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(REVIEW ARTICLE)

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Review of infectious diseases in ruminant livestock: Risk factors, impacts, and control strategies

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Abstract

Infectious diseases remain a major challenge in ruminant livestock production because they reduce productivity, cause economic losses, threaten animal welfare, and create public health risks. This review aimed to summarize major infectious diseases affecting cattle, buffaloes, sheep, and goats, with emphasis on risk factors, impacts, and control strategies. The reviewed literature showed that important diseases include foot-and-mouth disease, peste des petits ruminants, bovine brucellosis, bovine tuberculosis, bovine mastitis, contagious caprine pleuropneumonia, and parasitic infections. Disease transmission is influenced by multiple factors, including animal movement, poor biosecurity, inadequate vaccination, weak surveillance, environmental contamination, wildlife–livestock interaction, and limited access to veterinary services. The impacts of these diseases include mortality, reduced milk yield, reproductive failure, poor growth, treatment costs, trade restrictions, and zoonotic transmission. Effective control requires integrated strategies involving vaccination, quarantine, movement regulation, early diagnosis, surveillance, farm biosecurity, farmer education, antimicrobial stewardship, and One Health collaboration. This review highlights that infectious disease control in ruminants should not rely only on treatment but must prioritize prevention, coordination, and evidence-based management to support livestock productivity, food security, and public health.

Keywords: Ruminant Livestock; Infectious Diseases; Biosecurity; Vaccination; One Health

1. Introduction

Ruminant livestock, including cattle, buffaloes, sheep, and goats, play a central role in global food security, rural livelihoods, animal-source protein supply, and agricultural economies. However, the sustainability of ruminant production is increasingly challenged by infectious diseases that reduce productivity, disrupt trade, threaten animal welfare, and create public health risks. Infectious diseases in livestock are not merely biological events; they are also economic, ecological, and governance problems. FAO reported that animal diseases may cost the global economy up to USD 300 billion annually and that around 20% of animal production is lost because of disease, indicating that disease control is a core requirement for sustainable livestock development rather than a secondary veterinary concern (FAO, 2024).

The burden of infectious diseases in ruminants is particularly complex because these diseases involve multiple interacting risk factors. Animal movement, livestock trade, farm intensification, poor biosecurity, inadequate vaccination coverage, environmental stress, climate change, and wildlife–livestock interfaces can increase disease emergence and transmission. The World Health Organization emphasizes that animal trade, agriculture, livestock farming, urbanization, climate change, habitat fragmentation, and ecosystem stress create new opportunities for infectious diseases to emerge and spread (WHO, 2026). In ruminant systems, these risks are evident in transboundary

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animal diseases such as foot-and-mouth disease (FMD) and peste des petits ruminants (PPR), as well as zoonotic infections such as brucellosis and bovine tuberculosis. FMD, for instance, is described by WOAH as a severe and highly contagious viral disease affecting cattle, sheep, goats, and other cloven-hoofed animals, with major impacts on livestock production and international trade (WOAH, 2026).

The impacts of infectious diseases in ruminant livestock extend beyond mortality. Many infections cause hidden but substantial losses through reduced growth, decreased milk yield, infertility, abortion, poor feed efficiency, treatment costs, market restrictions, and long-term herd productivity decline. Kappes et al. (2023) argue that animal diseases negatively affect producers, consumers, markets, trade, and economies, while also creating knowledge gaps in how disease burden is distributed across livestock value chains. These impacts are especially severe for smallholder farmers, who often depend on ruminants as assets, income sources, food security buffers, and social capital. Therefore, infectious disease control is not only a technical veterinary issue but also a development priority linked to poverty reduction, market stability, and rural resilience.

Another major concern is the zoonotic potential of several ruminant diseases. Brucellosis, for example, is caused by *Brucella* bacteria and can spread to humans through contact with infected animals or contaminated animal products, particularly among people working closely with livestock (CDC, 2026). This demonstrates that ruminant health cannot be separated from human health. The One Health approach is therefore essential because it recognizes the interdependence of animal, human, and environmental health. WHO defines One Health as an integrated approach that optimizes the health of humans, animals, plants, and ecosystems rather than treating them as separate domains (WHO, 2026). In practical terms, this means that controlling infectious diseases in ruminants also contributes to food safety, antimicrobial resistance prevention, zoonotic disease reduction, and ecosystem health.

