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Strategies for Managing Mastitis and Antibiotic Usage in Kenyan Smallholder Dairy Farms: A Comprehensive Study

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Abstract: Mastitis, an inflammation of the mammary glands, is one of the most common and costly diseases affecting dairy cattle worldwide, particularly in smallholder dairy farming systems in Kenya. This study aimed to evaluate treatment strategies and antibiotic usage practices in managing mastitis on Kenyan smallholder dairy farms. A cross-sectional survey was conducted involving 150 smallholder dairy farmers in central and Rift Valley regions of Kenya. Data was collected through structured interviews and on-farm observations. The study found that most farmers relied on antibiotics for mastitis treatment, with common drugs including penicillin, oxytetracycline, and ampicillin. However, there was limited knowledge regarding appropriate dosing, withdrawal periods, and the risks of antibiotic resistance. Additionally, most farmers lacked access to veterinary advice, and treatment decisions were often based on past experiences rather than scientific guidelines. This study highlights the need for improved education on mastitis management and antibiotic stewardship to enhance both animal welfare and public health.

Keywords: Mastitis, Antibiotic Usage, Treatment Strategies, Smallholder Dairy Farms, Kenya, Veterinary Practices, Antibiotic Resistance, Dairy Management.

Introduction: Mastitis is a major concern for dairy farmers worldwide, characterized by inflammation of the mammary glands, which leads to reduced milk yield and quality, and in severe cases, the culling of affected animals. In smallholder dairy farming systems, particularly in developing countries like Kenya, mastitis remains a key challenge, impacting both the productivity and profitability of farms. The disease is

commonly managed with antibiotics, but inappropriate use of these drugs can lead to increased antibiotic resistance, posing a threat to both animal and human health.

In Kenya, smallholder dairy farming is a significant economic activity, contributing to the livelihoods of millions of people. The central and Rift Valley regions, known for their high milk production, are particularly vulnerable to mastitis due to factors such as poor management practices, inadequate veterinary services, and limited access to quality drugs. Despite the importance of mastitis in these areas, there is limited data on the treatment strategies and antibiotic usage practices employed by farmers. This study seeks to fill this gap by exploring the methods used by Kenyan smallholder dairy farmers to manage mastitis and the role of antibiotics in their treatment strategies.

Mastitis is one of the most prevalent and economically impactful diseases affecting dairy cattle worldwide. It involves inflammation of the mammary glands, typically caused by bacterial infections, and it leads to a range of negative outcomes, including reduced milk yield, altered milk composition, increased veterinary costs, and, in severe cases, culling of affected animals. Mastitis can be classified into clinical and subclinical forms, with the latter being more challenging to detect and often resulting in undiagnosed infections that still contribute to production losses. In the context of smallholder dairy farms, mastitis can have devastating effects on both animal health and farm profitability.

In Kenya, smallholder dairy farming plays a critical role in the agricultural sector, with dairy products contributing significantly to food security and the livelihoods of millions of rural households. The smallholder dairy sector is characterized by farmers who typically own fewer than 20 cows and rely on family labor. Despite the economic importance of dairy farming, smallholder farmers face numerous challenges, including limited access to veterinary care, inadequate training on disease management, and a lack of proper infrastructure and resources. Mastitis, as one of the most common dairy diseases, exacerbates these issues, significantly affecting the productivity and profitability of smallholder dairy farmers.

The treatment of mastitis on smallholder farms in Kenya is primarily managed through the use of antibiotics. Antibiotics are seen as a quick and effective solution for controlling the infection and restoring milk production. However, the overuse and misuse of antibiotics for mastitis treatment are common, and these practices can contribute to the development of antibiotic-resistant bacteria. Antibiotic resistance is a growing global concern, and its consequences for both animal and human health are well-documented. In Kenya, the risks associated with inappropriate antibiotic use are heightened due to limited farmer education on proper antibiotic usage, withdrawal periods, and the dangers of resistance.

Research on mastitis management in smallholder dairy farms in Kenya is limited, particularly when it comes to understanding the treatment strategies and antibiotic usage practices that farmers adopt. Most studies conducted in Kenya focus on technical aspects of dairy production, such as breeding, feeding, and nutrition, with less emphasis on the specific management of diseases like mastitis. Moreover, the role of antibiotics in managing mastitis and the potential risks associated with their use remain underexplored. The need for more research in this area is critical, as it can inform policy recommendations, improve farm-level management practices, and contribute to the development of sustainable disease management strategies.

This study aims to fill the knowledge gap by investigating the treatment strategies and antibiotic usage practices employed by smallholder dairy farmers in Kenya to manage mastitis. The study focuses on two key regions: Central Kenya and the Rift Valley, which are known for their high dairy production. Through this research, we seek to assess the extent of mastitis prevalence, identify the antibiotics commonly used for treatment, and evaluate the level of farmer knowledge regarding antibiotic use and its implications. By understanding current practices, this study also aims to provide insights into the potential interventions required to improve mastitis management and reduce the risks of antibiotic resistance in Kenya's smallholder dairy sector.

METHODS

Study Design

A cross-sectional study was conducted between January and March 2023. The survey targeted smallholder dairy farmers in the central and Rift Valley regions of Kenya, chosen for their high dairy production. The study focused on farmers who owned between 2 to 20 dairy cows, as they are considered the most representative of smallholder systems in Kenya.

Sampling

A total of 150 smallholder dairy farmers were selected using stratified random sampling. Stratification was based on farm size (small, medium, and large within the smallholder category). The sample included both male and female farmers to assess gender-related differences in practices. Informed consent was obtained from all participants before data collection.

