positive FMD samples of cow's milk, which were required based on the findings of a physical examination, were used in the milk quality test results using the Lactoscan instrument. The following milk quality indicators were observed: fat (%), solid nonfat (SNF) (%), specific gravity (g m/L), lactose (%), total solid (%), add water (%), and freeze point (°C) (Table 2). In terms of SNF, fat, total solid, lactose,

density, added water, and freeze point, the milk produced by FMD positive cows still had values that matched SNI 3141.1: 2011 norms, according to a number of parameters of the milk quality test performed using Lactoscan.

Solid nonfat (SNF) and fat components make up total solid, also known as total dry matter, which is a component of milk (Saputra, 2018). Fat and SNF, or total solid components other than fat (protein, lactose, and other substances), are included in the total solid component of milk. The average total solids in this study still meet the requirements as the national norm for total solids in milk is 10,815% (Maulidina *et al*., 2021).

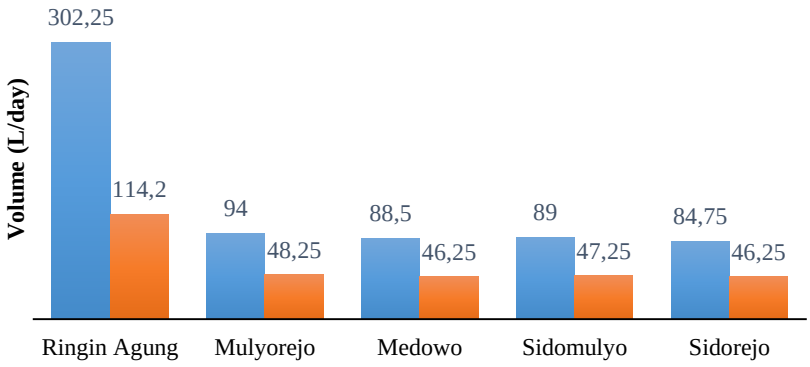

Figure 1. KUD Kertajaya fresh milk productivity in July 2022.

Table 1. Milk production in KUD Kertajaya before and after the FMD outbreak

Assessment period	Milk production (L/day)	p-value
Before FMD	658,5	0,046
During FMD	302,2	

Table 2. Lactoscan test results for 50 FMD positive samples

Parameters	Average	Standard
Fat (%)	4,43	3,0 (SNI)
SNF (%)	8,54	7,8 (SNI)
Specific gravity (g m/L)	1,028	1,027 (SNI)
Lactose (%)	4,67	4,0 (SNI)
Total solid (%)	12,97	10,18 (Maulidina et al., 2021).
Added water (%)	1,44	0
Freeze point (°C)	-0,54	-0,560 to -0,502 (SNI)

According to the SNI, fresh cow's milk typically contains 4,0% lactose (Rachmatiah *et al*., 2020). The quality of milk improves with lactose content (Kurniawan *et al*., 2020). Before an FMD outbreak, lactose levels were 56% according to information from KUD Kertajaya. The lactation phase causes variations in cow's milk lactose levels in addition to the FMD outbreak. Cow's milk will initially have a high lactose content before lowering throughout the course of the lactation period (Rachmatiah *et al*., 2020). Accordingly, the average percentage of lactose content from 50 FMD positive samples is 4,67%, which nevertheless satisfies SNI criteria for fresh milk based on the results of the Lactoscan test.

Water content and freezing point are the next two criteria in the test for milk quality. KUD Kertajaya has regulated 0% water content. According to Anindita and Soyi (2017), milk can freeze at a temperature between 0 to -0,52°C. According to SNI 3141.1: 2011 (Hariono *et al*., 2018), the freezing point of fresh cow's milk is between -0,560°C and -0,502°C. The amount of water and total solids in the milk determine its freezing point. The freezing point will be lowered when the milk's concentration or total solid content increases, which will result in a longer

time for the milk to freeze (Permana *et al*., 2020). Because milk concentration drops as the volume of the solution grows as a result of the addition of water, the freezing point rises as a result of the addition of water (Kristanti, 2017).

The production of milk in Medowo Village provides the local economy with a source of revenue. The income farmers get is adjusted for milk deposited, documented in the production log book, and archived at the KUD Kertajaya office. As of June 1, 2022, milk output in Medowo Village from 70 nursing cows that had not yet been diagnosed with FMD reached 642 liters. The same 70 cows who were infected with FMD had a total yield of 292,95 liters on July 1st, 2022, a decrease in production of 54,37%. According to Christi and Tanuwiria, (2019), genetic (30%) and environmental (70%) factors mostly affect the yield of cow's milk. The state of the cow's physique as inherited from her previous mother depends on genetic variables. Environmental influences, originate outside the body but have the potential to influence the amount of milk that cow produce (Pradika *et al*., 2019).

