

Study trend of mastitis research in goats

Dian Meididewi Nuraini^{1,2*}, Morsid Andityas³, Clara Ancilia Pramita Kusumasri², Afif Ihza Abdala², and Ling Wu²

¹Department of Animal Science, Faculty of Animal Science, Universitas Sebelas Maret, 57126, Surakarta, Indonesia

²Veterinary Science Program, Faculty of Veterinary Medicine, Khon Kaen University, 40000, Khon Kaen, Thailand

³Veterinary Technology Study Program, Department of Bioresources Technology and Veterinary, Vocational College, Universitas Gadjah Mada, 55281, Yogyakarta, Indonesia

Abstract. Mastitis is one of the most significant diseases affecting dairy goats, with substantial economic and animal welfare implications. Over the past decades, scientific attention toward goat mastitis has expanded, with studies addressing epidemiology, causative agents, diagnosis, treatment, and prevention strategies. This bibliometric study aimed to evaluate the global research trends in mastitis in goats by analyzing publications indexed in Scopus databases. Data were collected and analyzed using bibliometric tools in R software to assess publication patterns, sources, authors, country production, keyword occurrences, and thematic evolution. The analysis revealed a steady increase in publications, particularly in the last two decades, highlighting growing scientific interest in goat mastitis. The most relevant sources included Small Ruminant Research and other veterinary-focused journals, while prominent contributions were observed from institutions in Europe, Asia, and North America. Keyword analysis showed frequent terms such as *Staphylococcus aureus*, milk quality, and antimicrobial resistance, reflecting both traditional microbiological focus and recent concerns regarding resistance and molecular epidemiology. The findings provide insight into research hotspots and gaps, offering guidance for future studies on mastitis in goats.

1 Introduction

Mastitis, an inflammatory condition of the mammary gland, is one of the most critical diseases in dairy animals, including goats [1,2]. World widely, 19.2 million tons of goat milk is produced [3]. However, mastitis poses a major challenge to this industry, as the disease not only reduces milk yield and quality but also increases veterinary expenses and compromises animal welfare. In goats, mastitis occurs in both clinical and subclinical forms, with bacterial pathogens, especially *Staphylococcus aureus*, recognized as the most frequent causative agents [4,5]. The subclinical form is especially problematic because it often goes unnoticed by farmers, leading to prolonged infection and increased risk of pathogen transmission within herds.

* Corresponding author: dianmeididewi.n@kkumail.com

In recent years, research on mastitis in goats has gained increasing global attention due to the expansion of dairy goat farming, particularly in developing countries [3,6]. As the industry grows, so does the need for a deeper understanding of disease dynamics, pathogen distribution, antimicrobial resistance patterns, and effective control strategies. Understanding the research trend through bibliometric analysis allows for the identification of scientific productivity, collaboration networks, and thematic evolution. Such knowledge provides insight into how research has developed over time and where it is heading.

The objective of this study was to conduct a bibliometric analysis of global mastitis research in goats, highlighting publication trends, leading journals, key authors, country contributions, and emerging research themes. By mapping these patterns, the study aims to provide a clearer understanding of how the scientific landscape has evolved and to support future research priorities in the field of goat mastitis.

2 Materials and Methods

This bibliometric study was conducted using publications retrieved from Scopus database. A structured search was performed using the keywords "mastitis" and "goat" in titles, abstracts, and keywords. The time frame of analysis covered all available years up to the present. Bibliometric data were processed using R software (Bibliometrix package) and visualized through three-field plots, keyword networks, and thematic maps [7].

The following parameters were analyzed: 1) Annual scientific production (publication trend over time); 2) Most relevant sources (journals with the highest number of articles); 3) Most relevant authors and their productivity; 4) Author's production over time; 5) Most relevant affiliations; 6) Corresponding author's country and country production; 7) Keyword occurrence and co-occurrence; and 8) Thematic evolution and trending topics.

3 Results and Discussion

3.1 Annual Scientific Production

The annual trend analysis revealed a steady increase in publications on goat mastitis with a rate of 4.91%, with notable growth in the last two decades (Fig 1). The first study was published in 1947 and in total, 1,253 studies were produced afterwards. Early research primarily focused on clinical aspects and microbiological characterization. More recent studies incorporate molecular diagnostics, antimicrobial resistance, and genetic aspects of disease resistance.

