p-ISSN 1410-5659 e-ISSN 2621-5144
Published by:
Unpad Press

Jurnal Ilmu Ternak Universitas Padjadjaran, March 2026, 26(1):81-85
DOI: 10.24198/jit.v26i1.62997
Available online at http://journal.unpad.ac.id/jitunpad

REPRODUCTIVE PERFORMANCE OF FRIESIAN HOLSTEIN CROSSBRED DAIRY CATTLE AFTER A FOOT-AND-MOUTH DISEASE OUTBREAK IN LEMBANG, INDONESIA

Hanunghanindito Pamungkas[1], Septiyani[2, a], Nurcholidah Solihati[3]

[1]*Veterinary Professional Program, Faculty of Medicine, Padjadjaran University, West Java, Indonesia*
[2]*Department of Biomedical Science, Veterinary Medicine Study Program, Faculty of Medicine, Padjadjaran University, West Java, Indonesia*
[3]*Department of Livestock Production, Faculty of Animal Husbandry, Padjadjaran University, West Java, Indonesia*
[a]*email*: drh.septiyani@unpad.ac.id

Abstract

Foot-and-mouth disease (FMD) is a highly contagious viral disease that may impair reproductive efficiency in dairy cattle. This study aimed to evaluate changes in the reproductive performance of Friesian Holstein crossbred dairy cows following an FMD outbreak at UPTD BPTSP and HPT Cikole, Lembang, West Java, Indonesia. A retrospective study was conducted using reproductive records collected from 2019 to 2023. The reproductive parameters analyzed were calving interval, service per conception, conception rate, service period, and first mating postpartum. Differences between the pre- and post-FMD periods were assessed using paired sample t-tests. The results showed significant differences in calving interval, service per conception, conception rate, and first mating postpartum between the two periods ($P<0.05$), whereas service period did not differ significantly ($P=0.882$). Among these parameters, conception rate showed a marked decline from 92.30% before the outbreak to 63.54% after the outbreak ($P=0.001$). Overall, the post-FMD period was associated with poorer reproductive performance in the studied herd. These findings suggest that the FMD outbreak was followed by reduced reproductive efficiency, particularly in calving interval, service per conception, conception rate, and first mating postpartum.

Keywords: dairy cattle; foot-and-mouth disease; reproductive performance; conception rate; calving interval

INTRODUCTION

Dairy cattle are an important component of the livestock sector in Indonesia because they contribute to the supply of animal-derived protein and support human nutritional needs through milk production. Reproductive efficiency is a key determinant of productivity in dairy cattle because it influences calving frequency, lactation continuity, and herd profitability. Poor reproductive performance may prolong calving interval, increase the number of services required for conception, and reduce conception success, thereby decreasing the biological and economic efficiency of dairy production systems (Tawaf, 2017; Chaters *et al.,* 2018). Infectious diseases are among the important factors that can impair reproductive performance in dairy herds (Abdela, 2017).

Foot-and-mouth disease (FMD) is a highly contagious viral disease of cloven-hoofed animals caused by a virus of the genus *Aphthovirus* (WOAH, 2021). The disease affects cattle and other susceptible livestock species and is recognized as one of the most economically important transboundary animal diseases because of its impact on animal health, livestock productivity, and trade (WOAH, 2021; Abdela, 2017). In addition to its acute clinical manifestations, FMD may cause substantial production losses through reduced milk yield, weight loss, decreased work performance, reproductive disorders, and, in severe cases, mortality (Abdela, 2017; Tawaf, 2017).

The 2022 FMD outbreak in Indonesia raised serious concerns because it spread widely in 21 provinces, with a total of 336,892 infected animals. West Java was among the most affected provinces, with 33,210 reported cases, highlighting the relevance of evaluating the post-outbreak consequences of FMD in

Submitted 28 April 2025; accepted 30 March 2026.
Available online 31 March 2026.

dairy herds in this region (Ministry of Agriculture of the Republic of Indonesia, 2022). Previous studies have shown that FMD may adversely affect reproductive traits by increasing calving interval, reducing conception probability, and delaying reproductive recovery after calving (Chaters *et al.*, 2018; Tawaf, 2017). In a large dairy herd in Kenya, cows affected by FMD showed poorer fertility performance following the outbreak, indicating that the disease's consequences may extend beyond the acute clinical phase (Chaters *et al*., 2018).

Although the general impacts of FMD on animal health and production have been widely reported, evidence regarding post-outbreak reproductive performance in dairy cattle under Indonesian herd conditions remains limited. In particular, information on reproductive changes following FMD outbreaks in institutionally managed dairy herds is still scarce. Therefore, this study aimed to evaluate the reproductive performance of Friesian Holstein crossbred dairy cows after the FMD outbreak at UPTD BPTSP and HPT Cikole, Lembang, West Java, using farm reproductive records.

