



Available online

S4-Accredited – Decree No. 85/M/KPT/2020
Journal Page is available at <http://www.jurnalpeternakan.unisla.ac.id/index.php/ternak/index>



Prevalence of clinical and subclinical mastitis and its distribution pattern in the udder quarter of dairy cows at KPBSU Lembang, West Java

Debby Fadhilah Pazra^{1*}, Kenedy Putra¹, Muhammad Najia Dinulloh¹, Fathul Bahri²

¹Animal Health Study Program, Department of Animal Husbandry, Bogor Agricultural Development Polytechnic

²North Bandung Cattle Ranching Cooperative (KPSBU) Lembang, West Java

email : debbyfadhilah99@gmail.com

ARTICLE INFO

Article history:

Received 10 April 2026

Revised 20 Mei 2026

Accepted 21 Juni 2026

Keywords:

Clinical Mastitis,
Dairy Cows,
Mastitis,
Prevalence,
Subclinical Mastitis,
Udder Quarter

IEEE style in citing this article:

Debby Fadhilah Pazra, Kenedy Putra, Muhammad Najia Dinulloh. " Prevalence of clinical and subclinical mastitis and its distribution pattern in the udder quarter of dairy cows at KPBSU Lembang, West Java" *Animal Husbandry Journal: Scientific Journal of the Faculty of Animal Husbandry, Lamongan Islamic University*, vol. 17, no. 1, pp. 337-346, 2026.

ABSTRACT

Mastitis is a major disease in dairy cattle that significantly impacts milk production and quality and causes economic losses in the livestock industry. This study aimed to analyze the prevalence of clinical and subclinical mastitis and its distribution patterns in udder quarters of dairy cows at the North Bandung Cattle Breeders Cooperative (KPSBU) in Lembang, West Java. This cross-sectional study included 100 lactating Holstein Friesian dairy cows with a total of 400 udder quarters from five villages. Subclinical mastitis was detected using the California Mastitis Test (CMT), and clinical mastitis data were obtained from livestock recordings in 2025. Data analysis was conducted descriptively to calculate the prevalence and distribution patterns of diseases. The results showed that the prevalence of subclinical mastitis at the cow level was 73%, whereas that of clinical mastitis was 38.88%. At the udder quarter level, the prevalence of subclinical mastitis reached 62%, with a higher distribution in the rear quarter (66%) than in the front quarter (58%). The highest prevalence was found in the right rear quarter (70 %), followed by the left rear quarter (62 %). The distribution pattern of mastitis showed that the incidence of the disease was uneven across the udder quarters and tended to be higher in the hindquarter, especially on the right side. Furthermore, the higher prevalence of subclinical mastitis compared to clinical mastitis reflects the tip-of-the-iceberg phenomenon, where most cases go undetected clinically. In conclusion, the prevalence of mastitis in dairy cows at the Lembang Dairy Farm (KPSBU) was relatively high, especially subclinical mastitis, with a dominant distribution in the rear quarter, particularly the right rear quarter. Therefore, improved milking hygiene, early detection, and udder-based control strategies are needed to reduce the incidence of mastitis and increase dairy cow productivity.

Introduction

Mastitis is a major disease in dairy cattle that significantly impacts productivity, milk quality, and economic losses in the livestock industry. This disease is generally caused by intramammary infection involving various pathogenic agents, such as staphylococci, streptococci, coliform species, and other environmental bacteria (Bechtold *et al.*, 2024). Pathogens that cause mastitis can be classified into infectious and environmental pathogens, also known as major and minor pathogens, respectively. Infectious pathogens, such as *Staphylococcus* (S.) *aureus* and *Streptococcus* (Sc.) *agalactiae*, are thought to spread primarily through milk droplets between cows (Meçaj *et al.*, 2023). This usually occurs during milking, as the milker's hands, towels, or milking machines serve as sources of pathogen transmission (Bechtold *et al.*, 2024). In contrast, environmental pathogens such as Sc. *uberis* and coliforms such as *Escherichia* (E.) *coli* are commonly found in the cow's environment, such as bedding and stall environments, and can infect the udder (Khasa *et al.*, 2020). Major pathogens often cause clinical mastitis and can persist in the udder for long periods, whereas minor pathogens usually cause less severe infectious reactions (Woudstra *et al.*, 2023; Bechtold *et al.*, 2024).