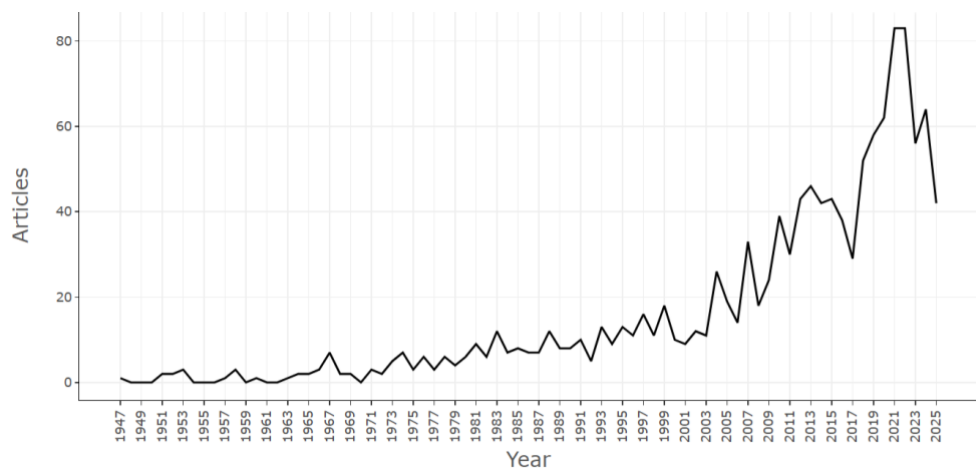


Fig. 1. Annual production of studies about mastitis in goat globally.

3.2 Most Relevant Sources

The most productive journals included *Small Ruminant Research*, *Journal of Dairy Science*, and other veterinary medicine outlets (Fig 2). These journals play a pivotal role in disseminating goat mastitis research globally, reflecting their commitment to small ruminant health.

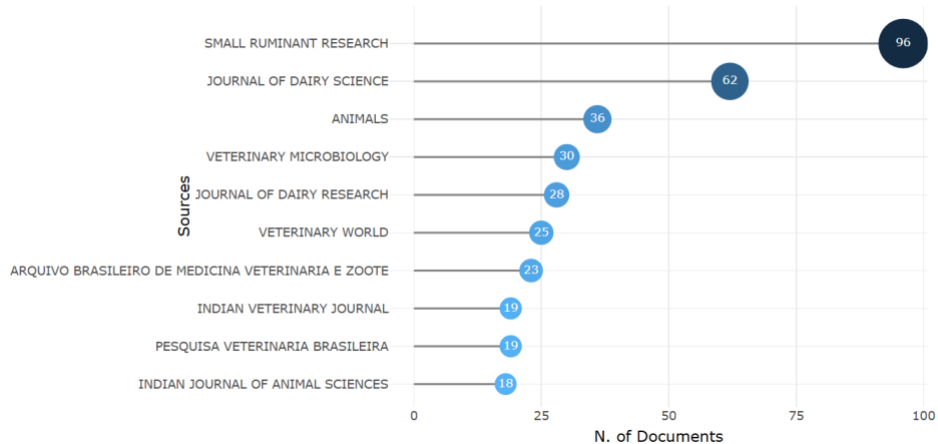


Fig. 2. Most relevant journals that publishing study related to goat mastitis globally.

3.3 Most Relevant Authors and Affiliations

Prominent authors contributed multiple publications, indicating strong research groups dedicated to small ruminant mastitis. According author productivity, Fthenakis, G.C and Isobe, N were the leading author with a total of 29 studies each (Fig 3). Meanwhile, according to the period, the early scientist working on goat mastitis were Conteras, A and Corrales, J.C which had started publishing their works since 1995. Affiliations with leading universities

and veterinary institutes, particularly in Europe and Asia, were frequently observed. These institutions often collaborate across countries, strengthening the global knowledge base.

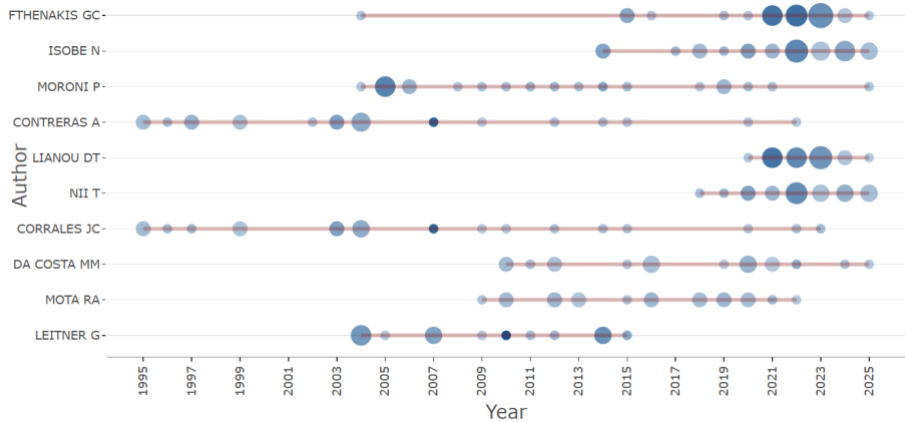


Fig. 3. Most relevant authors in goat mastitis topic over the years.

