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Effect of administration of vitamin E, selenium and antimicrobial therapy on incidence of mastitis, productive and reproductive performances in dairy COWS

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Abstract Administration of vitamin, mineral and antimicrobials at the end of lactation plays potential role in preventing mastitis in dairy cows. A total of 255 cows dividing into five groups (A = 50, B = 50, C = 50, D = 50 and E = 55) at their late gestation period were selected to explore the effect of vitamin E, selenium and antimicrobial therapy on mastitis incidence, their productive and reproductive performances. Each cow of group A received α -tocopherol + sodium selenite orally daily for last 30 days before calving, while each cow of group B, C and D was treated with α -tocopherol + sodium selenite intramuscular injection, procaine penicillin + neomycin sulfate, and dicloxacillin sodium intramammary infusions at Day 30–20 before calving, respectively. Group E cows served as untreated control. California mastitis test (CMT) revealed that 70.0%, 76.0%, 84.0% and 100.0% cows in group A, B, C and D, respectively were free from new intramammary infections (IMIs) during early lactation period. The bacteriological results showed highest IMIs rates (76.3%) in group E and lowest IMIs (2.0%) in group D ($P < 0.05$). *Staphylococcus aureus* and *Escherichia coli* were the most predominant udder pathogens in all groups except group D (only CNS). The mean IMIs incidence (20.5%) was significantly lower in treated cows ($P < 0.001$). The treated cows had higher cure rates (81.9%) than control cows (23.1%) and overall efficacy of treatments on cure rates was 71.8% for all mastitis pathogens ($P < 0.0001$). The productive and reproductive performances of the treated cows at postpartum and early lactation period remained always higher than their non-treated counterparts ($P < 0.001$). A number of cow and herd related factors were identified to be significantly associated with mastitis ($P < 0.001$). The results concluded that antimicrobial therapy had more beneficial effect in preventing mastitis over

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vitamin–mineral administration and intramammary infusion with dicloxacillin sodium remained as the best effective preventive strategies for mastitis in dairy cows.

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1. Introduction

Mastitis is one of the most devastating diseases of dairy cattle particularly for the backyard farmers in developing countries, and currently many dairy farmers have to face this problem as a constant challenge [1]. Despite intensive research and implementation of various mastitis control strategies over the last few decades, bovine mastitis has yet not disappeared, remains insurmountable to the dairy holders [2].

Intramammary infections (IMIs) found in early lactation can be the result of either IMI that do not resolve or new IMIs that develops during previous dry period. The importance of dry period in the dynamics of IMIs in dairy cattle is well established [3,4]. Recently, there has been increased interest in novel dry cow management strategies to prevent new IMIs such as administration of vitamin E and selenium [4], intramammary infusions with antimicrobials [5], external and internal teat sealers [6]. Despite dry cow udder health management programs, identifying infected cows in the immediate postpartum period should be an important procedure for the control of mastitis [7]. Dairy farms without an effective mastitis control program may witness up to 40.0% morbidity with IMI on an average of two quarters [8]. Conversely, there have been continuous changes in the predominating etiological agents of mastitis, greater understanding of the host responses to IMI and treatment protocols like vitamin–mineral and antimicrobial therapy [9]. There are time periods when IMI flare ups occur in dairy farms even though the best dry cow management practices are over there [1]. In another study, [10] reported that 50.0–75.0% of all bovine mastitis originated during dry period. Hence, mastitis prevention strategies should be attempted during dry period [11,12].

Administration of vitamin E–selenium to cows during dry period increases the immune response of mammary quarters [1,4] and could significantly reduce new mammary infections at calving, while their deficiencies could be associated with increased incidence of IMI [13,14]. Supplementation or injection of α -tocopherol and selenium were reported to be supportive for mammary gland immune system [4,6]. Antimicrobial agents are extensively over the last 40 years to control clinical mastitis in dairy animals and quite effective in reducing IMI at individual quarter level [5]. The intramammary infusion of antibiotics either alone or in combination with teat sealers is one of the most effective measures to prevent new IMI and cure of existing infections [15] and thus, has been recommended worldwide for many years [16]. However in Bangladesh, clinical mastitis in dairy animals is traditionally treated with only systemic antibiotics, and thus, intramammary infusions at dry period are yet to be scheduled. Besides different treatment regimens during dry period, various factors like management aspects (housing condition of the dry cow, farm hygiene, teat dipping, hand washing) and individual animal features (breed, parity, body condition, teat condition, integrity of the teat canal, milk yield, mastitis

category) also affect udder health during and after dry period [16,17].

Therefore, this study was designed to explore the effect of administration of vitamin E–selenium and antimicrobial therapy on mastitis incidence in dairy cows, their productive and reproductive performances. Interest was also focused on identifying the factors affecting mastitis incidence, cure rates and productive and reproductive traits of cows.

2. Materials and methods

2.1. Study area and farm management

The study was conducted in 4 districts of Bangladesh *viz.* Chittagong, Gazipur, Mymensingh and Sirajganj during the period from July 2013 to June 2014. The geographic position of the study area is Latitude: 20°45′–26°40′ N, Longitude: 88°05′–92°40′ E. The average annual rainfall was of 3,450 mm. The day temperature ranges from 7 to 20 °C in the cool months and in the other months it varies between 23 and 32 °C. Most of the dairy farms were smallholders farms. The cows gave birth randomly throughout year (no particular control breeding), were milked once daily with their calves used for stimulating milk let-down. Calves survived on residual milk after the hand milking. Control weaning was not practiced. The cows were fed on rice straw, cut-and-carry grasses and milling by-products as concentrate (crashed rice and/or sometimes mustard oil cake) with limited grazing on roadside and community land.

2.2. Dairy farm selection and data collection

A total of 255 crossbred cows from different smallholders farms at their late gestation period with previous history of either subclinical or clinical mastitis were selected for the present study from Chittagong, Sirajganj, Mymensingh and Gazipur districts of Bangladesh. The body condition score of the cows varied from 2.0 to 4.0 (1.0–5.0 scale). The cows were 2.5–10.0 years old and their parity ranged from 1 to 5. Most of the cows were milked manually and their average milk production ranged from 2 L to 18 L daily. The cows were divided into five groups (Group A = 50, B = 50, C = 50, D = 50 and E = 55). Cows belonged to group A, B, C and D received different preventive treatments against mastitis, while group E cows served as untreated control. Data from all selected cows regarding their age, breed, body condition score, parity, lactation stage, milk yield, pre and post-treatment mastitis incidence etc were collected using an interviewer administered questionnaire. All the treatment procedures and data collection were done either by researcher or by trained veterinarians.

2.3. Productive and reproductive parameters

Data regarding productive and reproductive performances of all experimental cows were collected during early lactation

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