Mastitis is generally divided into two forms: clinical and subclinical. Clinical mastitis is characterized by physical changes in the udder and milk, whereas subclinical mastitis does not show obvious clinical symptoms but can cause a decrease in milk production of up to 10–20% (Rai *et al.*, 2022). Subclinical mastitis often has a higher prevalence than clinical mastitis and is a major problem because it is difficult to detect without special tests, such as the California Mastitis Test (CMT). A global meta-analysis showed that the prevalence of subclinical mastitis was 42% (Confidence Interval [CI]: 38–45 %), while that of clinical mastitis was 15% (CI 12–19%) (Krishnamoorthy *et al.*, 2021). The prevalence of subclinical mastitis in Indonesia was higher than the global prevalence, reaching 58.24% (CI 51.26%–65.23%), and the clinical prevalence was lower than the global prevalence, reaching 3.31% (CI 1.42%–5.19%). Among the provinces in Indonesia, Central Java had the highest prevalence (66.62%, CI 49.37%–83.87%), while Yogyakarta had the lowest (41.77%, CI 14.96%–68.58%). Based on a meta-analysis, no significant change in mastitis prevalence in Indonesia was observed from 2003 to 2022 (Nuraini *et al.*, 2023). Furthermore, another global meta-analysis study showed that the prevalence of subclinical mastitis at the cow level reached approximately 46%, whereas at the udder quarter level, it was approximately 32% (Çelik Gürbulak and Akçay, 2023). This suggests that disease distribution at the udder quarter level plays an important role in understanding the infection dynamics and mastitis control strategies.

Mastitis remains a significant animal health problem in Indonesia, particularly in smallholder dairy farms. Studies have shown that both subclinical and clinical mastitis affect milk production and quality and pose a potential public health risk through contaminated milk products (Nuraini *et al.*, 2023). Research in East Java reported that the prevalence of subclinical mastitis is influenced by various factors, such as husbandry management, barn sanitation, and milking practices that do not implement good hygiene and sanitation (Khasanah *et al.*, 2021). Furthermore, the distribution of mastitis across udder quarters is not always uniform. Several studies have shown that the rear quarter, particularly the right rear quarter, exhibits a higher prevalence of mastitis than the front quarter (Slyzius *et al.*, 2014; Khelili *et al.*, 2025), although some studies have shown a higher prevalence in the front quarter, particularly the right front quarter (Mgonja *et al.*, 2023).

These differences in distribution are important to study because they can provide specific information on mastitis prevention and control strategies at the farm level.

The North Bandung Cattle Breeders Cooperative (KPSBU) Lembang is a dairy cow milk production center in West Java that plays a strategic role in the national milk supply. However, information on the prevalence of mastitis, both subclinical and clinical, and its distribution patterns at the udder quarter level in this region is limited. Therefore, this study aimed to analyze the prevalence of subclinical and clinical mastitis and its distribution patterns at the udder quarter level of dairy cows at KPSBU Lembang, West Java, to provide a basis for developing more effective and sustainable mastitis control strategies.

Method

This cross-sectional study was conducted to determine the prevalence of subclinical and clinical mastitis in dairy cattle. This study used 100 lactating Friesian Holstein (FH) dairy cows with a total of 400 teats from several farms in KPBSU Lembang located in five villages (Suntenjaya, Sukajaya, Jayagiri, Cikidang, and Cikahuripan) with a high cow population (>250 cows). The sample size was determined using the formula $n = 4pq/L^2$, where p = prevalence, $q = 1-p$, and L = margin of error (Dohoo *et al.*, 2003). This calculation assumed a prevalence of 82.5% (Anggraeni and Nurfuadi, 2021) and a 95% confidence level. The samples taken in this study were milk from individual cows with lactation periods of 1-7.

Samples were randomly collected by milking lactating cows in the morning or afternoon, discarding the first and second milk out, and collecting up to 15 mL per teat. Subsequently, a CMT test was performed to detect subclinical mastitis by taking as much as 3 mL of milk from each teat on the paddle and adding 3 mL of CMT reagent, followed by homogenization of the mixture. The paddle was moved horizontally for 10-20 seconds and the reaction results were read based on changes marked by the formation of a thick mass, indicating a positive result, and the absence of a thick mass, indicating a negative result. Positive results were divided into several levels based on the amount of thick mass formed: positive (+) with a small thick mass, positive (++) , and positive (+++) with a thick mass that resembled gelatin.