3.4 Country Production

Corresponding author analysis revealed that Brazil was the leading contributor to the literature, with a total of 893 published studies, followed by China with 505 studies (Table 1). In addition to these countries, several European nations, especially Italy, Spain, and France, also highly contributed to the publication of mastitis in goat, reflecting their active research communities in dairy small ruminants. Important inputs were also observed from India and the United States. Among these countries, India stands out as the world’s largest producer of goat milk, accounting for 32.6% of global production [3]. Among continents, Asia has the highest production which accounting 56.5% goat production followed by Africa with 23.3% and Europe with 15.9% [3]. At the continental level, Asia leads goat milk production with 56.5% of the global share, followed by Africa at 23.3% and Europe at 15.9% [3].

These production patterns align with the distribution of research outputs, with a considerable number of mastitis-related studies originating from Asia and Europe, both major producers. However, despite Africa’s position as the second-largest producer, it remains significantly underrepresented in the scientific literature. This discrepancy highlights a notable research gap in the region and underscores the need for strengthened surveillance and increased research efforts to better understand and address mastitis in goat populations across African countries.

Table 1. Leading country in publishing study related mastitis in goat.

No	Country	Study frequency
1	Brazil	893
2	China	505
3	Spain	477
4	India	474

5	Italy	407
6	United State of America	363
7	Greece	319
8	France	272
9	Turkey	145
10	Japan	136

3.5 Keyword Occurrence and Thematic Trends

Frequent keywords included goat, mastitis, *Staphylococcus aureus*, milk quality, antimicrobial resistance, and somatic cell count (Fig 4). Over time, there has been a thematic shift from traditional bacteriological and clinical aspects toward molecular epidemiology, resistance profiling, and genetic selection for mastitis resistance. Recent thematic maps indicate strong attention to public health implications of antimicrobial resistance (Fig 5).

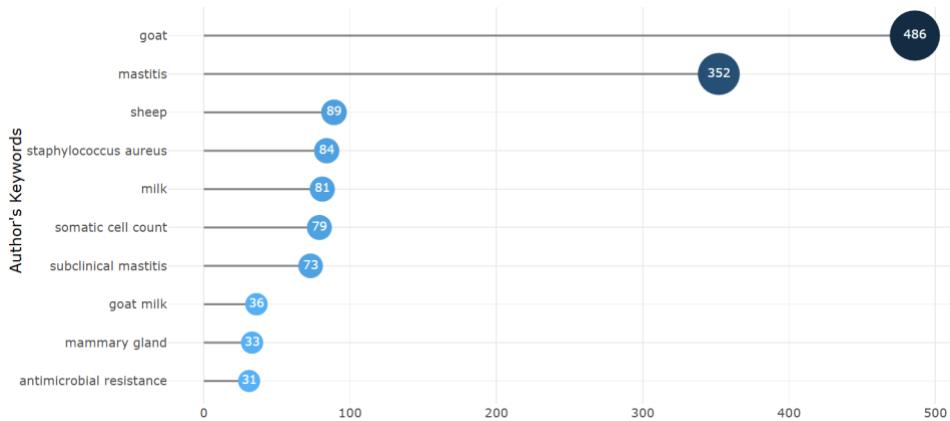


Fig. 4. Most frequently used keywords in goat mastitis studies.

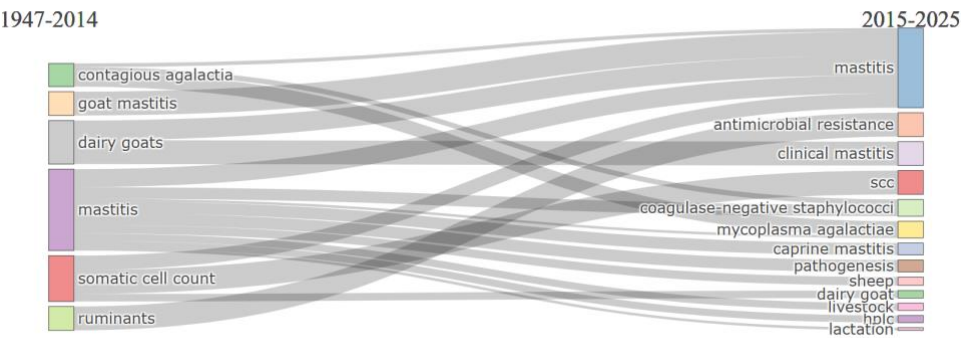


Fig. 5. Trend shift of study topic in goat mastitis studies.