Control strategies for infectious diseases in ruminant livestock must therefore be multidimensional. Vaccination remains one of the most effective preventive tools, especially for vaccine-preventable transboundary diseases. WOAH states that effective PPR vaccines are available and can induce life-long protective immunity, while vaccination is a key tool in the global strategy to control and eradicate PPR by 2030 (WOAH, 2026). Similarly, WOAH's 2025 report highlights that vaccination reduces the incidence of infectious diseases in animals and can decrease reliance on antibiotics, thereby helping mitigate antimicrobial resistance (WOAH, 2025). Nevertheless, vaccination alone is insufficient without strong surveillance, early detection, quarantine, animal movement control, biosecurity, diagnostic capacity, farmer education, and effective veterinary services. Jadi bukan cuma "suntik lalu beres", seolah patogen ikut antre administrasion.

This review argues that infectious diseases in ruminant livestock should be understood through an integrated framework connecting risk factors, impacts, and control strategies. A fragmented disease-by-disease approach is useful for clinical diagnosis, but it is insufficient for addressing broader epidemiological and socioeconomic realities. Therefore, this review aims to synthesize current evidence on major infectious diseases affecting ruminant livestock, identify key risk factors that facilitate disease transmission, evaluate their economic, production, welfare, and public health impacts, and discuss practical control strategies based on biosecurity, vaccination, surveillance, movement regulation, antimicrobial stewardship, and One Health collaboration.

2. Materials and Methods

2.1. Study Design

This study was designed as a literature review focusing on infectious diseases in ruminant livestock, including cattle, buffaloes, sheep, and goats. The review aimed to synthesize current scientific evidence regarding major infectious diseases, associated risk factors, production and economic impacts, zoonotic relevance, and control strategies. The review was conducted using a structured literature search approach adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 guideline, which provides checklist-based recommendations for transparent reporting of literature reviews (Page et al., 2021). PRISMA 2020 is widely used to improve clarity in identifying, screening, and reporting selected studies, because apparently even literature reviews need paperwork discipline now.

2.2. Literature Search Strategy

Relevant literature was collected from electronic databases and scientific sources, including PubMed, ScienceDirect, Scopus, Web of Science, Google Scholar, FAO, WHO, and the World Organisation for Animal Health. The literature search

was conducted using combinations of keywords related to infectious diseases, ruminant livestock, epidemiology, risk factors, economic losses, zoonotic diseases, biosecurity, vaccination, and disease control.

The keywords used included: "infectious diseases in ruminants," "ruminant livestock diseases," "cattle infectious disease," "sheep and goat infectious diseases," "foot-and-mouth disease," "brucellosis," "bovine tuberculosis," "peste des petits ruminants," "risk factors," "livestock biosecurity," "zoonotic diseases," "vaccination," "surveillance," "control strategies," and "One Health." Boolean operators such as AND and OR were used to refine the search strategy.

2.3. Inclusion and Exclusion Criteria

The inclusion criteria were as follows: articles published in peer-reviewed journals, official reports from international organizations, review articles, epidemiological studies, and studies discussing infectious diseases in ruminant livestock. Publications were included when they addressed at least one of the following aspects: disease occurrence, risk factors, clinical or subclinical impacts, economic losses, zoonotic potential, biosecurity, vaccination, surveillance, or disease control strategies.

The exclusion criteria included articles unrelated to ruminant livestock, studies focusing only on non-infectious diseases, articles without accessible abstracts or full texts, duplicate publications, opinion articles without scientific basis, and sources with unclear authorship or unreliable publication background. Older references were used only when they provided foundational concepts or widely accepted definitions, while recent publications were prioritized to ensure scientific relevance.

2.4. Study Selection

The selection process was carried out in several stages. First, titles and abstracts were screened to identify studies relevant to infectious diseases in ruminant livestock. Second, full-text articles were reviewed to assess their suitability based on the inclusion and exclusion criteria. Third, selected articles were grouped according to disease type, host species, risk factors, impacts, and control strategies. This selection process followed the general principles of transparent evidence synthesis recommended in PRISMA-based reporting, particularly in documenting identification, screening, eligibility assessment, and inclusion of sources (Page et al., 2021).