One of the sources of necessary lipids to satisfy metabolic requirements, supply milk constituents, and enhance animal body weight is feed. By figuring out the right ratio for nursing or broiler cattle, artificial feed can provide a significant amount of essential fat content (Mucra *et al*., 2021). Thus, a single FMD infection can make livestock less hungry, which prevents the body from getting the critical fats it requires, resulting in a drop in the amount of fat in the milk that lactating animals produce.

The milk output of 70 positive FMD sample depends on the amount of feed consumed and the appetite of the cattle. One element that may impact the milk production of dairy cows is the feed. Forage is one kind of animal feed that must be provided to at least 70% of breastfeeding cows in order to maximize milk output (Santosa *et al*., 2017). The main symptoms of FMD infection in cattle include the development of vesicles, salivation, and discomfort in the mouth area, which leads to decreased appetite. Therefore, a decrease in appetite brought on by FMD-related tongue problems makes cows less hungry, which lowers milk production.

In addition to diet, other factors that affect milk production include cage biosecurity and the presence of FMD in the surroundings of animals. In Medowo Village, many breeders use cages with inadequate biosecurity. Better biosecurity implementation will make it easier for the virus to spread from outside the fence to the region around the livestock (Fikri and Purnama, 2020). FMD has the potential to adhere to the body of calves and even gather around the female cows' teats, resulting in the formation of blisters or vesicles (Purnama *et al*., 2019). FMD can spread to cattle's mammary glands and harm the nipple structure, which will have an effect on the quantity and quality of milk produced by the cows (Armson *et al*., 2020).

Milk clotting in the nipple canal can also be brought on by uneven milking intervals or nonexistent milking (Bahari *et al*., 2023). For the bacteria that cause mastitis, which can lower milk production and quality, this might become a breeding environment. Mastitis is a mammary gland-related internal inflammation brought on by bacteria such as *Streptococcus agalactiae*, *Staphylococcus aureus*, or *Staphylococcus epidermidis* (Manu *et al*., 2019). By maintaining a clean cage and performing regular milking sessions, the presence of different bacteria that cause mastitis can be reduced. It is possible to improve the milk's quality and make it more palatable.

CONCLUSION

In conclusion, KUD Kertajaya's milk productivity during the FMD pandemic indicated a decline in production when compared to before FMD. Despite a decline in productivity, the 50 FMD-positive samples that underwent the Lactoscan test had fat contents of 4,43%, solid nonfat (SNF) levels of 8,54%, specific gravities of 1,028, lactose levels of 4,67%, total solids of 12,97%, added water of 1,44, and freezing points of -0,54°C. Accordingly, based on the results of these test criteria, it can be assumed that fresh milk from dairy cows that have tested positive for

FMD generally still exhibits SNI-compliant quality.

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REFERENCES

Anindita, N. S., & Soyi, D. S. (2017). Studi kasus: Pengawasan Kualitas Pangan Hewani melalui Pengujian Kualitas Susu Sapi yang Beredar di Kota Yogyakarta. *Journal Animal Science*, 19, 96–105.

Armson, B., Gubbins, S., Mioulet, V., Qasim, I. A., King, D. P., & Lyons, N. A. (2020). Foot and Mouth Disease Surveillance Using Pooled Milk on a Large Scale Dairy Farm in an Endemic Setting. *Frontline Veterinary Science*, 7, 264.

Bahari, B., Agoeshermadi, H., Fikri, F., Sardjito, T., Purnomo, A., Chhetri, S., Maslamama, S. T., & Purnama, M. (2023). Efficacy of Intra-vulvo Submucosal Prostaglandins on Estrous Cycles in Goats. *Indian Veterinary Journal*, 100(4).

Christi, R. F., & Tanuwiria, U. H. (2019). Pengaruh Pemberian Lemna Minor terhadap Produksi Susu Harian dan 4% FCM Susu Sapi Perah Friesian Holstein. *Jurnal Ilmu-Ilmu Peternakan*, 22, 65–72.

Colenutt, C., Brown, E., Nelson, N., Paton, D. J., Eblé, P., Dekker, A., Gonzales, J. L., & Gubbins, S. (2020). Quantifying the Transmission of Foot and Mouth Disease Virus in Cattle via a Contaminated Environment. *American Society for Microbiology*, 11, e00381.