MATERIALS AND METHODS

The study was conducted at UPTD BPTSP and HPT Cikole, Lembang, West Java, Indonesia. The study population consisted of Friesian Holstein crossbred dairy cows maintained at the farm. Based on farm records, the herd comprised 255 cows in 2022, of which 120 were reported to be affected by foot-and-mouth disease (FMD). The herd was managed under routine institutional dairy farm practices, including daily feeding, milking, health monitoring, and reproductive management conducted by farm personnel. This research used a retrospective observational design based on farm reproductive records archived from January 2019 to December 2023. Data were collected from the periods before and after the 2022 FMD outbreak to evaluate changes in reproductive performance following the outbreak.

The reproductive parameters analyzed were calving interval, service per conception, conception rate, service period, and first mating postpartum. The number of records available for analysis differed among reproductive parameters. A total of 33 records were available for calving interval, 39 for service per conception, 39 for conception rate, 39 for service period, and 20 for first mating postpartum. Only archived reproductive records available in the farm database were included in the analysis. Descriptive statistics were calculated for each reproductive parameter, including the mean, minimum and maximum values, and coefficient of variation, for both the pre-FMD and post-FMD periods. To determine whether reproductive performance differed significantly between the two periods, paired sample t-tests were applied. Differences were considered statistically significant at $P < 0.05$.

RESULTS AND DISCUSSION

Table 1 presents the reproductive performance of Friesian Holstein crossbred dairy cows before and after the FMD outbreak. The evaluated parameters included calving interval, service per conception, conception rate, service period, and first mating postpartum. Each parameter is presented as mean, minimum, and maximum values, followed by the results of a paired-sample t-test to compare the pre- and post-FMD periods.

Based on Table 1, a total of 33 records were included in the calving interval analysis. The descriptive results showed that the mean calving interval increased from 527 days in the pre-FMD period to 603 days in the post-FMD period. Statistical analysis using the paired sample t-test showed a significant difference between the two periods ($P = 0.004$), indicating that the calving interval was prolonged after the FMD outbreak and that reproductive performance deteriorated in the post-FMD period. This finding is consistent with Chaters *et al.* (2018), who reported impaired fertility performance after FMD outbreaks. The prolonged calving interval observed in the present study may be associated with systemic illness, reduced feed intake due to oral lesions, inflammatory stress, and subsequent nutritional imbalance, all of which may interfere with ovarian activity and postpartum reproductive recovery. Reduced feed intake during and after illness may also contribute to negative energy balance, which has been associated with delayed resumption of estrous cyclicity and reduced fertility in dairy cows (Wathes *et al.,*

2007). In addition, post-FMD reproductive disturbances, including delayed conception and pregnancy loss, may further contribute to extended calving intervals (Kartono and Assauwab, 2023).

A total of 39 records were available for the analysis of service per conception. The mean service per conception increased from 1.15 in the pre-FMD period to 2.20 in the post-FMD period. The paired sample t-test showed that this difference was statistically significant (P = 0.027), indicating that more insemination services were required to achieve conception after the FMD outbreak. This finding suggests reduced reproductive efficiency in the post-FMD period. The increase in service per conception may be associated with impaired estrus expression, suboptimal ovulation, reduced conception efficiency, or an unfavorable uterine environment after systemic disease. In addition, metabolic, inflammatory, and immune challenges during the transition period may impair reproductive recovery and fertility in dairy cows (Pascottini *et al.*, 2022; Santos *et al.*, 2016). Likewise, metabolic disturbances such as subclinical ketosis have been associated with reduced pregnancy success after insemination, which may increase the number of services required per conception (Walsh *et al.*, 2007). These findings support previous reports that FMD and related physiological stress can impair fertility and increase the number of services required for successful conception (Chaters *et al.*, 2018).

For the conception rate, 39 records were analyzed. The mean conception rate decreased markedly from 92.30% in the pre-FMD period to 63.54% in the post-FMD period. Statistical analysis showed that this difference was highly significant (P = 0.001), indicating a substantial decline in reproductive performance after the FMD outbreak. Conception rate is an important indicator of herd fertility because it reflects the combined effects of estrus detection, timing of insemination, ovarian activity, fertilization, and early embryo survival. The decline observed in this study may indicate that cows in the post-FMD period experienced persistent physiological stress and incomplete reproductive recovery, resulting in lower pregnancy success rates. This interpretation is biologically plausible, as reproductive performance in dairy cows is closely associated with the occurrence of periparturient metabolic and reproductive disorders, which can impair the resumption of normal cyclicity and reduce fertility (Thatcher *et al.,* 2006). In addition, postpartum uterine disease and inflammatory disorders may compromise the uterine environment and subsequent reproductive performance (LeBlanc, 2008). Similar mechanisms may involve interactions among metabolic imbalance, uterine health, and immune dysfunction, all of which have been associated with reduced fertility in transition dairy cows (Esposito *et al.*, 2014). Infectious diseases may also adversely affect conception rate, as viral infections in dairy cows have been associated with reduced fertility and impaired reproductive performance (Wathes *et al.*, 2020). Chaters *et al.* (2018) also reported impaired fertility performance following FMD exposure in a large dairy herd. Taken together, these findings suggest that the decline in conception rate observed in the present study may reflect longer-lasting reproductive effects of FMD beyond the acute phase of disease.