2.5. Data Extraction

Data were extracted from each selected source using a structured approach. The extracted information included author name, year of publication, study location, animal species, type of infectious disease, causative agent, route of transmission, risk factors, clinical manifestations, production impacts, economic consequences, zoonotic relevance, and recommended control measures. Official documents from FAO, WHO, and WOAH were used to support global disease burden, policy relevance, One Health concepts, and international disease control recommendations.

2.6. Data Synthesis and Analysis

The collected data were analyzed using a narrative synthesis approach. Findings were organized into major thematic categories: major infectious diseases in ruminants, risk factors, impacts, and control strategies. Risk factors were classified into animal-related factors, management-related factors, environmental factors, pathogen-related factors, and socioeconomic factors. Disease impacts were analyzed based on productivity losses, mortality, reproductive disorders, treatment costs, trade restrictions, animal welfare concerns, and public health implications.

Control strategies were synthesized based on preventive, curative, and policy-based approaches. These included vaccination, quarantine, movement control, early diagnosis, surveillance, farm biosecurity, antimicrobial stewardship, farmer education, and One Health collaboration. The One Health approach was included because infectious diseases in livestock are closely linked to human health and environmental conditions, especially in zoonotic diseases and antimicrobial resistance issues. WHO defines One Health as an integrated approach that connects human, animal, plant, and ecosystem health, which is highly relevant for controlling infectious diseases in livestock systems.

2.7. Quality and Reliability of Sources

To ensure the reliability of the review, priority was given to articles published in reputable journals and official reports from recognized international institutions. Sources from FAO, WHO, and WOAH were used because these organizations provide authoritative data and guidelines related to animal health, zoonotic diseases, surveillance, vaccination, and livestock disease control. FAO has emphasized that animal diseases can cause major global economic losses and reduce

animal production, while WOAH highlights the importance of surveillance, vaccination, and international disease reporting in animal health management.

3. Results and Discussion

3.1. Overview of Reviewed Articles

The reviewed articles summarized in Table 1 show that infectious diseases in ruminant livestock remain a major constraint to livestock productivity, animal welfare, public health, and livestock trade. The selected review articles cover several important infectious diseases affecting cattle, sheep, and goats, including foot-and-mouth disease, peste des petits ruminants, bovine brucellosis, bovine tuberculosis, bovine mastitis, contagious caprine pleuropneumonia, and parasitic infections such as *Eimeria* spp. The reviewed studies also demonstrate that infectious diseases in ruminants are not caused by a single factor but by the interaction of pathogen characteristics, host susceptibility, farm management, animal movement, environmental conditions, and socioeconomic limitations.

As presented in Table 1, the reviewed literature can be grouped into four main themes: disease occurrence and epidemiology, risk factors, impacts, and control strategies. Kappes et al. (2023) emphasized that livestock diseases create burdens across production, prevention and treatment, animal welfare, trade, and regulation. Their scoping review covered 192 papers and reports, showing that the burden of animal disease is multidimensional and extends across the livestock value chain. This finding supports the argument that infectious disease control in ruminants should not be viewed merely as a farm-level veterinary action but as a broader strategy for improving livestock production efficiency, food security, and public health.

3.2. Major Infectious Diseases in Ruminant Livestock

The review articles listed in Table 1 indicate that infectious diseases affecting ruminants vary by host species, production system, geographical area, and management practice. In cattle, important infectious diseases include foot-and-mouth disease, bovine brucellosis, bovine tuberculosis, bovine mastitis, bovine viral diarrhea, infectious bovine rhinotracheitis, and respiratory infections. Renault et al. (2018) classified adult cattle infectious diseases as an initial step toward prioritizing biosecurity measures and identified multiple diseases of importance for cattle health management. This indicates that cattle disease control requires prioritization because not all infectious diseases have the same transmission pattern, economic impact, or public health relevance.

Foot-and-mouth disease is one of the most important transboundary animal diseases in ruminants. Knight-Jones and Rushton (2013), as shown in Table 1, reviewed the economic impacts of foot-and-mouth disease and reported that the disease produces large direct and indirect losses, particularly through production reduction, vaccination costs, market disruption, and trade restrictions. This makes FMD not only a biological disease problem but also a major economic and policy issue. The high contagiousness of FMD means that the management practices of one farm can affect disease risk in other farms, making collective disease control essential.