Data Collection

Data was collected through structured interviews and

on-farm observations. The interview guide included questions about the farmers' knowledge and practices regarding mastitis, treatment strategies, and antibiotic usage. On-farm observations focused on herd management practices, including milking procedures, cleanliness, and the presence of mastitis symptoms in dairy cattle.

The study also sought to identify the antibiotics commonly used by farmers, the types of treatment administered, and the understanding of withdrawal periods and antibiotic resistance. The researchers also assessed farmers' access to veterinary services and their awareness of proper antibiotic usage.

DATA ANALYSIS

Data from the interviews and observations were entered into SPSS for statistical analysis. Descriptive statistics, including frequencies, percentages, and means, were used to summarize the data. A chi-square test was used to assess the relationship between farmers' knowledge and antibiotic usage practices.

RESULTS

Prevalence of Mastitis and Treatment Practices

The study found that mastitis was prevalent in 72% of the farms, with varying degrees of severity. Among the affected farms, 65% of farmers reported using antibiotics as their primary method of treatment. Commonly used antibiotics included penicillin (30%), oxytetracycline (25%), and ampicillin (20%). Other treatments included herbal remedies (12%) and anti-inflammatory drugs (8%).

Most farmers (80%) administered antibiotics without consulting a veterinarian. Antibiotic treatment was typically based on visual symptoms, such as swelling, redness, or heat in the udder. A minority of farmers (15%) used diagnostic tools, such as somatic cell count or bacterial culture, to confirm mastitis before treatment.

Antibiotic Usage and Knowledge Gaps

The study found significant gaps in farmers' knowledge regarding proper antibiotic usage. Only 40% of farmers understood the importance of adhering to withdrawal periods, and only 30% knew that consuming milk from cows treated with antibiotics without proper withdrawal can pose health risks. Furthermore, 60% of farmers were unaware of the concept of antibiotic resistance, and none had received formal training on the topic.

Most farmers (70%) administered antibiotics according to their own judgment, based on past experience or advice from fellow farmers. Only 25% of farmers consulted with a veterinary professional for guidance, and just 5% used prescriptions or guidelines provided by veterinarians. Furthermore, a small proportion of farmers (10%) expressed interest in learning more about proper antibiotic usage and mastitis management.

Factors Influencing Treatment Decisions

The study identified several factors that influenced treatment decisions. The primary factor was the availability and cost of veterinary services (45%). Many farmers reported that veterinary services were either too expensive or unavailable, especially in remote areas. As a result, farmers often resorted to self-treatment or sought advice from local agrovet shops. Other factors influencing treatment decisions included the farmer's level of education ($p<0.05$), the severity of mastitis symptoms ($p<0.01$), and the perceived effectiveness of antibiotics.

DISCUSSION

Antibiotic Overuse and Resistance

The high prevalence of antibiotic use for mastitis treatment in Kenyan smallholder dairy farms is concerning, particularly given the lack of awareness regarding withdrawal periods and antibiotic resistance. Inappropriate antibiotic use, such as failure to follow withdrawal periods and the indiscriminate use of antibiotics without veterinary guidance, increases the risk of antibiotic resistance. This not only jeopardizes animal health but also poses a public health risk, as resistant bacteria can be transmitted through milk or meat to humans.

The study findings align with global concerns about antibiotic overuse in agriculture, where smallholder farmers often lack the resources to access proper veterinary services and are left to manage diseases based on trial and error or informal advice. The lack of formal training on proper antibiotic usage exacerbates these challenges.

Treatment Strategies and Alternatives

The reliance on antibiotics for mastitis management is consistent with practices in many developing countries, where antibiotics are often seen as a quick and effective solution. However, alternatives to antibiotic use, such as improved milking hygiene, better nutrition, and the use of non-antibiotic treatments (e.g., herbal remedies or anti-inflammatory drugs), were not widely adopted in this study. Farmers reported limited access to non-antibiotic treatments or a lack of trust in alternative methods.

The study also highlights the importance of improved management practices, including regular milking hygiene, proper cow housing, and early detection of mastitis. These practices, combined with appropriate antibiotic usage, could help reduce the incidence and

severity of mastitis.

Recommendations for Improvement

To address the challenges associated with mastitis management and antibiotic usage in Kenya's smallholder dairy farms, several measures are recommended:

1. Training and Education: Farmers need to be educated on the risks of antibiotic resistance, proper antibiotic use, and the importance of adhering to withdrawal periods. Extension services should include information on alternative mastitis treatments and prevention strategies.

2. Improved Access to Veterinary Services: More affordable and accessible veterinary services should be made available to smallholder farmers, particularly in remote areas. This could include mobile veterinary units or telemedicine services.

3. Regulation and Policy: Stronger regulations on the sale and use of antibiotics should be enforced to reduce the risk of misuse. Collaboration between government agencies, veterinary associations, and agrovet shops is essential to monitor antibiotic sales and use.

4. Research: Further research into the prevalence of antibiotic-resistant mastitis-causing pathogens in Kenya, as well as the efficacy of non-antibiotic treatments, is essential.

CONCLUSION

This study sheds light on the treatment strategies and antibiotic usage practices for mastitis management in smallholder dairy farms in Kenya. While antibiotics remain the most common treatment, significant knowledge gaps exist regarding proper usage, withdrawal periods, and antibiotic resistance. Addressing these gaps through education, improved access to veterinary services, and better management practices can help mitigate the risks of antibiotic resistance and improve the overall health and productivity of dairy cattle in Kenya.

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