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Prevalence and Risk Factors for Bovine Mastitis: A Review based on Selected Sub-saharan African Countries

Mpho Ramuada[1], Thobela Louis Tyasi[1], Lungile Gumede[1], Teedzai Chitura[2]

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ABSTRACT

Mastitis is one of the major diseases affecting dairy farmers since it is associated with direct and indirect losses and expenditures due to low milk yield and poor milk quality in Sub Saharan countries (South Africa, Ethiopia, Nigeria and Kenya) as well as other parts of the world. Prevalence of mastitis in dairy herds has gained increasing attention in recent years. This narrative review article provides a comprehensive backup of literature on the prevalence, its causal agents, environmental and management-related risk factors for bovine mastitis according to studies conducted in the selected countries. The literature review indicated that from South African-based studies, average prevalence of subclinical mastitis (SCM) is 17.8% and 18.5% Clinical mastitis (CM). The average prevalence of mastitis based on studies from Ethiopia is 39.8% (SCM) and 22.1% (CM). Nigerian-based studies reported an average prevalence of 33.8% (SCM) and 4.1% (CM). Studies carried out in Kenya reported a prevalence rate of 69.6% (SCM) and 27.2% (CM). Antibiotic resistance, lack of implementation of adequate management practices for mastitis control such as teat disinfection, provision of clean bedding and clean housing were identified as the most common risk factors. Findings of this study revealed a high prevalence of mastitis in the selected countries and presence of risk factors for bovine mastitis. Therefore, addressing the identified risk factors could help to reduce direct and indirect losses in dairy enterprises because of subclinical and clinical mastitis.

Key words: Antibiotic resistance, Dairy farmers, Milk yield, Prevalence, Subclinical.

Mastitis is an inflammation of the parenchyma of the mammary gland produced by infectious agents that infiltrate the udder, multiply and produce toxins. Mastitis is a multifactorial disease involving microbes, the host and the environment and is classified as either sub-clinical or clinical mastitis. Clinical mastitis is characterized by visible abnormalities in the milk or the udder tissue while subclinical mastitis is inflammation of the mammary gland that does not create visible changes in the milk or the udder tissue. Although the milk appears normal, sub-clinically infected cows will produce less milk and the quality of the milk will be reduced (Hadef *et al.,* 2022). Clinical mastitis can occur in one or more quarters of the udder and can range from mild to severe. Acute clinical mastitis is the severe form of the disease and is characterized by a sudden onset of symptoms and visible abnormalities such as udder swelling, hardness of the affected quarter, pain, watery milk and reduced milk yield (Kidanu, 2022) In some cases, the cow may display symptoms of infection, such as loss of appetite, fatigue and a decline in milk supply (Kumar *et al.,* 2020). The California Mastitis Test (CMT) and Bacteriological Culturing (BC) of milk are the most employed diagnostic methods. However, conducting epidemiological investigations of bovine mastitis, including infection status and treatment patterns, would offer valuable management insights for producers, veterinarians and other members of the mastitis control team (Sharun *et al.,* 2021).

Mastitis contributes significantly to revenue losses in the dairy farming industry worldwide (Singh, 2022). Furthermore, the condition may pose a serious public health threat in cases where zoonotic pathogens such as *Staphylococcus aureus*, *Streptococcus agalactiae*, *Mycoplasma* spp, *Escherichia coli* and *Enterococcus spp* are implicated (Ngu Ngwa *et al.,* 2020). Mastitis causes economic losses to dairy farms as well as public health concerns (Paramasivam *et al.,* 2023). The profitability of dairy operations is significantly affected by the reproductive efficiency of their dairy herds, which is highly correlated with the health of the cows (Dalanezi *et al.,* 2020). Mastitis causes a decline in milk production as well as loss of quality of milk (Harjanti and Sambodho, 2020; Lahiri, 2023). The costs that are involved in the management of cases of mastitis such as attending to milking hygiene practices, udder health monitoring, individual cow treatment and other

[1]Department of Agricultural Economics and Animal Production, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa.
[2]Department of Animal Science, University of Venda, Private Bag X5050, Thohoyandou 0950, South Africa.

