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Incidence in Dairy Cows in Sudan**

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Abstract

Purpose: The aim of the study was to assess the impact of grazing management practices on mastitis incidence in dairy cows in Sudan.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: The study indicated that pasture-based systems can lead to a decrease in mastitis incidence compared to confinement systems. This reduction is attributed to factors such as increased exercise, improved hygiene, and reduced stress levels in grazing cows. Additionally, the consumption of fresh grass may enhance the cow's immune response, thereby lowering the risk of mastitis. However, other research suggests that improper grazing management, such as

overgrazing or exposure to wet pasture conditions, can actually increase the risk of mastitis due to higher exposure to environmental pathogens. Overall, effective grazing management practices, including rotational grazing, proper stocking rates, and maintaining clean and dry pasture conditions, are essential in minimizing mastitis incidence in dairy herds.

Implications to Theory, Practice and Policy: Ecological theory, one health theory and stress theory may be used to anchor future studies on assessing the impact of grazing management practices on mastitis incidence in dairy cows in Sudan. Implement educational programs and training initiatives for dairy farmers to increase awareness of effective grazing management practices for mastitis prevention. Develop policies that incentivize the adoption of best practices in grazing management for mastitis prevention.

Keywords: *Grazing, Management Practices, Mastitis, Dairy Cows*

INTRODUCTION

Mastitis, characterized by inflammation of the mammary gland, is a significant concern in dairy cow management due to its detrimental effects on milk production, quality, and animal welfare. In developed economies like the United States, mastitis remains a prevalent issue despite advancements in management practices and technology. According to a study by Ruegg and Reinemann (2011), the overall prevalence of mastitis in US dairy herds ranged from 15% to 60%, with an average of 20%. Additionally, data from the National Animal Health Monitoring System (NAHMS) in the US indicated a gradual decline in the prevalence of clinical mastitis from 21.2% in 2002 to 14.7% in 2014, suggesting improved management practices and disease control efforts.

In the United Kingdom (UK), mastitis also poses a significant challenge to the dairy industry. According to the UK National Mastitis Survey conducted by the University of Bristol (2018), the prevalence of clinical mastitis in UK dairy herds ranged from 13% to 25%. Furthermore, data from the UK's DairyCo Mastitis Control Plan showed that despite a decline in bulk tank somatic cell count (SCC), indicating improved udder health, mastitis still accounted for approximately 15% of all cow treatments on British dairy farms. These statistics highlight the persistent nature of mastitis in developed economies and the ongoing efforts to mitigate its impact on dairy cow health and productivity.

In Brazil, a key player in global agriculture, mastitis remains a significant concern for dairy farmers. Studies have indicated mastitis prevalence rates ranging from 20% to 45% in Brazilian dairy herds (Barreiro, 2015). Factors contributing to the high prevalence include suboptimal milking hygiene, inadequate housing conditions, and limited access to veterinary services, particularly in remote rural areas. Moreover, the tropical climate in many regions of Brazil creates favorable conditions for bacterial growth, further exacerbating the challenge of mastitis control. Efforts to address mastitis in Brazilian dairy herds require a comprehensive approach focusing on improving management practices, enhancing farmer education, and increasing access to veterinary care.

In China, with its rapidly growing dairy industry, mastitis represents a significant threat to milk quality and production efficiency. Studies have reported mastitis prevalence rates ranging from 20% to 40% in Chinese dairy farms (Wang, 2017). Contributing factors include intensive production systems, high stocking densities, and suboptimal milking practices. Additionally, the widespread use of antibiotics without proper prescription and monitoring has contributed to the emergence of antimicrobial resistance, further complicating mastitis management efforts. Addressing mastitis in China requires a concerted effort to promote sustainable and responsible dairy farming practices, including improved hygiene, proper milking techniques, and judicious use of antimicrobials.

In developing economies, mastitis poses multifaceted challenges to dairy production, impacting both animal welfare and economic sustainability. For instance, in Bangladesh, where dairy farming is a crucial source of livelihood for many rural households, mastitis prevalence rates have been reported as high as 45% in some regions (Islam, 2018). Factors contributing to this high prevalence include poor hygiene practices during milking, inadequate housing facilities, and limited access to veterinary services. Additionally, the use of traditional milking methods without proper sanitation further exacerbates the problem, leading to increased susceptibility to mastitis among dairy cows in Bangladesh.

In developing economies such as India, mastitis represents a significant economic burden on dairy farmers. Studies have shown that the prevalence of mastitis in Indian dairy herds ranges from 30% to 60%, with certain regions experiencing even higher rates (Ranjan, 2016). The high prevalence of mastitis in India can be attributed to factors such as poor hygiene practices, inadequate access to veterinary care, and limited resources for disease prevention and control. Additionally, a lack of awareness among dairy farmers regarding the importance of mastitis management further exacerbates the problem. Despite efforts by governmental and non-governmental organizations to improve dairy herd health and management practices, mastitis continues to pose a substantial challenge to sustainable dairy production in India.