The prevalence of clinical mastitis was determined from mastitis cases that had been recorded in the livestock recording of KPBSU Lembang in 2025. Cases of clinical mastitis in dairy cows were determined based on clinical symptoms in the form of swelling, pain, and redness of the udder, fever, refusal to eat, drastically decreased milk production, clots in the milk, milk changing color to yellow, and even mixed with blood and pus.

Data Analysis

The prevalence of mastitis in dairy cows was calculated using the formula $P = N/NT$, where P is the prevalence, N is the number of dairy cows positive in the CMT (subclinical mastitis) or cows showing symptoms of mastitis (clinical mastitis), and NT is the total number of dairy cows examined. The data analysis was descriptive and presented in the form of tables and graphs.

Results and Discussion

Based on the results of the CMT test, the prevalence of subclinical mastitis in dairy cattle in KPBSU Lembang was 73% (Table 1), with Suntenjaya Village showing the highest prevalence at 94.12% and Jayagiri Village showing the lowest prevalence at 50.00% (Figure 1). Several previous studies have also shown diversity in the prevalence of subclinical

mastitis in dairy cattle, such as in West Java, with a prevalence range of 67.37–84.31% (Qolbaini *et al.*, 2014; Susanty *et al.*, 2017; Anggraeni and Nurfuadi, 2021; Siagian and Amidjaya, 2022).

Table 1 Prevalence of subclinical mastitis in dairy cows at KPBSU Lembang

Region (Village)	Sample (tail)	CMT test results (tail)		Prevalence (%)
		Positive	Negative	
Suntenjaya	17	16	1	94,12
Sukajaya	23	18	5	78,26
Jayagiri	20	10	10	50,00
Cikidang	16	12	4	75,00
Cikahuripan	24	17	7	70,83
Number	100	73	27	73,00

Based on a meta-analysis, the prevalence of subclinical mastitis in Indonesia was lower than that in this study, at 58.24% (CI 51.26%–65.23%), with Central Java Province showing the highest prevalence (66.62%, CI 49.37%–83.87%), while Yogyakarta showed the lowest prevalence (41.77%, CI 14.96%–68.58%) among the provinces in Indonesia (Nuraini *et al.*, 2023). According to Nuraini *et al.* (2023), a meta-analysis study, no significant changes in the prevalence of mastitis in Indonesia were observed from 2003 to 2022. The global prevalence of subclinical mastitis through a meta-analysis study showed a prevalence of subclinical mastitis of 42% (CI 38–45%). Analysis by continent showed the highest prevalence of subclinical mastitis in North America, and among countries, the highest prevalence of subclinical mastitis was in Uganda (Krishnamoorthy *et al.*, 2021).

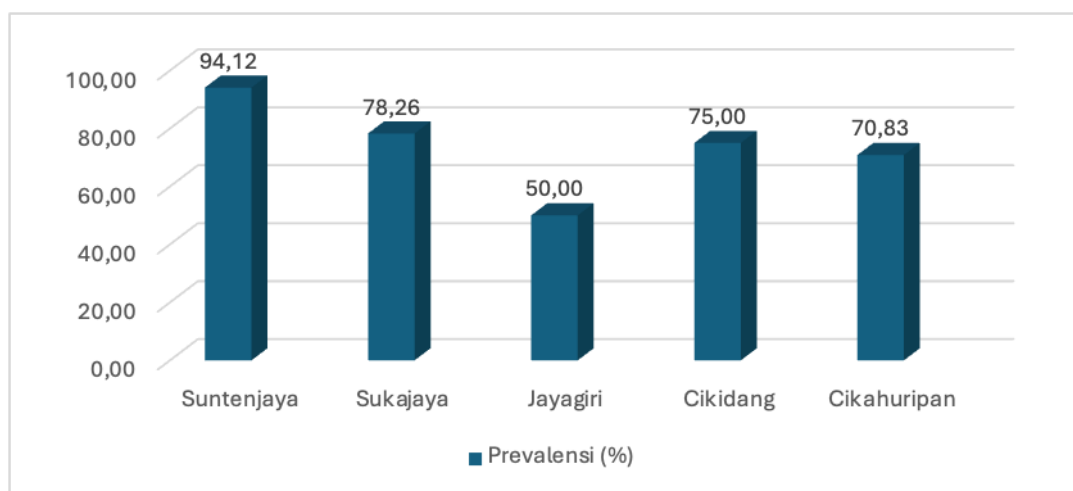


Figure 1. Prevalence of subclinical mastitis in dairy cattle per village within the Lembang KPBSU area.