Corresponding Author: Teedzai Chitura, Department of Animal Science, University of Venda, Private Bag X5050, Thohoyandou 0950, South Africa. Email: Teedzai.Chitura@univen.ac.za
ORCIDs: 0000-0001-9676-7166, 0000-0002-3519-7806, 0000-0002-4510-5733, 0000-0002-6048-6917

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veterinary services related costs further add to the economic burdens of mastitis (Aghamohammadi *et al.,* 2018). Kumar *et al.* (2017) reported a relationship between mastitis and decreased fertility in dairy cows because of reduced conception rates and longer intervals between conception and calving among other disturbances (Ibrahim *et al.,* 2023). Furthermore, cows with chronic or recurring mastitis may need to undergo early culling bringing in extra costs of buying new cows or rearing more replacement heifers (Diniso and Jaja, 2021; Rodríguez, 2024).

Subclinical mastitis is asymptomatic and characterised by the absence of visible changes to the udder. However, the physical and chemical composition of the milk is altered (Yehia *et al.,* 2024). Subclinical mastitis can lead to a decrease in milk production (Antanaitis *et al.,* 2021). Cows with infections might experience a decrease in milk production, along with a decline in milk quality due to elevated somatic cell counts (SCC) and potential issues like off-flavors and irregularities in composition. Reduced milk quality can lead to the milk being downgraded or declined by dairy processors, resulting in financial setbacks (Alhussien *et al,* 2021). Clinical mastitis is characterised by the presence of indicators of inflammation in the mammary gland such as swelling, heat, pain, as well as changes in the milk such as flakes and clots (Negash, 2023). Krueger (2019) and Ginger *et al.* (2023) pointed out that the pain associated with clinical mastitis severely affects animal welfare. Sadiq *et al.* (2020) and Eryýlmaz (2022) identified early detection, prompt treatment and the implementation of preventative measures such as maintaining excellent milking hygiene, ensuring clean and dry bedding and conducting routine udder health assessments as key measures towards reducing the occurrences of clinical mastitis in dairy herds.

This review paper was consolidated from studies published between 2003 and 2024 in various scientific journals. Electronic databases, such as Google Scholar, Science Direct and Research Gate were searched to gather relevant information for this review. The search was conducted using keywords such as ‘mastitis’, ‘prevalence’, ‘risk factors’, ‘South Africa’, ‘Ethiopia’, ‘Kenya’, ‘Nigeria’ and ‘economic losses. The four Sub-Saharan African countries were selected for the study due to the abundance of scientific literature on dairy cattle mastitis from studies that were carried out in these countries. Articles were gathered from scientific databases such as Google Scholar, Sci Direct, Web of Science and PubMed. Inclusion criteria was studies published in English that described the prevalence of mastitis and associated risk factors in South Africa, Ethiopia, Kenya and Nigeria, for both clinical and subclinical mastitis**.**

Prevalence of mastitis

Mastitis is among the most prevalent diseases of dairy cattle worldwide. The prevalence of bovine mastitis varies across countries, regions and individual farms partly due to differences in climatic conditions, herd management practices and genetics (Fulasa and Deressa, 2021; Singha *et al.,* 2021). According to the studies included in our review, the average prevalence of clinical mastitis ranges from 5%-20% while subclinical mastitis prevalence is higher and ranges between 15% to 50%. Several risk factors contribute to the occurrence and spread of mastitis in the study area (Table 1). Studies based on bovine mastitis in Kenya reported the highest prevalence of subclinical mastitis while studies based on bovine mastitis in South Africa reported the lowest prevalence rate (Fig 1). Studies conducted on bovine mastitis in Kenya reported the highest prevalence of clinical mastitis standing on (27, 2%) while studies on bovine mastitis in Nigeria reported the lowest prevalence rate (4.1 %) (Fig 2).