Fikri, F., & Purnama, M. T. E. (2020). Biosecurity Application of Small Scale Chicken Abattoir in Sidoarjo, East Java, Indonesia. *Systematic Reviews in Pharmacy*, 11(6), 226–229.

Hariono, B., Utami, M. M. D., & Bakri, A. (2018). Uji Sifat Fisika Dan Kimia Susu Sapi Terpapar Uv Dengan 1,3,5 Sirkulasi. *Jurnal Ilmiah Inovasi*, 18, 63–67.

Kristanti, N. (2017). Daya Simpan Susu Pasteurisasi Ditinjau dari Kualitas Mikroba Termodurik dan Kualitas Kimia. *Jurnal Ilmu dan Teknologi Hasil Ternak*, 12, 1–7.

Kurniawan, R. C., Budiarti, C., & Sayuthi, S. M. (2020). Tampilan Gula Darah, Laktosa dan Produksi Susu Sapi Perah Laktasi yang Disuplementasi Baking Soda (NaHCO3). *Mediagr*o, 15, 132–138.

Larasati, N., Sulistyoningrum, T. P., Estri, M. N., Sihwaningrum, I., & Reorita, R. (2021). Prediksi Berat Tubuh Sapi Perah Friesian Holstein Menggunakan Model Von Bertalanffy. *Jurnal Ilmu Matematika dan Pendidikan Matematika*, 13, 93–104.

Manu, K. R., Tangkonda, E., & Gelolodo, M. A. (2019). Isolasi dan Identifikasi terhadap Bakteri Penyebab Mastitis pada Sapi Perah di Desa Benlutu Kecamatan Batu Putih Kabupaten Timor Tengah Selatan. *Jurnal Veteriner Nusantara*, 2, 10–19.

Maulidina, A., E. Taufik, A., & Atabany. (2021). Kinerja Outbound Logistik Susu Segar di Koperasi Peternak Sapi Bandung Utara (KPSBU) Lembang. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan*, 9, 95–101.

Mucra, D. A., Adelina, T., Harahahap, A. E., & Juliantoni, J. (2021). Peningkatan Ekonomi Masyarakat Pulau Kecil Melalui Pemanfaatan dan Pengolahan Biji Karet Dengan Teknologi Wafer Sebagai Pakan Ternak Kambing. *Jurnal Ilmu Pengetahuan dan Pengembangan Masyarakat Islam*, 15, 93–101.

Permana, A. H., Hernaman, I., & Mayasari, N. (2020). Profil Protein Darah Sapi Perah Masa Transisi dengan Indigofera zollingeriana Sebagai Pengganti Konsentrat Serta Penambahan Mineral dalam Pakan. *Sains Peternakan*, 18, 53–59.

Pradika, A. Y., Chusniati, S., Purnama, M. T. E., Effendi, M. H., Yudhana, A., & Wibawati, P. A. (2019). Uji Total *Escherichia coli* pada Susu Sapi Segar di Koperasi Peternak Sapi Perah (KPSP) Karyo Ngremboko Kecamatan Purwoharjo Kabupaten Banyuwangi. *Jurnal Medik Veteriner*, 2, 1–6.

Purnama, M. T. E., Dewi, W. K., Prayoga, S. F., Triana, N. M., Aji, B. S. P., Fikri, F., & Hamid, I. S. (2019). Preslaughter stress in banyuwangi cattle during transport. *Indian Veterinary Journal*, 96(12), 50–52.

Rachmatiah, T., Anggraini, R., & Sigoro, I. (2020). Analisis Cemaran Mikroba, Kandungan Nutrisi Pada Susu Sapi Segar Hasil Peternakan Sapi Perah. Sainstech. *Jurnal Penelitian dan Pengkajian Sains dan Teknologi*, 23, 91–94.

Santosa, B., Fitasari, E., & Suliana, G. (2017). Produksi Pakan Fungsional Mengandung Tiga Senyawa Bioaktif dari Ampas Tahu dengan Menggunakan Mikroba Effective Microorganism-4 dan *Lactobacillus plantarum*. *Buana Sains*, 17, 3707–3710.

Saputra, F. T. (2018). Evaluasi Total Solid Susu Segar Peternak Tawang Argo Berdasarkan Standard Nasional Indonesia. *Journal Tropical Animal Production*, 19, 22–26.

Tadesse, B., Tesfahun, A., Molla, W., Demisse, E., & Jemberu, W. T. (2020). Foot and Mouth Disease Outbreak Investigation and Estimation of its Economic Impact in Selected Districts in Northwest Ethiopia. *Journal Veterinary Medicine and Science*, 6, 122–132.

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