Service period from 39 records increased numerically from 63.83 days in the pre-FMD period to 82.11 days in the post-FMD period, but the difference was not statistically significant (P = 0.882). This finding may be related to the multifactorial nature of the service period, which is influenced not only by disease status but also by estrus expression, insemination timing, nutritional recovery, postpartum uterine health, and embryo survival (Bruinjé *et al.*, 2024; LeBlanc, 2008). Moreover, stress and health disturbances during the postpartum period may impair reproductive recovery and fertility in dairy cows, thereby contributing to variation in service period among individuals (Crowe & Williams, 2012). The substantial variation among cows in the present study may therefore have reduced the ability to detect statistical significance. Thus, although the effect was not statistically significant, the numerical increase in service period may still reflect impaired reproductive recovery after the FMD outbreak, consistent with previous evidence that FMD can adversely affect herd fertility performance (Chaters *et al.,* 2018).

A total of 20 records were available for the analysis of first mating postpartum. The mean first mating postpartum interval increased from 90 days in the pre-FMD period to 137 days in the post-FMD period.

Table 1. Comparison of reproductive performance before and after the FMD outbreak in Friesian Holstein crossbred dairy cows

Parameter	n	Pre-FMD (Mean ±SD; Min-Max)	Post-FMD (Mean ± SD; Min-Max)	p-value
Calving interval (days)	33	527.39 ± 1.35; 328–786	603.66 ± 1.93; 324–1000	0.004
Service per conception	39	1.15 ± 0.36; 1–2	2.20 ± 0.86; 1–4	0.027
Conception rate (%)	39	92.30 ± 18.27; 50–100	63.54 ± 24.42; 33.33–100	0.001
Service period (days)	39	63.83 ± 22.72; 31–92	82.11 ± 39.41; 47–197	0.882
First mating postpartum (days)	20	90.00 ± 52.94; 21–271	137.00 ± 45.93; 44–236	0.012

Notes: Differences between pre-FMD and post-FMD periods were analyzed using paired sample t-tests. Differences were considered statistically significant at $P < 0.05$.

The paired sample t-test showed that this difference was statistically significant ($P = 0.012$), indicating delayed resumption of breeding activity after the FMD outbreak. This delay may reflect prolonged postpartum anestrus, slower recovery of reproductive function, or reduced readiness for insemination after illness. Reduced feed intake, metabolic imbalance, poor body condition, and systemic stress following FMD may suppress ovarian activity and delay the return to estrus. Prolonged postpartum anestrus has been associated with low energy status and other nutritional risk factors in dairy cows (Kamal *et al.*, 2014). In addition, negative energy balance during the peripartum period may have carryover effects on the resumption and normality of estrous cyclicity, as well as on the success of subsequent inseminations (Wathes *et al.,* 2007). Postpartum anestrus is also associated with delayed recovery of follicular activity and re-establishment of ovarian cyclicity after calving (Peter *et al.,* 2009). Kartono and Assauwab (2023) also suggested that post-FMD cows may require a longer recovery period before rebreeding, because post-infection physiological recovery may take precedence over reproductive function.

Overall, the findings of this study indicate that the post-FMD period was associated with poorer reproductive performance in Friesian Holstein crossbred dairy cows, as reflected by prolonged calving interval, increased service per conception, reduced conception rate, and delayed first mating postpartum. Although the service period did not differ significantly, its numerical increase suggests that reproductive recovery may still have been adversely affected. These results highlight the potential long-term consequences of FMD on dairy herd fertility and emphasize the importance of reproductive monitoring, nutritional support, and post-disease management in affected herds. From a practical perspective, these results highlight the importance of post-FMD nutritional rehabilitation and reproductive monitoring, as maladaptation to metabolic and inflammatory challenges may have lasting consequences for fertility in dairy cows (Pascottini *et al.,* 2022).