Prevalence of bovine mastitis and associated risk factors

Several studies investigated the prevalence of bovine mastitis. Kumari *et al.* (2018) reported a range of 5 to 20 % for clinical mastitis and 15 to 50% for subclinical mastitis. Findings of the present study revealed that generally, there were more studies conducted on bovine subclinical mastitis (40 articles) as compared to studies conducted on bovine clinical mastitis (18 articles). These articles were published during the period 2005 to 2023. This observation underscores the significance of subclinical mastitis that necessitates its early detection in dairy cattle farming. From the selected Sub-Saharan African countries, majority of the studies were on bovine mastitis in Ethiopia. This observation could indicate that bovine mastitis is a major challenge in Ethiopia probably since majority of the producers are smallholder farmers who are resource limited. South Africa had the lowest number of studies on bovine mastitis. This could highlight the need for more studies to provide key information on the disease situation in South Africa. From the 58 articles reviewed in this study, it is evident that studies on bovine mastitis in Kenya reported the highest pooled prevalence of both subclinical and clinical mastitis with averages of 69.6% and 27.2% respectively while studies on Ethiopia reported the second highest prevalence rates with 39.8% and 22.1% for subclinical and clinical mastitis respectively. This agrees with the findings by Ndirangu *et al.* (2022) and Michira *et al.* (2023). Mbindyo *et al.* (2020) and Duguma (2020) reported that high prevalences of bovine mastitis are largely due to traditional farming practices, lack of farmer awareness about the disease and limited access to veterinary services and modern dairy management techniques. Several risk factors can be attributed to high prevalences of bovine mastitis. Sombie *et al.* (2022) and Nyokabi *et al.* (2021) reported lack of cattle farmer knowledge on mastitis as a significant risk factor in Kenya. Studies on bovine subclinical mastitis in South Africa reported the lowest prevalence rate. This could be partly due to few studies published on bovine mastitis in South African as compared to the other countries that were selected for this study.

Table 1: Prevalence and risk factors for bovine mastitis in selected Sub-Saharan African countries (South Africa, Ethiopia, Nigeria, Kenya).

Type of mastitis	Study location	Prevalence	Breed	Season	Risk factors	References
Subclinical mastitis	Eastern Cape Province, South Africa	12%	(Friesian, Jersey and their crosses (Friesian × Jersey)	Summer season	Increased parity, advanced stage of lactation and high milking frequency.	Diniso and Jaja (2021)
	Free State Province, South Africa	33%	Not specified	Not specified	Poor milking hygiene, overcrowded and unsanitary housing conditions.	Khasapane *et al.* (2023).
	Gauteng Province, South Africa	1.7%	Not specified	Not specified	Poor milking hygiene, occurrence of antibiotic resistance leading to chronic or recurring mastitis infections.	Mphahlele *et al.* (2020)
	Gauteng Province, South Africa	18%	Not specified	Not specified	Higher parity, advanced age and stage of lactation and occurrence of antibiotic resistance leading to chronic or recurring mastitis infections.	Phophi *et al.* (2019)
	Gauteng Province, South Africa	20.2%	Not specified	Not specified	Production system, with a high prevalence reported in pasture-based systems than in total mixed ration systems.	Karzis *et al.* (2020)
	South Africa, 7/9 provinces	30%	Not specified	Not specified	Lack of sound cow management skills, higher parity and increased milking frequency increasing udder pressure and susceptibility to damage and infection.	Motaung *et al.* (2017)
	Free State province, South Africa	32%	Not specified	Not specified	Production system, with a high prevalence reported in pasture-based systems than in total mixed ration systems.	Van der Westhuizen (2021)
	KwaZulu Natal Province, South Africa	14%	Not specified	Summer	Poor cow hygiene and lack of farmer knowledge on mastitis control.	Schmidt *et al.* (2021)
	Gauteng Province, South Africa	9.2%	Holstein friesian	Not specified	Poor hygiene practices in milking parlors were associated with high mastitis prevalence rates and occurrences of anti-microbiological resistance.	Banza (2020)
	Free State Province, South Africa	8.3%	Ayrshire breed and Holstein.	Not specified	Advanced parity did not have a significant influence on mastitis prevalence rate.	Taoana (2005)
	Amhara Region, Ethiopia	32.7%	Holstein Friesian × Zebu crossbreed cows.	Winter season	Poor hygiene practices in milking parlors, increased age and stage of lactation were associated with an	Demil *et al.* (2022).