In contrast to the prevalence of subclinical mastitis, the prevalence of clinical mastitis in dairy cows in KPBSU Lembang showed a lower percentage of 38.88% (Table 2) with the highest prevalence of clinical mastitis in Suntenjaya Village at 57.66% and the lowest prevalence in Cikahuripan Village at 28.73% (Figure 2). Previous studies have shown that the prevalence of clinical mastitis in dairy cows in several regions of Indonesia varies from 1.56%

to 20% (Nianto *et al.*, 2019; Nisa *et al.*, 2019; Harjanti and Sambodho, 2020; Raisatulhaq *et al.*, 2025).

Table 2 Prevalence of clinical mastitis in dairy cows at KPBSU Lembang

Region (Village)	Population (tail)	Mastitis (case)	Prevalence (%)
Suntenjaya	418	241	57,66
Sukajaya	1642	746	45,43
Jayagiri	770	231	30,00
Cikidang	278	116	41,73
Cikahuripan	1239	356	28,73
Number	4347	1690	38,88

A meta-analysis of dairy cattle in Indonesia showed a prevalence of clinical mastitis of 3.31% (CI 1.42%–5.19%) (Nuraini *et al.*, 2023), which is lower than that in this study. This is different from the global prevalence of clinical mastitis in various countries worldwide through meta-analyses that showed a higher prevalence of 15% (CI 12–19%) (Krishnamoorthy *et al.*, 2021) than that in this study and a higher prevalence than that in the meta-analysis study in Indonesia by Nuraini *et al.* (2023). Analysis by continent showed the highest prevalence of clinical mastitis in Europe, and among countries, the highest prevalence of clinical mastitis in the United Kingdom (Krishnamoorthy *et al.*, 2021).

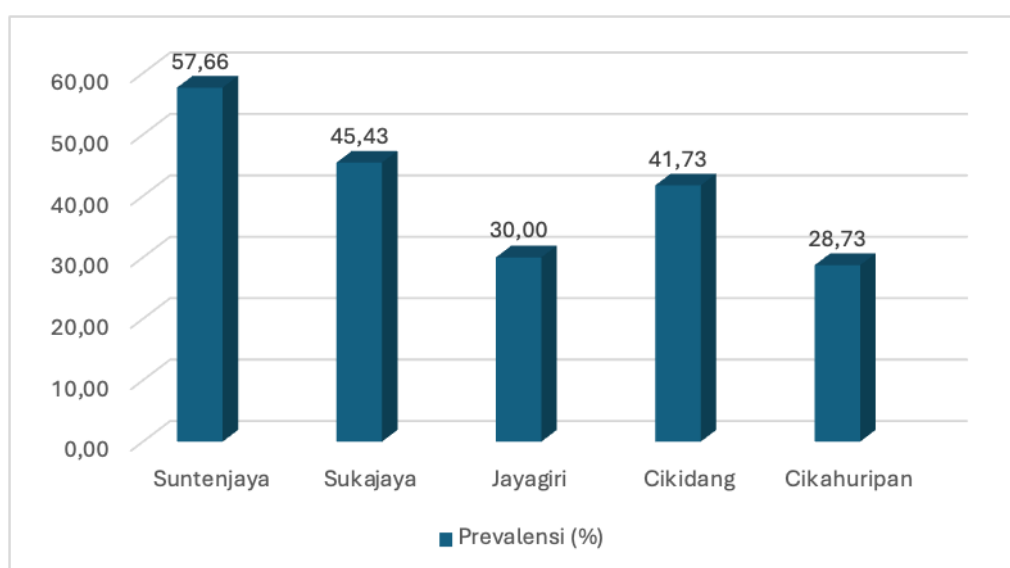


Figure 2. Prevalence of clinical mastitis in dairy cattle per village within the Lembang KPBSU area.