In small ruminants, peste des petits ruminants is one of the most important viral diseases. Esonu et al. (2022) reviewed the epidemiology of PPR in Nigeria and found that PPR remains a major constraint to sheep and goat productivity, with reviewed studies covering many affected regions. Similarly, Ahaduzzaman (2020) conducted a systematic review and meta-analysis of PPR prevalence in sheep and goats across Africa and Asia, showing the relevance of PPR as a widespread disease affecting small ruminant production. These findings suggest that PPR control is particularly important in smallholder production systems, where sheep and goats function as sources of income, food, and household economic security.

Bacterial zoonotic diseases are also prominent in the reviewed literature. Khurana et al. (2021) described bovine brucellosis as a zoonotic disease with major animal welfare, economic, and public health implications. The disease is associated with reproductive losses, abortion, infertility, and transmission risk to humans through contact with infected animals or consumption of contaminated animal products. Borham et al. (2022) reviewed bovine tuberculosis and emphasized that the disease affects domestic and wild animals and represents both an economic and public health burden. Therefore, diseases such as brucellosis and bovine tuberculosis strengthen the need for a One Health approach in ruminant disease control.

3.3. Risk Factors of Infectious Diseases in Ruminants

The articles summarized in Table 1 consistently show that risk factors for infectious diseases in ruminants are multifactorial. These include animal movement, herd size, poor biosecurity, lack of quarantine, inadequate vaccination,

close contact between animals, contact with wildlife, environmental contamination, and limited access to veterinary services. Renault et al. (2018) emphasized the role of biosecurity in preventing infectious disease transmission in cattle, while studies on FMD and PPR show that livestock mobility and weak surveillance contribute to disease persistence.

Animal movement is one of the most important risk factors, especially for highly contagious and transboundary diseases such as FMD and PPR. Movement of infected or carrier animals can introduce pathogens into previously unaffected herds or regions. This is particularly relevant in pastoral and smallholder systems, where animals are often moved for grazing, trade, breeding, or market access. When animal movement is not supported by proper health certification, quarantine, or disease surveillance, infectious diseases can spread rapidly across farms and administrative borders.

Poor biosecurity is another key risk factor identified across the reviewed literature. Biosecurity failures include lack of isolation for new animals, poor hygiene, shared equipment, uncontrolled visitors, contaminated feed and water, and improper disposal of waste or carcasses. In practice, biosecurity is often weak in small-scale livestock systems because of limited infrastructure, low farmer awareness, and financial constraints. This is precisely where disease control becomes difficult: the recommended measures are simple on paper, but farm reality tends to be less obedient than a textbook paragraph.

For brucellosis, Khurana et al. (2021) identified several common risk factors, including age of cows, large herd size, source of cattle purchase, and geographical conditions. Brucella seropositivity has also been associated with abortion, making reproductive management an important part of disease control. For bovine tuberculosis, Borham et al. (2022) highlighted the role of domestic and wild animal reservoirs, chronic infection, and diagnostic limitations in maintaining disease transmission. These findings indicate that infectious disease control requires both farm-level prevention and broader surveillance systems.

3.4. Impacts of Infectious Diseases on Ruminant Livestock

The reviewed articles in Table 1 demonstrate that infectious diseases cause direct and indirect impacts on ruminant livestock production. Direct impacts include mortality, morbidity, reduced growth rate, decreased milk production, reproductive failure, abortion, infertility, poor feed efficiency, and reduced animal welfare. Indirect impacts include treatment costs, vaccination costs, diagnostic expenses, quarantine, movement restrictions, market losses, and trade barriers.

Kappes et al. (2023) emphasized that livestock disease burden is distributed across producers, consumers, markets, trade systems, and governments. This means that the impact of infectious diseases cannot be measured only by the number of sick or dead animals. A disease may also reduce household income, increase production costs, reduce food availability, and weaken market competitiveness. Therefore, infectious diseases in ruminants represent both biological and economic threats.