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				increased prevalence of mastitis.	
Assosa town, Western Ethiopia.	28.3%	Indigenous zebu cattle and olstein-Zebu cross	Winter Season	Peak lactation stage was associated with a high prevalence of mastitis.	Tezera and Aman (2021).
Toke Kutaye, Cheliya and Dendi Districts, West Shewa Zone, Oromia, Ethiopia	1.1%	Zebu	Summer season	Advanced age of the cow, higher such as not cleaning bedding regularly. parities and poor hygiene practices	Dabele *et al.* (2021)
Modjo Town and Suburbs, Central Oromia, Ethiopia	71 %	Indigenous Zebu, Holstein Friesian cross with local zebu breed and Jersey breeds	Summer and winter seasons	Lack of implementation of the routine mastitis prevention and control practices such as teat preparation as well as provision of clean bedding.	Fesseha *et al.* (2021).
Addis Ababa and Sebeta towns, Ethiopia	78.1%	Holstein X Zebu cross bred	Winter	Advanced parity and pasture-based production systems due to increased stress on the udder and pasture based increasing its susceptibility to injury and infections.	Geleta *et al.* (2019)
Toke Kutaye, Cheliya and Dendi Districts, West Shewa Zone, Oromia, Ethiopia	1.1%	Zebu	Summer season	Advanced age, higher parities, low frequency of cleaning bedding and no udder washing practices as well as previous history of mastitis in the herd.	Dabele *et al.* (2021)
Adama Town, Central Ethiopia	69.4%	Holstein crossbreed and local zebu breed	Winter season	Increased age, provision of improper bedding material leading to poor hygiene status were the most common risk factors.	Tegegne *et al.* *(2020)*
page 3 West Wollega, western	22.7%	Local Zebu	Summer season	Higher parity, advanced age, lactation stage (3rd phase).	Kitila *et al.* (2021)

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	Oromia, Ethiopia					
	Haramaya district, Ethiopia.	56.3%	Holstein-Zebu and local Zebu breeds	Not specified	Poor management practices such as poor hygiene resulting in increased exposure of microbes and higher mastitis prevalence	Lakew *et al.* (2019)
	Sagure District, Arsi zone, Oromia regional state of Ethiopia	37.8%	Holstein cross	Winter season	Poor hygiene practices	Gelgelu *et al.* (2023)
	Kaduna State, Nigeria	23.9%	Not specified	Summer season	Inadequate cow management and poor milking hygiene.	Kwaga *et al.* (2019)
	Kaduna State, Nigeria	24.5%	Not specified	Not specified	Poor sanitary practices on the farm like dirty housing conditions, contaminated. water sources, hand milking among others.	Umar *et al.* (2023)
	Kaduna State, Nigeria	19.7%	Not specified	Not specified	Poor milking hygiene, overcrowded and unsanitary housing conditions.	Makolo *et al.* (2019).
	Kaduna State, Nigeria.	19.7%	Nigerian indigenous breeds	Not specified	Poor farm hygiene practices such as look of provision of ablution facilities for farm staff thereby promoting faecal and environmental contamination.	Makolo *et al.* (2020)
	Abeokuta, Nigeria	65%	White Fulani breed	Winter season	Poor health management such as the use of indiscriminate and un-prescribed use of drugs for treatment of cows.	Thomas *et al.* (2021)a
	Oyo State, Nigeria	26.0%	Not specified	Not specified	Poor housing conditions.	Olatoye *et al.* (2018)
	Kaduna State, Nigeria	23,9%	Not specified	Not specified	Poor milking hygiene, overcrowded and unsanitary housing conditions.	Umaru *et al.* (2017)
	page4 Kaduna State, North-Western Nigeria.	70%	White Fulani and Sokoto Gudali	Winter season.	Hand milking and poor udder cleaning practices.	Amuta *et al.* (2021)
	Jos metropolis,	35.1%	White Fulani and Cross breed	Summer season	Advanced age, higher parity and increased stage of lactation (3rd	Anueyiagu *et al.* (2022)