Despite this thematic progression, one important dimension that remains insufficiently explored in the existing literature is the variation in dairy goat breeds used across studies. Different breeds, such as Saanen, Alpine, Toggenburg, Jamunapari, Damascus, and various indigenous breeds, possess distinct genetic backgrounds, udder morphologies, and immune characteristics, all of which may influence their susceptibility to mastitis [8]. If future studies consistently reported breed information, it would provide valuable insights into potential genetic correlations with mastitis infection, supporting efforts to identify resistant genetic lines and informing selective breeding strategies aimed at reducing disease burden.

Another underreported aspect is the scale and management system of the farms studied. Mastitis risk is strongly shaped by production conditions, including milking routines, bedding hygiene, housing design, nutrition, and labor availability [1]. Intensive dairy operations may face higher pathogen pressure due to larger herd sizes and more frequent milking, while smallholder or pastoral systems may encounter different challenges such as limited access to veterinary services or diagnostic facilities. Without clearly distinguishing between these production contexts, it becomes difficult to fully interpret patterns of disease prevalence, pathogen distribution, and antimicrobial resistance.

Integrating information on breed variation and farm management scale into future research would therefore enrich the thematic landscape of mastitis studies. It would also support more precise epidemiological interpretations and facilitate the development of tailored interventions, whether genetic, managerial, or policy-based, to improve udder health and reduce the impact of mastitis at both local and global levels.

4 Conclusion

This bibliometric analysis shows a steady global rise in goat mastitis research, mainly driven by Europe, Asia, and North America, with Africa remaining underrepresented. The focus has shifted from clinical and bacteriological studies to molecular diagnostics, antimicrobial resistance, and genetic improvement. Future research should continue addressing antimicrobial stewardship and explore innovative preventive and therapeutic strategies.

This study received no external funding. The work was conceptualized, and data collection, analysis, and drafting were carried out by Dian Meididewi Nuraini, data analysis and manuscript editing were carried out by Morsid Andityas, while Clara Ancilia Pramita, Afif Ihza Abdala, and Ling Wu contributed to data collection, reviewing and editing the manuscript.

References

1. A. Manning, N. Vasileiou, J.P. Crilly, Control of mastitis in dairy sheep and goats. *Livestock*. **26**, 161-8 (2021)
<https://doi.org/10.12968/live.2021.26.3.161>
2. A.B. Bezerra, C.M. de Leon, P.E. Givisiez, N.M. Silva, L. Santos Filho, W.E. Pereira, E.C. Pimenta Filho, P.S. Azevedo, C.J. Oliveira, Pathogen-specific changes in composition and quality traits of milk from goats affected by subclinical intramammary infections. *J. Dairy Res.* **88**, 166-9 (2021)
<https://doi.org/10.1017/S0022029921000418>
3. C.A. Meza-Herrera, C. Navarrete-Molina, U. Macias-Cruz, G. Arellano-Rodriguez, A. De Santiago-Miramontes, M.A. Sariñana-Navarrete, R. I. Marin-Tinoco, C.C. Perez-Marin, Dairy goat production systems: a comprehensive

- analysis to reframe their global diversity, *Animals*, **14**, 3717 (2024)
<https://doi.org/10.3390/ani14243717>
4. A.I. Gelasakis, A.S. Angelidis, R. Giannakou, G. Filioussis, M.S. Kalamaki, G. Arsenos, Bacterial subclinical mastitis and its effect on milk yield in low-input dairy goat herds. *J. Dairy Sci.* **99**, 3698–3708 (2016)
<https://doi.org/10.3168/jds.2015-10694>
5. G. Pulina, M.J. Milán, M.P. Lavín, A. Theodoridis, E. Morin, J. Capote, D.L. Thomas, A.H.D. Francesconi, G. Caja, Invited review: Current production trends, farm structures, and economics of the dairy sheep and goat sectors. *J. Dairy Sci.* **101**, 6715–6729 (2018)
<https://doi.org/10.3168/jds.2017-14015>
6. B.A. Miller, C.D. Lu, Current status of global dairy goat production: an overview. *Anim. Biosci.* **32**, 1219–1232 (2019)
<https://doi.org/10.5713/ajas.19.0253>
7. M. Aria, C. Cuccurullo, bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetrics* **11**, 959–975 (2017)
<https://doi.org/10.1016/j.joi.2017.08.007>
8. A. Tibebe, Y. Teshome, H. Tamrat, A. Bahiru, Mastitis in goat: A review of etiology, epidemiology, economic impact, and public health concerns. *One Health* **21**, 101131 (2025)
<https://doi.org/10.1016/j.onehlt.2025.101131>