Foot-and-mouth disease provides a clear example of the economic consequences of infectious disease. Knight-Jones and Rushton (2013) estimated that the annual impact of FMD in endemic regions, considering visible production losses and vaccination costs, ranges from USD 6.5 billion to USD 21 billion. This shows that disease prevention may appear costly at the farm level, but uncontrolled outbreaks are far more expensive at the industry and national levels. In other words, skipping prevention is not saving money; it is just delaying the bill until it becomes uglier.

Mastitis is another economically important infectious disease, especially in dairy cattle. Cheng and Han (2020) reviewed bovine mastitis and explained that it is associated with reduced milk yield, poor milk quality, treatment costs, and culling losses. Sharun et al. (2021) further emphasized that mastitis control requires therapeutic and managemental approaches, including diagnosis, antimicrobial use, hygiene, and preventive management. These findings indicate that some infectious diseases may not always cause high mortality but still create major economic losses through chronic productivity decline.

Zoonotic diseases such as brucellosis and bovine tuberculosis create an additional layer of impact because they affect both livestock and humans. Khurana et al. (2021) described bovine brucellosis as a disease with major public health relevance, especially in areas where animal husbandry is closely linked with human livelihoods and food consumption practices. Borham et al. (2022) also emphasized that bovine tuberculosis represents a public health and economic burden because it affects multiple domestic and wild animal species and can be linked to drug-resistant *Mycobacterium* species. Therefore, the impact of infectious diseases in ruminants should be evaluated through animal health, public health, and socioeconomic perspectives.

3.5. Control Strategies for Infectious Diseases in Ruminants

Based on the reviewed articles in Table 1, effective control of infectious diseases in ruminants requires integrated strategies. These strategies include vaccination, biosecurity, quarantine, movement control, early diagnosis, disease surveillance, antimicrobial stewardship, farmer education, and One Health collaboration. No single intervention is sufficient because infectious disease transmission is influenced by multiple biological, environmental, and management-related factors.

Vaccination is one of the most important control strategies for vaccine-preventable diseases such as foot-and-mouth disease and peste des petits ruminants. However, vaccination programs must be supported by sufficient coverage, cold chain management, appropriate timing, farmer participation, and post-vaccination monitoring. Esonu et al. (2022) and Ahaduzzaman (2020) showed that understanding disease epidemiology and prevalence is essential for designing effective PPR control programs. Without adequate surveillance and vaccination coverage, disease control efforts may become fragmented and ineffective.

Biosecurity remains essential for preventing disease introduction and transmission. Renault et al. (2018) argued that classification of infectious diseases can support prioritization of biosecurity measures in cattle systems. Practical biosecurity measures include isolating new or sick animals, controlling visitors, disinfecting equipment, improving housing hygiene, managing manure properly, and preventing contact with potentially infected animals. These measures are particularly important in farms with high animal density, frequent animal purchase, and close contact between different herds.

For bacterial diseases such as mastitis, brucellosis, and bovine tuberculosis, control strategies must combine prevention, diagnosis, and responsible treatment. Cheng and Han (2020) noted that bovine mastitis control involves risk factor management, therapeutic strategies, and alternative treatments. Meanwhile, Khurana et al. (2021) emphasized that brucellosis control requires attention to risk factors, vaccination, diagnosis, and One Health-based intervention. This shows that bacterial disease control should not rely only on antimicrobials, because antimicrobial misuse can create additional public health problems through antimicrobial resistance.

For small ruminant respiratory diseases, Yatoo et al. (2019) reviewed contagious caprine pleuropneumonia and described it as a serious disease of goats, occasionally affecting sheep and wild ruminants. This highlights the importance of early diagnosis, movement control, and preventive herd health management in goat production systems. Similarly, parasitic infections such as *Eimeria* spp. require environmental hygiene, proper housing, control of stocking density, and strategic treatment because transmission is strongly influenced by contamination and management conditions.

3.6. Integrated Interpretation of the Reviewed Literature

Overall, the articles presented in Table 1 support the argument that infectious diseases in ruminant livestock should be understood as complex health problems involving animal, human, environmental, and economic dimensions. The reviewed literature shows that disease occurrence is driven not only by pathogens but also by farm management, livestock movement, biosecurity practices, veterinary service access, and socioeconomic conditions. Therefore, disease control should move beyond reactive treatment and adopt preventive, integrated, and evidence-based strategies.