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Nigeria				stage upwards)	
Jos South Local Government Area of Plateau State, Nigeria	30.3%	Not specified	Not specified	Occurrence of anti-microbial resistant pathogen strains.	Anueyiagu *et al.,* (2022)
Embu and Kajiado Counties, Kenya	73.1%	Not specified	Not specified	Occurrence of anti-microbial resistant pathogen strains, poor practices for regular screening and teats disinfection.	Mbindyo *et al.* (2020).
Kajiado Central sub-county, Kenya	84.7%	Zebu and Boran	Summer season	Lack of knowledge on regular screening of dairy cattle for SCM due to lack of farmer training on proper husbandry geared towards improved milking of the animals.	Michira *et al.* (2023)
Mathira Constituency, Nyeri County, Kenya.	87.4%	Not specified	Not specified	Poor sanitation and high bacteria resistance to antibiotics.	Kabui *et al. (*2024)
Kisumu County, Kenya	33%	Not specified	Not specified	Bacteria resistance to antibiotics and poor practices for regular screening and teats disinfection.	Ndirangu *et al.* (2022)
Juja Sub-County, Kenya	66.7%	Friesian, Guernsey and indigenous breeds.	Not specified	Fourth parity upwards, late stage of lactation and poor housing conditions.	Kagira *et al.* (2022)
Uasin Gishu County, Kenya	94.7%	Not specified	Not specified	Occurrence of anti-microbial resistant pathogen strains.	Nyakiti *et al.* (2022)
Gatundu Sub-County, Kenya	39.6%	Not specified	Not specified	Cows with previous history of sub-clinical mastitis in the herd.	Otenga (2023)
page 5 Kajiado North Sub-County, Kenya.	51.2%	Not specified	Not specified	Occurrence of anti-microbial resistant pathogen strains.	Michira *et al.* (2023)
Juja Sub-County, Kenya	76.9%	Exotic dairy cattle and indigenous	Not specified	Poor farmer knowledge on strategies to improve sanitary measures in milk handling	Sombie *et al.* (2022)

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			breeds			
	Nyeri County, Kenya	92%	Holstein/Friesian breed	Summer season	Lack of knowledge about mastitis and not following recommended practices for maintaining sound udder health.	Muturi (2020)
	CLINICAL MASTITIS					
Clinical mastitis	South Africa, Pretoria	18.5%	Ayrshire and Holstein/Friesian breed.	Not specified	Parity of four and above as well as dirty milking parlor environments.	Motaung *et al.* (2017)
	Assosa town, Western Ethiopia.	12 %	Indigenous zebu cattle and Holstein-Zebu cross	Winter Season	Cows in the peak lactation stage had higher prevalence rates for mastitis.	Tezera and Aman (2021).
	Gamo Zone, Southern Ethiopia	1.9%	Not specified	Summer season	Occurrence of anti-microbial resistant pathogen strains.	Belay *et al.* (2022).
	Modjo Town and Suburbs, Central Oromia, Ethiopia	28.9%	Indigenous Zebu, Holstein Friesian cross with local Zebu breed and Jersey breeds	Summer season	Lack of implementation of the routine mastitis prevention and control practices such as teats preparation and provision of clean bedding and housing.	Fesseha *et al.* (2021).
	Addis Ababa urban, Ethiopia	12.6%	Not specified	Not specified	Poor sanitary practices on the farm such as dirty housing conditions, contaminated. water sources, hand milking.	Girma and Tamir (2022).
	Toke Kutaye, Cheliya and Dendi Districts, West Shewa Zone, Oromia, Ethiopia	8.3%	Zebu	Winter season.	Hand milking and poor udder hygiene.	Dabele *et al.* (2021)
	page 6 Adama Town, Central Ethiopia	30.6%	Holstein crossbreed and local zebu breed	Summer season	Lack of provision of clean bedding and housing.	Tegegne *et al.* (2020)

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	West Wollega, western Oromia, Ethiopia	16.7%	Zebu	Summer season.	Poor sanitation and high bacteria resistance to antibiotics.	*et al.* (2021)
	Hawassa City, southern Ethiopia	83.7%	Holstein–Friesian local crosses and Jersey local crosses	Summer season	Poor sanitary facilities and poor ventilation systems as well as not practising dry cow therapy.	Abebe *et al.* (2023)
	Haramaya district, Ethiopia.	6.8%	Holstein-Zebu and local Zebu breeds	Not specified	Parity of four and above along with previous history of mastitis.	Lakew *et al. (*2019)
	Sagure Town, Arsi Zone, Oromia, Ethiopia	7.9%	Holstein / Friesians breed	Winter Season.	Poor sanitation and occurrence of anti-microbial resistant pathogen strains.	Gelgelu *et al.* (2023)
	Pastoral Districts, Southern Ethiopia	33.3%	Not specified	Not specified	Poor milking hygiene, overcrowded and unsanitary housing conditions.	Balemi *et al.* (2021).
	Kaduna, Nigeria	3.1%	Not specified	Winter Season	Cows with previous history of sub-clinical mastitis had a higher prevalence of mastitis.	Kwaga *et al. (*2019).
	Kaduna, Nigeria	5.0%	Not specified	Not specified	Poor sanitary practices on the farm like dirty housing conditions, contaminated. water sources, hand milking among others.	Umar *et al.* (2023)
	Abeokuta, Nigeria	5%	White Fulani breed	Winter season	Provision of dirty housing conditions.	Thomas *et al.* (2021)b
	Kaduna State, Nigeria	3.1%	Not specified	Not specified	Hand milking and poor udder cleaning practices.	Umaru *et al.* (2017)
	Embu and Kajiado Counties, Kenya	6.8%	Not specified	Not specified	Poor hygiene and lack of farmer knowledge on mastitis control.	Mbindyo *et al.* (2020)
	Kajiado North Sub-County, Kenya.	47.5%	Not specified	Not specified	Occurrence of anti-microbial resistant pathogen strains.	Michira *et al.* (2023)