The results of this study indicate that the prevalence of subclinical mastitis is almost twice as high as the prevalence of clinical mastitis. According to Cobirka *et al.* (2020), subclinical mastitis can occur 15-40 times more frequently than clinical mastitis, and it is the most common form of mastitis worldwide (Dahmani and Zenia, 2025; Mazreku *et al.*, 2025). Epidemiologically, this is known as the iceberg phenomenon, where the tip of the iceberg is clinical mastitis and the bottom of the iceberg is subclinical mastitis that is not visible. This suggests that visible clinical mastitis is only a small portion of the actual cases. The high

prevalence of subclinical mastitis compared to clinical mastitis can be attributed to the absence of clinical symptoms that appear in subclinical mastitis, leading to delayed detection and accumulation of mastitis cases due to lack of immediate treatment (Stanek *et al.*, 2024). Untreated mastitis can become a reservoir of infection, potentially leading to transmission between cows (Ranasinghe *et al.*, 2021). Furthermore, clinical mastitis is typically acute, and symptoms are readily apparent, allowing prompt treatment or elimination of the disease. In contrast, subclinical mastitis is typically chronic, allowing it to persist throughout lactation without any clinical symptoms. Subclinical mastitis is often caused by pathogenic bacteria, such as *Staphylococcus aureus* (chronic subclinical) and coagulase-negative staphylococci (CNS). These bacteria are usually not strong enough to cause clinical symptoms but remain present in the udder (Mazreku *et al.*, 2025).

The prevalence of subclinical mastitis at the udder quarter level in this study was 62%, and the distribution pattern of subclinical mastitis in the udder quarters showed a higher prevalence in the rear quarter (66%) than in the front quarter (58%), especially in the right rear udder area (70 %) and the left side (62 %) (Table 3). This is in line with previous studies with varying prevalence rates (Slyzius *et al.*, 2014; Khelili *et al.*, 2025). The distribution pattern of mastitis at the udder quarter level is not even but tends to be more frequent in certain udder quarters. Several studies have reported that the prevalence of mastitis is higher in the rear udders, especially in the right position, than in the front udders (Slyzius *et al.*, 2014; Rifa'I *et al.*, 2024; Khelili *et al.*, 2025). Factors that influence the higher incidence of rear udder curvature include a higher risk of exposure to feces and urine due to the position of the rear udder quarter close to the tail, anus, and cross-contamination with the rear legs, resulting in higher bacterial contamination (Büthe *et al.*, 2025; Khelili *et al.*, 2025). Milk production is higher in the rear quarter, resulting in an increased intramammary pressure. This results in the teat sphincter opening more easily and allowing bacteria to enter more easily (Slyzius *et al.*, 2014). The rear udder quarter is more difficult to clean during milking, and milking factors, such as the habit of milking from front to back, result in the rear curvature being exposed for a longer time, thus increasing the risk of contamination. In addition, the high prevalence of mastitis in the right udder quarter compared to the left can be caused by operator milking habits, the position of the cow lying more often to the right, resulting in a higher potential for the udder to be contaminated with bacteria in the pen, and the dominant direction of human activity (Rifa'I *et al.*, 2024).

Table 3 Prevalence of subclinical mastitis in udder quarters

Variables	Prevalence (%)	
Prevalence of udder quarter level	n = 400 62	
Side and position of the infected udder	Front right (n=100)	59
	Front left (n=100)	57
	Rear right (n=100)	70
	Rear left (n=100)	62
	Front (n=200)	58
	Rear (n=200)	66
	Right (n=200)	64,5
Left (n=200)	59,5	

CMT score on the udder	- (n=400)	38,8
	+ (n=400)	34,5
	++ (n=400)	20,75
	+++ (n=400)	6,75

Mastitis is a multifactorial disease that occurs due to complex interactions between pathogens, cows (hosts), and the environment. Etiologically, mastitis is caused by bacterial infections, such as *Staphylococcus aureus*, *Streptococcus* spp., and *Escherichia coli*, which enter through the teat canal and develop in the udder tissue (Yu *et al.*, 2025). Recent research has shown that the main risk factors for mastitis include improper husbandry management, poor udder hygiene, improper milking management, damp barn conditions, and individual cow factors, such as age, parity, and lactation phase (Iraguha *et al.*, 2026). Recent studies have shown that poor udder hygiene is the most dominant factor (very high odds ratio). In addition, unhygienic milking practices (not washing hands, not pre-/post-dipping), and high-milk-producing cows in early lactation are at greater risk due to high udder pressure and decreased immunity (Al Arefin and Nizami, 2025). Tropical environmental factors, such as high humidity and fecal contamination, also accelerate the growth of pathogens, thereby increasing the prevalence of mastitis on farms (Stanek *et al.*, 2024).