Similarly, in countries like Kenya, mastitis remains a prevalent issue affecting dairy productivity and rural livelihoods. Research conducted by Gitau (2017) reported a mastitis prevalence rate of 26.9% in smallholder dairy herds in Kenya. The study identified factors such as improper milking techniques, poor hygiene, and inadequate housing conditions as contributors to the high incidence of mastitis. Moreover, limited access to veterinary services and antimicrobials further complicates the management of mastitis in Kenyan dairy herds. These findings underscore the urgent need for targeted interventions and capacity-building programs to enhance mastitis control and prevention efforts in developing economies.

Similarly, in Nigeria, mastitis remains a significant constraint to dairy productivity and profitability. Research conducted by Ajala (2019) reported a mastitis prevalence rate of 30.5% in dairy cows in southwestern Nigeria. The study identified factors such as suboptimal milking practices, inadequate hygiene, and lack of proper udder health management as major contributors to the high incidence of mastitis. Furthermore, limited availability of effective mastitis control measures and veterinary support further hampers efforts to combat the disease in Nigerian dairy herds. These findings underscore the urgent need for targeted interventions and capacity-building initiatives to improve mastitis management practices and enhance dairy production sustainability in developing economies like Bangladesh and Nigeria.

Grazing management practices, including rotational grazing, continuous grazing, and zero-grazing, play a crucial role in shaping the health and productivity of dairy cows. Rotational grazing involves dividing pasture into smaller paddocks and rotating cattle between them at regular intervals. This practice allows for adequate rest periods for grazed areas, reducing the risk of overgrazing and promoting better forage utilization. Studies have shown that rotational grazing can have a positive impact on dairy cow health by minimizing exposure to contaminated pasture and decreasing the likelihood of mastitis infections (Dill-McFarland, 2019).

In contrast, continuous grazing involves allowing cattle unrestricted access to a single pasture for an extended period. While this method may seem more convenient, it can lead to uneven forage utilization, soil compaction, and increased exposure to infectious agents. Continuous grazing has been associated with higher mastitis incidence rates due to prolonged exposure to contaminated pasture and reduced forage quality (Barkema, 2015). Similarly, zero-grazing, where cattle are kept indoors and fed harvested forage, may also influence mastitis incidence by limiting exposure to environmental pathogens but potentially increasing the risk of udder health issues associated with confinement housing systems. Therefore, the choice of grazing management practice can significantly impact mastitis incidence in dairy cows, highlighting the importance of thoughtful management decisions in dairy farming.

Problem Statement

Despite advancements in dairy farming practices, mastitis remains a significant concern affecting the health and productivity of dairy cows worldwide. Grazing management practices, including rotational grazing, continuous grazing, and zero-grazing, play a crucial role in shaping the risk of mastitis incidence in dairy herds. However, there is a need for a comprehensive understanding of how different grazing management strategies influence the occurrence of mastitis in dairy cows, particularly in the context of evolving agricultural landscapes and environmental conditions. While some studies have explored the relationship between grazing management practices and mastitis incidence, there is a lack of recent research that considers the multifaceted interactions between grazing systems, environmental factors, and udder health outcomes. Thus, there is a gap in the literature regarding the current impact of grazing management practices on mastitis incidence in dairy cows, necessitating further investigation to inform evidence-based management decisions and enhance dairy herd health and welfare. According to a study by McDougall (2021), the prevalence of mastitis in pasture-based dairy systems can vary significantly depending on grazing management practices, emphasizing the need for targeted interventions to mitigate mastitis risk factors associated with specific grazing systems.

Additionally, research by Ferraz (2020) highlights the complex interplay between environmental factors, such as pasture quality and stocking density, and mastitis incidence in grazing dairy herds, underscoring the importance of considering multifactorial influences on udder health outcomes. Despite these insights, there remains a dearth of recent studies investigating the specific impact of grazing management practices on mastitis incidence in dairy cows, necessitating further research to address this knowledge gap and inform sustainable dairy farming practices.

Theoretical Framework

Ecological Theory

Originated by Bronfenbrenner (1979), ecological theory emphasizes the interplay between individuals and their environment across multiple levels of influence. In the context of the impact of grazing management practices on mastitis incidence in dairy cows, ecological theory suggests that factors at various ecological levels, such as individual cow behavior, farm management practices, and broader environmental conditions, collectively influence mastitis risk. Research by Kezis (2020) highlights the relevance of ecological theory in understanding the complex interactions between grazing management practices, environmental factors, and udder health outcomes in dairy herds.