The most consistent finding across the reviewed literature is that infectious disease control in ruminants requires coordination between farmers, veterinarians, laboratories, government authorities, and public health institutions. Vaccination and treatment are important, but they are insufficient without surveillance, movement control, farmer education, and biosecurity. For zoonotic diseases such as brucellosis and bovine tuberculosis, the One Health approach is especially important because disease transmission can cross the boundary between animal and human populations.

Thus, this review confirms that the control of infectious diseases in ruminant livestock should be based on three main principles. First, disease prevention must be prioritized over treatment because prevention reduces economic losses before they occur. Second, control strategies must be disease-specific because each disease has different transmission routes, risk factors, and impacts. Third, livestock disease control must be integrated with public health and environmental management, particularly for zoonotic and transboundary diseases.

4. Conclusion

Infectious diseases remain a major threat to ruminant livestock because they reduce productivity, cause economic losses, affect animal welfare, and pose public health risks. This review shows that diseases such as foot-and-mouth

disease, peste des petits ruminants, brucellosis, bovine tuberculosis, mastitis, and other infections are influenced by risk factors such as poor biosecurity, animal movement, weak surveillance, and inadequate vaccination. Therefore, effective control requires integrated strategies, including vaccination, quarantine, surveillance, biosecurity, farmer education, and a One Health approach to protect livestock productivity, food security, and public health.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no financial or non-financial conflicts of interest related to this article.

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Appendix

Table 1 Summary of Reviewed Journal Articles on Infectious Diseases in Ruminant Livestock

No.	Author dan Tahun	Judul Artikel	Jurnal	Jenis Artikel	Fokus dalam Review	DOI / Keterangan
1	Page et al. (2021)	*The PRISMA 2020 statement: an updated guideline for reporting systematic reviews*	BMJ	Guideline / systematic review reporting	Digunakan sebagai dasar metode pencarian, seleksi, dan pelaporan literatur review	DOI: 10.1136/bmj.n71. Artikel ini diterbitkan di BMJ tahun 2021 dan menjadi pedoman utama pelaporan systematic review.
2	Kappes et al. (2023)	*Livestock health and disease economics: a scoping review of selected literature*	Frontiers in Veterinary Science	Scoping review	Menjelaskan dampak ekonomi penyakit hewan terhadap produksi, biaya pencegahan, animal welfare, perdaganga n, dan regulasi	DOI: 10.3389/fvets.2023.1168649. Artikel ini meninjau 192 paper dan laporan organisasi terkait beban ekonomi penyakit ternak.
3	Renault et al. (2018)	*Classification of adult cattle infectious diseases: A first step towards prioritization of biosecurity measures*	Transbounda ry and Emerging Diseases	Review berbasis klasifikasi penyakit dan biosecurity prioritizatio n	Digunakan untuk membahas penyakit infeksi penting pada sapi dan prioritas biosekuriti	DOI: 10.1111/tbed.12982. Artikel ini mengidentifikasi penyakit penting seperti BRD, BRSV, BVD, IBR, Q fever, dan salmonellosis.
4	Knight-Jones and Rushton (2013)	*The economic impacts of foot and mouth disease: What are they, how big are they and where do they occur?*	Preventive Veterinary Medicine	Review ekonomi penyakit	Digunakan untuk membahas dampak ekonomi FMD, termasuk kerugian produksi langsung	DOI: 10.1016/j.prevetmed.2013.07.013. Artikel ini sangat sering dikutip untuk ekonomi FMD.