CONCLUSIONS

The study demonstrated that the post-FMD period was associated with a decline in several important indicators of reproductive performance in Friesian Holstein crossbred dairy cows at UPTD BPTSP and HPT Cikole, Lembang. Significant differences were observed in calving interval, service per conception, conception rate, and first mating postpartum ($P < 0.05$), whereas service period did not differ significantly between the pre- and post-FMD periods. Among these parameters, conception rate showed the most marked decline. These findings suggest that the reproductive effects of FMD may persist beyond the acute clinical phase and may interfere with reproductive recovery and breeding efficiency in affected dairy herds.

ACKNOWLEDGMENT

The authors gratefully acknowledge UPTD BPTSP and HPT Cikole, Lembang, for providing access to the facilities, records, and other resources required for this study.

REFERENCES

Abdela, N. (2017). Sero-prevalence, risk factors, and distribution of foot and mouth disease in Ethiopia. Acta Tropica, 169, 125–132. https://doi.org/10.1016/j.actatropica.2016.12.025

Bruinjé, T. C., LeBlanc, S. J., Oguejiofor, C. F., & Wathes, D. C. (2024). Implications of transition cow health for reproductive performance and physiology in dairy cows. Journal of Dairy Science, 107(Suppl. 1), 385–402. https://doi.org/10.3168/jds.2023-24562

Chaters, G., Rushton, J., Dulu, T.D., and Lyons, N.A. 2018. Impact of foot-and-mouth disease on fertility performance in a large dairy herd in Kenya. Preventive Veterinary Medicine 159: 57–64.

Crowe, M.A., & Williams, E.J. (2012). Effects of stress on postpartum reproduction in dairy cows. Journal of Animal Science, 90(5), 1722–1727.

Esposito, G., Irons, P.C., Webb, E.C., & Chapwanya, A. (2014). Interactions between negative energy balance, metabolic diseases, uterine health, and immune response in transition dairy cows. Animal Reproduction Science, 144(3–4), 60–71.

Kamal, M.M., Bhuiyan, M.M.U., Parveen, N., Momont, H.W., & Shamsuddin, M. (2014). Risk factors for postpartum anestrus in crossbred cows in Bangladesh. Turkish Journal of Veterinary and Animal Sciences, 38(2), 151–156. https://doi.org/10.3906/vet-1303-74

Kartono, K., & Assauwab, M. H. (2023). Analisa pengaruh penyakit mulut dan kuku terhadap angka kelahiran dan kematian pedet sapi Aceh di Kecamatan Darul Hasanah Kabupaten Aceh Tenggara. Jurnal Agroplasma, 10(1). https://doi.org/10.36987/agroplasma.v10i1.4236

LeBlanc, S.J. 2008. Postpartum uterine disease and dairy herd reproductive performance: a review. The Veterinary Journal 176(1):102–114.

Pascottini, O.B., LeBlanc, S.J., & Opsomer, G. (2022). Maladaptation to the transition period and consequences on health and fertility of dairy cows. Reproduction in Domestic Animals, 57(Suppl 3), 88–95.

Peter, A.T., Vos, P.L.A.M., & Ambrose, D.J. (2009). Postpartum anestrus in dairy cattle. Theriogenology, 71(9), 1333–1342

Santos, J.E.P., Bisinotto, R.S., and Ribeiro, E.S. 2016. Mechanisms underlying reduced fertility in anovular dairy cows. Theriogenology 86(1):254–262.

Tawaf, R. (2017). Dampak Sosial Ekonomi Epidemi Penyakit Mulut dan Kuku Terhadap Pembangunan Peternakan DI Indonesia. Agroinovasi Spesifik Lokasi Untuk Ketahanan Pangan Pada Era Masyarakat Ekonomi ASEAN, 2, 1535–1547. http://repository.pertanian.go.id/handle/123456789/7248

Thatcher, W.W., Bilby, T.R., Bartolome, J.A., Silvestre, F., Staples, C.R., & Santos, J.E.P. 2006. Strategies for improving fertility in the modern dairy cow. Theriogenology 65(1):30–44

Walsh, R.B., Walton, J.S., Kelton, D.F., LeBlanc, S.J., Leslie, K.E., and Duffield, T.F. 2007. The effect of subclinical ketosis in early lactation on reproductive performance of postpartum dairy cows. Journal of Dairy Science 90(6):2788–2796

Wathes, D.C., Fenwick, M., Cheng, Z., Bourne, N., Llewellyn, S., Morris, D.G., Kenny, D., Murphy, J., and Fitzpatrick, R. 2007. Influence of negative energy balance on cyclicity and fertility in the high producing dairy cow. Theriogenology 68(Suppl 1): S232–S241.

Wathes, D. C., Oguejiofor, C. F., Thomas, C., & Cheng, Z. (2020). Importance of viral disease in dairy cow fertility. Engineering, 6(1), 26–33. https://doi.org/10.1016/j.eng.2019.07.020

World Organisation for Animal Health (WOAH). (2021). Foot and mouth disease. Paris, France: WOAH