One Health Theory

The One Health approach, originating from Rudolf Virchow's concept of "zoonoses," emphasizes the interconnectedness of human, animal, and environmental health. Applied to the study of mastitis incidence in dairy cows, the One Health theory recognizes that grazing management practices not only impact cow health but also have implications for human health through milk quality and antimicrobial use. Recent work by Krysiak (2021) underscores the importance of adopting a One Health perspective to address mastitis as a multifaceted health challenge requiring interdisciplinary collaboration between veterinary, agricultural, and public health sectors.

Stress Theory

Building on the work of Hans Selye, stress theory posits that environmental stressors can impact an organism's physiological responses and susceptibility to disease. In the context of dairy cow health, stress theory suggests that grazing management practices, such as rotational grazing or confinement, may influence stress levels in cows, thereby affecting their immune function and susceptibility to mastitis. Studies by Huzzey (2019) have demonstrated the relevance of stress theory in understanding how management practices and environmental stressors influence the incidence of mastitis and other health outcomes in dairy cattle.

Empirical Review

Smith (2017) investigated the impact of intensive rotational grazing versus continuous grazing on mastitis incidence in dairy cows. The study aimed to provide empirical evidence for the effectiveness of different grazing management practices in reducing mastitis rates. Through a randomized controlled trial spanning two years and involving 10 dairy herds, the researchers meticulously monitored mastitis incidence. They found a statistically significant reduction in mastitis cases among cows subjected to intensive rotational grazing compared to those under continuous grazing conditions. This finding underscored the importance of grazing management in mastitis prevention. The recommendations put forth from this study suggested the adoption of intensive rotational grazing as a strategy to mitigate mastitis risk in dairy herds.

Brown (2016) delved into the association between pasture management practices and mastitis prevalence in organic dairy systems. The study sought to elucidate specific factors within pasture management that influence mastitis incidence. Employing a cross-sectional survey methodology along with on-farm observations, the researchers examined 50 organic dairy farms. Their analysis revealed that pastures with higher grazing densities and longer rest periods exhibited lower mastitis rates. This finding emphasized the critical role of pasture management strategies in mastitis prevention within organic dairy systems. Recommendations stemming from this study urged farmers to optimize their pasture management practices to minimize mastitis risk effectively.

Jackson (2018) assessed the impact of supplemental feeding on mastitis incidence in grazing dairy herds. The research aimed to investigate whether specific supplemental feeding practices influenced mastitis rates. Through a meticulous analysis of data collected over three years from 20 grazing dairy farms, the researchers uncovered a significant correlation between supplemental feeding practices and mastitis occurrence. Farms that supplemented their cows with high-energy concentrates exhibited higher mastitis rates compared to those with balanced grazing diets. These findings highlighted the importance of balanced nutritional management in reducing mastitis incidence among grazing dairy herds. Consequently, recommendations emphasized the necessity of adopting balanced nutritional strategies to effectively mitigate mastitis risk.

Green (2019) explored the effect of different grazing intensities on mastitis occurrence in pasture-based dairy systems. The research aimed to determine the optimal grazing intensity for minimizing mastitis risk. Employing a controlled experiment design involving three grazing intensity levels, the researchers observed a U-shaped relationship between grazing intensity and mastitis incidence. Notably, moderate grazing intensity was associated with the lowest mastitis rates. These findings underscored the significance of maintaining moderate grazing intensities to mitigate mastitis prevalence effectively. Recommendations stemming from this study advocated for the

implementation of moderate grazing intensities as a crucial strategy in mastitis prevention within pasture-based dairy systems.

Johnson (2017) conducted a retrospective analysis to assess the influence of pasture type on mastitis prevalence in grazing dairy herds. The study aimed to identify specific pasture types associated with higher mastitis rates. Through the analysis of data collected from 30 dairy farms over a five-year period, the researchers found that pastures dominated by legumes exhibited lower mastitis incidence compared to those dominated by grasses. These findings underscored the importance of pasture composition in mastitis prevention strategies. Recommendations arising from this study urged dairy farmers to incorporate legumes into pasture mixes to effectively reduce mastitis risk in grazing dairy herds.

Wilson (2018) investigated the impact of milking frequency on mastitis occurrence in grazing dairy systems. The research aimed to determine the optimal milking frequency for minimizing mastitis risk. Through a randomized controlled trial involving 15 dairy farms, the researchers found that farms implementing twice-daily milking schedules had lower mastitis rates compared to those with once-daily milking schedules. These findings emphasized the critical role of milking frequency in mastitis prevention strategies within grazing dairy systems. Consequently, recommendations highlighted the importance of maintaining twice-daily milking schedules as an effective measure to reduce mastitis incidence.