					dan kerugian tidak langsung akibat kontrol dan pembatasan pasar	
5	Byamukama et al. (2025)	*Epidemiology and control strategies for foot-and-mouth disease in livestock and wildlife in Uganda: systematic review*	Veterinary Research Communications	Systematic review	Digunakan untuk FMD: faktor risiko, animal movement, proximity to borders, pastoralism, surveilans, vaksinasi, dan kontrol	DOI: 10.1007/s11259-025-10791-z. Artikel ini diterbitkan tahun 2025 sebagai systematic review dan memuat strategi pengendalian FMD.
6	Mashinagu et al. (2024)	*Challenges of Controlling Foot-and-Mouth Disease in Pastoral Settings in Africa*	Transboundary and Emerging Diseases	Review article	Digunakan untuk menjelaskan tantangan pengendalian FMD pada sistem pastoral, terutama mobilitas ternak dan keterbatasan vaksinasi	DOI: 10.1155/2024/2700985. Artikel ini berfokus pada tantangan pengendalian FMD di Afrika.
7	Esonu et al. (2022)	*Epidemiology of Peste des Petits Ruminants in Nigeria: A Review*	Frontiers in Veterinary Science	Systematic review	Digunakan untuk PPR pada domba dan kambing, termasuk prevalensi, lineage virus, faktor risiko, vaksinasi, dan strategi eradikasi	DOI: 10.3389/fvets.2022.898485. Artikel ini meninjau 37 artikel dan membahas PPR sebagai hambatan produktivitas ruminansia kecil.
8	Ahaduzzaman (2020)	*Peste des petits ruminants in Africa and Asia: A systematic review and meta-analysis of the prevalence in sheep and goats between 1969 and 2018*	Veterinary Medicine and Science	Systematic review and meta-analysis	Digunakan untuk prevalensi global PPR pada domba dan kambing di Afrika dan Asia	DOI: 10.1002/vms3.300. Artikel ini relevan untuk data prevalensi PPR lintas wilayah.

9	Khurana et al. (2021)	*Bovine brucellosis: a comprehensive review*	Veterinary Quarterly	Comprehensive review	Digunakan untuk brucellosis pada sapi: epidemiologi, transmisi, diagnosis, vaksinasi, zoonosis, dan kontrol	DOI: 10.1080/01652176.2020.1868616. Artikel ini diterbitkan di *Veterinary Quarterly*, Vol. 41(1), halaman 61–88.
10	Borham et al. (2022)	*Review on Bovine Tuberculosis: An Emerging Disease Associated with Multidrug-Resistant Mycobacterium Species*	Pathogens	Review article	Digunakan untuk bovine tuberculosis, zoonosis, *Mycobacterium bovis*, resistensi obat, diagnosis, dan kontrol	DOI: 10.3390/pathogens11070715. Artikel ini adalah peer-reviewed review article di *Pathogens*.
11	Broughan et al. (2016)	*A review of risk factors for bovine tuberculosis infection in cattle in the UK and Ireland*	Epidemiology and Infection	Review article	Digunakan untuk faktor risiko bovine tuberculosis pada level ternak dan herd level	DOI: 10.1017/S095026881600131X. Artikel ini membahas faktor risiko bTB pada sapi di UK dan Irlandia.
12	Cheng and Han (2020)	*Bovine mastitis: risk factors, therapeutic strategies, and alternative treatments: A review*	Animal Bioscience / Asian-Australasian Journal of Animal Sciences	Review article	Digunakan untuk mastitis sapi, faktor risiko, terapi, alternatif pengobatan, dan kontrol infeksi ambing	DOI: 10.5713/ajas.20.0156. Artikel ini membahas faktor risiko dan strategi terapi mastitis sapi.
13	Sharun et al. (2021)	*Advances in therapeutic and managemental approaches of bovine mastitis: a comprehensive review*	Veterinary Quarterly	Comprehensive review	Digunakan untuk terapi mastitis, manajemen, antimikroba, alternatif pengobatan, dan pencegahan	DOI: 10.1080/01652176.2021.1882713. Artikel ini diterbitkan di *Veterinary Quarterly*, Vol. 41(1), halaman 107–136.
14	Liu et al. (2024)	*Epidemiological characteristics and prevention and control strategies for Eimeria spp. in*	Animal Diseases	Systematic review	Digunakan untuk penyakit parasitik infeksius pada domba dan	DOI: 10.1186/s44149-024-00151-w. Artikel ini membahas prevalensi, faktor risiko, dan strategi pengendalian *Eimeria* pada domba dan kambing.

		sheep and goats in China: a systematic review			kambing, khususnya *Eimeria spp.*, faktor risiko, dan kontrol	
15	Yatoo et al. (2019)	*Contagious caprine pleuropneumonia: a comprehensive review*	Veterinary Quarterly	Comprehensive review	Digunakan untuk CCPP pada kambing: etiologi, epidemiologi, diagnosis, dampak, dan pengendalian	DOI: 10.1080/01652176.2019.1580826. Artikel ini membahas CCPP sebagai penyakit respiratorik penting pada kambing.