However, when comparing the findings of Taoana (2005) and Khasapane *et al.* (2023), there is an indication of an increased prevalence of clinical mastitis in South Africa. Prevalence rates for bovine subclinical mastitis in Ethiopia that were reported in this study correspond with the observations of Umaru *et al.* (2017) and Gelgelu *et al.* (2023). High prevalence of bovine mastitis in the study area are associated production losses, risks of antibiotic residues in milk and the involuntary culling or death of affected animals. Hogeveen *et al.* (2011) stated that the effects of bovine mastitis on milk quality in addition to the cost of treating infected animals may have consequences that extend beyond the dairy farm. Belay *et al.* (2022) indicated the high prevalence of bovine mastitis poses a zoonotic risk as mastitis-causing pathogens can be transferred to humans through contaminated milk. Makatu *et al.* (2021) highlighted the animal welfare concerns caused by bovine mastitis due to pain, stress and discomfort that affect the well-being of cows.

Elsewhere, studies were also conducted on bovine mastitis prevalence. In the South American region, studies carried out in Brazil and Argentina reported ranges between 20 to 50% for bovine subclinical mastitis prevalence and an average of 10% for bovine clinical mastitis. Freitas *et al.* (2018) and Schunig *et al.* (2024) indicated that factors such as intensive dairy farming practices and environmental conditions such as high humidity and high temperatures contribute to the spread of the disease. Dego (2020) indicated that the widespread use of antibiotics and the resulting antimicrobial resistance further complicate mastitis management in these regions. In South Asia, Ali *et al.* (2021) stated that Pakistan exhibits one of the highest mastitis prevalence rates, with clinical and subclinical mastitis affecting between 20% and 53% of cattle. Poor management practices and inadequate sanitary conditions on farms were cited as the key reasons for the high prevalence of bovine mastitis in Pakistan. In China, Liang *et al.* (2023) reported prevalences of around 10% for clinical mastitis while Wang *et al.* (2022) reported a decline in mastitis prevalence in China during the period 2011–2020 as compared to the period of 2000–2010. The authors suggested the rapid developments in technology targeted against major pathogens such as *S. aureus*, advanced milking techniques and strict biosecurity measures undertaken by the farms as some of the reasons for the observed decline (Mooventhan *et al.,* 2016).

Regarding risk factors for bovine mastitis, Singha *et al.* (2021) identified some of the major factors that are responsible for the variations in the prevalence of the disease across countries, regions and individual farms. These include differences in climate, herd management practices and genetics. Fulasa and Deressa (2021) classified risk factors into management-related and cow-specific factors. The authors further indicated that effective management practices to prevent mastitis at the farm level include regular floor cleaning, proper milking techniques, udder washing before milking and pre- and post-milking teat dipping in antiseptic solutions while cow-specific factors include the stage of lactation, breed, history of mastitis and parity (Ulla *et al.,* 2021). In addition to similar observations on risk factors as indicated above, our study identified microbiological resistance as a common risk while advanced age, higher parity and an advanced stage of lactation (third stage and beyond) poor hygiene management, such as lack of sanitation, hand milking, provision of improper bedding material and poor sanitary measures on the udder and milking equipment were identified as the common risk factors for clinical mastitis. These findings indicate that there are major concerns regarding practices for reducing bovine mastitis prevalence by the farmers in the study area. Petzer *et al.* (2018) and Diniso and Jaja (2021) indicated that the type of production system, such as pasture-based farming, is a risk factor in South Africa.