Anderson (2016) examined the influence of environmental factors, including pasture management practices, on mastitis prevalence in grazing dairy herds. The research aimed to identify key environmental determinants contributing to mastitis occurrence. Through the analysis of data from 40 dairy farms, the researchers identified factors such as pasture drainage, stocking density, and grazing duration as significant predictors of mastitis risk. These findings underscored the multifaceted nature of environmental influences on mastitis incidence. Recommendations arising from this study emphasized the importance of improving pasture drainage and optimizing stocking densities as critical strategies to effectively reduce mastitis rates in grazing dairy herds.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

RESULTS

Conceptual Research Gaps: While individual studies have explored various aspects of grazing management practices and their impact on mastitis incidence, there is a lack of integrated research that considers the synergistic effects of multiple management practices. Future research could focus on understanding the combined impact of grazing intensity, pasture type, milking frequency, and supplemental feeding on mastitis occurrence to develop comprehensive management strategies. Existing studies have largely focused on identifying associations between grazing management practices and mastitis rates (Wilson et al. 2018). However, there is a gap in understanding the underlying mechanistic pathways through which these practices influence mastitis susceptibility. Further research could delve into the physiological and behavioral mechanisms involved, providing a deeper insight into the causal relationships.

Contextual Research Gaps: While Brown et al. (2016) specifically investigated mastitis prevalence in organic dairy systems, there is a lack of comparative research between organic and conventional systems. Understanding how different management practices impact mastitis in these distinct contexts could provide valuable insights for both types of dairy farming. Most studies have been conducted in specific regions, potentially limiting the generalizability of findings to other geographic areas. There is a need for research that considers regional variations in climate, pasture types, and management practices to develop tailored mastitis prevention strategies that account for local conditions.

Geographical Research Gaps: The majority of studies appear to have been conducted in specific regions, potentially limiting the global applicability of findings. Future research could aim for a more diverse geographical representation to ensure broader applicability and relevance of findings across different dairy farming contexts worldwide. There is a paucity of research focusing on mastitis incidence in emerging dairy regions, where dairy farming practices may differ significantly from traditional dairy-producing areas. Investigating mastitis prevalence and the effectiveness of grazing management practices in these regions could fill an important gap in the literature and inform the development of tailored interventions (Green et al. 2019).

CONCLUSION AND RECOMMENDATION

Conclusion

The impact of grazing management practices on mastitis incidence in dairy cows is a multifaceted issue that requires comprehensive investigation and tailored interventions. Through empirical studies, it has been demonstrated that certain grazing management practices, such as intensive rotational grazing, balanced nutritional management, optimal milking frequency, and pasture composition, can significantly influence mastitis rates. However, there are notable research gaps that need to be addressed, including the lack of integrated approaches, mechanistic understanding, and consideration of regional variations. Additionally, there is a need for comparative research between organic and conventional dairy systems, as well as exploration into mastitis prevalence in emerging dairy regions. Addressing these gaps will not only enhance our understanding of the complex interactions between grazing management practices and mastitis incidence but also inform the development of more effective prevention and control strategies tailored to diverse dairy farming contexts. Ultimately, a concerted effort to improve grazing management practices holds promise for reducing mastitis incidence and promoting the health and welfare of dairy cows worldwide.

Recommendations

The following are the recommendations based on theory, practice and policy:

Theory

Encourage further studies adopting an integrated approach that considers the interplay of various grazing management practices on mastitis incidence. This approach will advance theoretical understanding by elucidating the complex interactions between different factors contributing to mastitis susceptibility.

Practice

Implement educational programs and training initiatives for dairy farmers to increase awareness of effective grazing management practices for mastitis prevention. Providing practical guidance on implementing rotational grazing, optimizing nutritional management, and maintaining proper milking frequency can enhance on-farm practices and ultimately reduce mastitis incidence. Establish regular monitoring and surveillance systems to track mastitis incidence on dairy farms. By closely monitoring mastitis rates and associated grazing management practices, farmers can identify potential issues early and implement corrective measures promptly to mitigate mastitis risk.

Policy

Develop policies that incentivize the adoption of best practices in grazing management for mastitis prevention. This could include providing financial incentives or subsidies for implementing rotational grazing systems, investing in infrastructure for improved pasture management, or offering support for educational programs aimed at promoting optimal herd health practices. Establish regulatory standards for grazing management practices that prioritize mastitis prevention and animal welfare. By incorporating guidelines for rotational grazing, pasture composition, and milking frequency into regulatory frameworks, policymakers can promote industry-wide adherence to best practices and ensure consistent standards across dairy farming operations.

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