Subclinical mastitis is the most economically damaging form of mastitis because it is often inconspicuous and chronic. Its primary impact is a gradual and long-term decrease in milk production, which can exceed 10% during lactation (Çelik Gürbulak *et al.*, 2024). Furthermore, subclinical mastitis causes a decline in milk quality, such as decreased fat, protein, and mineral content, thus reducing the milk's market value (Mia *et al.*, 2025). Recent studies have also shown that this condition affects reproductive efficiency and increases production costs, as infected cows tend to experience fertility problems and require additional treatment costs (Rodriguez *et al.*, 2024). Subclinical mastitis often acts as a reservoir of infection within the herd because of its undetectable nature, increasing the risk of transmission to other cows and worsening the health of the herd (Muhwezi *et al.*, 2025).

Unlike subclinical mastitis, clinical mastitis has a more immediate and visible impact on both the udder and the general condition of the cow. The main impact of this disease is a drastic reduction in milk production, which can reach 20–50%, depending on the severity of the infection (Stanek *et al.*, 2024). The milk produced is often unfit for consumption due to physical changes (clots, blood, and pus); therefore, it must be discarded, causing significant economic losses. Furthermore, clinical mastitis causes permanent udder tissue damage, increases medical costs, and is a leading cause of culling in dairy cattle (Stanek *et al.*, 2024). Globally, clinical mastitis is among the diseases with the highest economic losses in the dairy industry, with estimates reaching billions of dollars annually (Rasmussen *et al.*, 2024).

Mastitis prevention is most effectively achieved through an integrated management approach encompassing hygiene, monitoring, and animal health. A recent review emphasized that hygienic milking procedures (pre- and post-dipping), equipment sanitation, and barn cleanliness are key strategies for reducing the incidence of mastitis (Stanek *et al.*, 2024). Furthermore, routine monitoring using sensitive methods, such as CMT and somatic cell count (SCC), is crucial for the early detection of subclinical mastitis (Ramuada *et al.*, 2024). The control group also received selective antibiotic treatment, dry cow therapy, and improved cow nutrition and immunity (de Jong *et al.*, 2023). Modern approaches are beginning to utilize vaccines, alternative therapies (herbs, phages, probiotics), and

monitoring technology to reduce antibiotic dependence and prevent resistance (Yu *et al.*, 2025).

Conclusion

Based on the research results, the prevalence of mastitis in dairy cattle at KPBSU Lembang was relatively high, with a prevalence of subclinical mastitis of 73% at the cow level and 62% at the udder quarter level, while clinical mastitis was 38.88%. Subclinical mastitis was more prevalent than clinical mastitis, reflecting the iceberg phenomenon, where most cases are not clinically detected. The distribution pattern of mastitis in the udder quarters shows that the incidence of the disease is uneven and tends to be higher in the rear quarter than in the front quarter, with the highest prevalence in the right rear quarter. These findings indicate that mastitis remains a significant health problem in smallholder dairy farms and is influenced by management factors, hygiene, and environmental conditions. Therefore, more effective control efforts are needed, including improving milking hygiene, early detection of subclinical mastitis, and implementation of quarter-based udder health management, to reduce the prevalence of mastitis and sustainably increase dairy cattle productivity.

Conflict of Interest

This research has been approved by all authors and there is no conflict of interest either in funds or other matters concerning the interests of researchers.

References

- [1]. Al Arefin, K. S., & Nizami, T. A. (2025). Prevalence and risk factors of mastitis in dairy cows in Chattogram, Bangladesh. *Veterinary Research Notes*, 5(4), 33–39. <https://doi.org/10.5455/vrn.2025.e54>.
- [2]. Anggraeni, H. E., & Nurfuadi, S. Z. (2021). Prevalensi mastitis subklinis peternakan rakyat di Kabupaten Bogor. *Journal of Applied Veterinary Science and Technology*, 2(1), 1–4.
- [3]. Bechtold, V., Petzl, W., Huber-Schlenstedt, R., & Sorge, U. S. (2024). Distribution of bovine mastitis pathogens in quarter milk samples from Bavaria, Southern Germany between 2014 and 2023: A retrospective study. *Animals*, 14(17), 2504. <https://doi.org/10.3390/ani14172504>.
- [4]. Bütthe, T., Jessberger, N., Schneider, B., et al. (2025). Occurrence of mastitis pathogens in cow's milk samples from the Hanover region, north-western Germany: An overview of routine laboratory data from 2005 to 2023. *Veterinary Research Communications*, 49, 1–8. <https://doi.org/10.1007/s11259-025-10773-1>.
- [5]. Çelik Gürbulak, E., & Akçay, A. (2024). Meta-analysis of the prevalence of subclinical mastitis in dairy cattle. *Journal of the Hellenic Veterinary Medical Society*, 74(4), 6649–6662. <https://doi.org/10.12681/jhvms.31916>.
- [6]. Cobirka, M., Tancin, V., & Slama, P. (2020). Epidemiology and classification of mastitis. *Animals*, 10(12), 2212. <https://doi.org/10.3390/ani10122212>.
- [7]. Dahmani, A., & Zenia, S. (2025). Prevalence and risk factors of bovine mastitis from dairy farms in the north of Algeria. *Journal of the Hellenic Veterinary Medical Society*, 76(4), 9891–9900. <https://doi.org/10.12681/jhvms.37891>.
- [8]. de Jong, E., McCubbin, K., Speksnijder, D., et al. (2023). Invited review: Selective treatment of clinical mastitis in dairy cattle. *Journal of Dairy Science*, 106(6), 3761–3778. <https://doi.org/10.3168/jds.2022-22972>.
- [9]. Dohoo, I., Martin, W., & Stryhn, H. (2003). *Veterinary epidemiologic research* (2nd ed.). Charlottetown: AVC Inc.