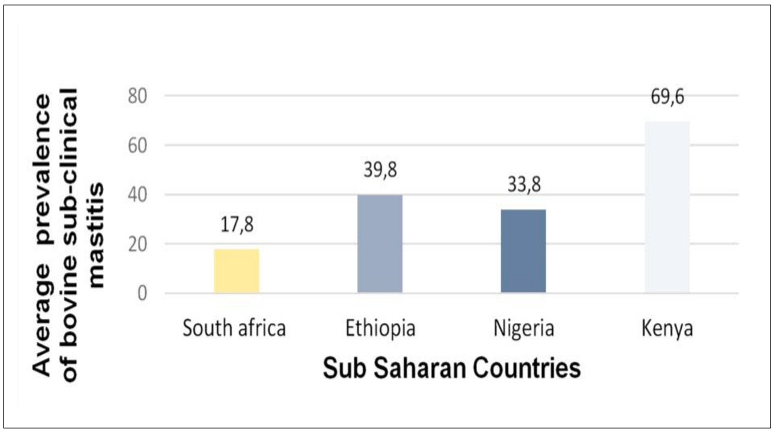

Fig 1: Average prevalences of subclinical mastitis as reported by studies based on bovine mastitis in the selected Sub-Saharan countries (South Africa, Ethiopia, Nigeria and Kenya).

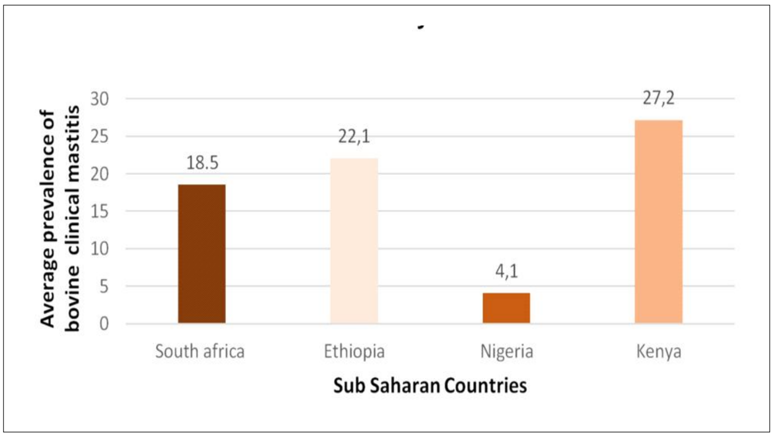

Fig 2: Average prevalence of clinical mastitis as reported by studies on South Africa, Ethiopia, Nigeria and Kenya.

Prevention and control measures for bovine mastitis

Zigo *et al.* (2019) emphasized prevention of bovine mastitis to safeguard animal health, ensure high milk quality and to optimize cow productivity. El-Sayed and Kamel (2021) pointed out that strategies for mastitis prevention and control vary based on factors like farm size, management practices and the prevalence of specific pathogens in the area. Breen (2019) highlighted a five-point core plan for mastitis prevention and control that includes disinfecting teats, adhering to hygienic milking procedures, removing cows with chronic mastitis, administering dry cow therapy with antibiotics and treatment of cows with clinical mastitis. Patel *et al.* (2021) identified bedding materials provided to dairy cows as the primary sources of environmental mastitis and indicated that measures to reduce bacterial counts in bedding generally lower the risk. Vargova *et al.* (2023) indicated that cleaning teats and pre-milking teat dipping in antiseptic solution can help to reduce bacterial counts on the skin of the udder. Tiwari *et al.* (2020) mentioned post-milk teat dipping as a significant measure to reduce the rate of new infections, particularly from contagious mastitis pathogens. Tegegne *et al.* (2020). stated that dry cow therapy is the most effective method for curing chronic and subclinical mastitis and that timely and effective treatment of active cases also helps prevent new infections (Sinha *et al.,* 2018).

CONCLUSION

Bovine mastitis is highly prevalent in selected countries. Understanding the risk factors for bovine mastitis is essential for controlling the disease at the farm level and as a result reduce both direct and indirect losses in dairy enterprises due to subclinical and clinical mastitis.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

This review complies with rigorous ethical standards in scientific research and reporting. All referenced information has been properly cited to ensure due credit is given to previous work. The is no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

Conflict of interest

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