- [10]. Harjanti, D. W., & Sambodho, P. (2020). Effects of mastitis on milk production and composition in dairy cows. *IOP Conference Series: Earth and Environmental Science*, 518, 012032. <https://doi.org/10.1088/1755-1315/518/1/012032>.
- [11]. Iraguha, B., Gasana, M. N., & Mpatwenumugabo, J. P. M. (2026). Bovine mastitis epidemiology: Prevalence, risk factors, control program gaps and biosecurity recommendations. *PLoS ONE*, 21(3), e0329250. <https://doi.org/10.1371/journal.pone.0329250>.
- [12]. Khasanah, H., Setyawan, H. B., Yulianto, R., & Widianingrum, D. C. (2021). Subclinical mastitis: Prevalence and risk factors in dairy cows in East Java, Indonesia. *Veterinary World*, 14(8), 2102–2108. <https://doi.org/10.14202/vetworld.2021.2102-2108>.
- [13]. Khasa, V., Chaudhary, V., & Singh, P. (2020). Mastitis: A review on disease affecting livestock and its control. *Journal of Entomology and Zoology Studies*, 8, 1393–1395.
- [14]. Khelili, A., Achek, R., Abdullah, M. R., et al. (2025). Characterization and antimicrobial resistance of bacteria causing subclinical mastitis in dairy cows in the upper Cheliff region, Northern Algeria. *Antibiotics*, 14(12), 1190. <https://doi.org/10.3390/antibiotics14121190>.
- [15]. Krishnamoorthy, P., Goudar, A. L., Suresh, K. P., & Roy, P. (2021). Global and countrywide prevalence of subclinical and clinical mastitis in dairy cattle and buffaloes: A systematic review and meta-analysis. *Research in Veterinary Science*, 136, 561–586. <https://doi.org/10.1016/j.rvsc.2021.04.021>.
- [16]. Mazreku, N., Sylejmani, D., & Robaj, A. (2025). Prevalence of subclinical mastitis, related risk factors, and antimicrobial susceptibility of bacteria isolated from milk of dairy cows in Kosovo. *Veterinary Medicine*, 70(4), 117–123. <https://doi.org/10.17221/102/2024-VETMED>.
- [17]. Meçaj, R., Muça, G., Koleci, X., et al. (2023). Bovine environmental mastitis and their control: An overview. *International Journal of Agriculture and Biosciences*, 12, 216–221.
- [18]. Mia, M. P., Hossain, H., et al. (2025). Prevalence and consequences of bovine subclinical mastitis in hill tract areas of the Chattogram division, Bangladesh. *Journal of Advanced Biotechnology and Experimental Therapeutics*, 8(1), 163–181.
- [19]. Mgonja, F. R., Charles, M. M., & Katakweba, A. S. (2023). Prevalence of subclinical mastitis and associated risk factors in dairy cattle from institution farms in Morogoro municipality. *World Journal of Veterinary Science*, 4(1), 1020.
- [20]. Muhwezi, R., Emmanuel, E., Sankarapandian, V., et al. (2025). Prevalence, associated factors, and bacterial profiles of subclinical mastitis in dairy cattle in Uganda: A systematic review and meta-analysis. *Scientific African*, 27, e02607.
- [21]. Nianto, Z. T., Moelia, E. M., & Widyasworo, A. K. (2019). Analisa faktor yang mempengaruhi mastitis pada sapi perah. *Aves: Jurnal Peternakan*, 13(1), 23–27. <https://doi.org/10.35457/aves.v12i1.1132>.
- [22]. Nisa, H. C., Purnomo, S. B., Damayanti, T. L., et al. (2019). Analysis of factors affecting subclinical and clinical mastitis in dairy cows. *Ovozoa Journal of Animal Reproduction*, 8(1), 66–70.
- [23]. Nuraini, D. M., Andityas, M., Sukon, P., & Phuektes, P. (2023). Prevalence of mastitis in dairy animals in Indonesia: A systematic review and meta-analysis. *Veterinary World*, 16(7), 1380–1389. <https://doi.org/10.14202/vetworld.2023.1380-1389>.

- [24]. Qolbaini, E. N., Artika, I. M., & Safari, D. (2014). Detection of subclinical mastitis in dairy cows using California mastitis test. *Current Biochemistry*, 1(2), 66–70.
- [25]. Rai, A. K., Nayak, A., Jogi, J., et al. (2022). Prevalence of clinical and subclinical mastitis in dairy cows and buffaloes. *The Pharma Innovation Journal*, 11(7), 4771–4773.
- [26]. Raisatulhaq, R., Anggaeni, T. T. K., & Tasripin, D. S. (2025). Prevalence and risk factors of mastitis in dairy farm, Tasikmalaya, Indonesia. *Open Veterinary Journal*, 15(2), 785–794. <https://doi.org/10.5455/OVJ.2025.v15.i2.27>.
- [27]. Ramuada, M., Tyasi, T. L., Gumede, L., & Chitura, T. (2024). A practical guide to diagnosing bovine mastitis: A review. *Frontiers in Animal Science*, 5, 1504873. <https://doi.org/10.3389/fanim.2024.1504873>.
- [28]. Ranasinghe, R. M. S. B. K., Deshapriya, R. M. C., Abeygunawardana, D. I., et al. (2021). Subclinical mastitis in dairy cows in major milk-producing areas of Sri Lanka. *Journal of Dairy Science*, 104, 12900–12911. <https://doi.org/10.3168/jds.2021-20223>.
- [29]. Rasmussen, P., Barkema, H. W., Osei, P. P., et al. (2024). Global losses due to dairy cattle diseases. *Journal of Dairy Science*, 107, 6945–6970. <https://doi.org/10.3168/jds.2023-24626>.
- [30]. Rifa'i, Radiati, L. E., Hawa, L. C., & Surjowardojo, P. (2024). Prevalence of subclinical mastitis in Holstein-Friesian cows among small-scale farms in Batu, Indonesia. *International Journal of Veterinary Science*, 13(5), 592–595. <https://doi.org/10.47278/journal.ijvs/2024.144>.
- [31]. Rodriguez, Z., Cabrera, V., Hogeveen, H., & Ruegg, P. L. (2024). Economic impact of subclinical mastitis treatment in early lactation. *Journal of Dairy Science*, 107(7), 4634–4645.
- [32]. Siagian, T. B., & Amidjaya, S. H. (2022). Correlation between teat length and lactation periods on subclinical mastitis. *E3S Web of Conferences*, 348, 00031.
- [33]. Stanek, P., Żółkiewski, P., & Januś, E. (2024). A review on mastitis in dairy cows research: Current status and future perspectives. *Agriculture*, 14(8), 1292. <https://doi.org/10.3390/agriculture14081292>.
- [34]. Susanty, H., Purwanto, B. P., Sudarwanto, M., & Atabany, A. (2017). Spatial model of dairy farming practices and subclinical mastitis prevalence. *International Journal of Scientific and Basic Applied Research*, 35(2), 225–236.
- [35]. Slyzius, E., Juozaitiene, V., Juozaitis, A., et al. (2014). Udder quarters morphological and milking traits influencing mastitis. *Bulgarian Journal of Agricultural Science*, 20(6), 1502–1507.
- [36]. Woudstra, S., Wenten, N., Zhang, Y., et al. (2023). Strain diversity and infection durations of mastitis pathogens. *Journal of Dairy Science*, 106, 4214–4231.
- [37]. Yu, W., Zhang, Z., Wang, Z., et al. (2025). Comprehensive prevention and control of mastitis in dairy cows: From etiology to prevention. *Veterinary Sciences*, 12(9), 800. <https://doi.org/10.3390/vetsci120>.