Clinical study and therapeutic efficacy evaluation on ringworm infection in crossbred dairy calves at Holeta research center, Central highlands of Ethiopia

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IJASR 2019
VOLUME 2
ISSUE 6 NOVEMBER - DECEMBER **ISSN: 2581-7876**

Abstract – Ringworm infection is common in the dairy industry. Crossbred calves were affected by ringworm infection at holeta research center in August 2015/2016. The main clinical lesions observed on the affected calves were alopecia, circular and raised lesions which were mostly seen on the head, neck, face and other body parts. All the affected calves were treated with two treatment regimens. The treatment regime I (one) comprised of the combination of whit-field and Iodine tincture and the treatment regimen II (two) included ketoconazole treatment only. The findings indicated that all treated calves were recovered post treatment and the treatment regimen-I was better than regimen-II due to the fast recovery rate and regression of lesions. Therefore, ringworm infection should be treated through potent combination therapies and biosecurity protocols should be promoted in the dairy farms.

Keywords: Crossbred calves, Lesion, Ringworm, Treatment

Introduction

Bovine ringworm is a zoonotic infection of the superficial, keratinized structures of skin and hair of animals including man. It is caused by a keratinophilic fungus called dermatophytes in the genera of Trichophyton, Microsporum and Epidermophyton (Gudding and Lund, 1995). Calves are infected by contact with infected animals, particularly with cattle confined to a barn. Some calves develop natural immunity against the appearance of cutaneous lesion; however, they can be a source of infection for others. Young calves are frequently infected from spores contaminated materials that have not been properly disinfected. The transmission between calves occurs by direct contact with symptomatic or asymptomatic dairy calves (Murray *et al*., 2005). The occurrence of infection is higher in the winter due to housing of animals in close proximity for long periods and the infected debris in buildings (Al Ani *et al.,* 2002). However; the disease appears to be more common in the tropical areas than temperate countries or areas having hot and humid climatic conditions (Radiostitis *et al*., 1997).

The disease is characterized by the typical formation of cutaneous lesions with a diameter of 10 to 50 mm patches of hair loss, sloughing and crust formation which is raised above the skin. These lesions are most frequently confined to the head, neck and the entire body surface in severe cases. It is enzootic in herds and the occurrence of infection is higher in young calves than in the adult cattle (Akbarmehr, 2011). It is responsible for significant economic losses due to damage of skin, animal products and economics of the herd (Weber, 2000). A wide range of treatments that have been used to treat ringworm infection in cattle includes Chlorhexidine, Salicylic acid, Iodine tinctures and griseofulvin (Radiostits, 2007). However, some treatment options have been ineffective or even toxic to the host (Rochette *et al.,* 2003). The treatment of ringworm with topical antifungal chemical has been used widely and provides a good recovery rates. Topical and herbal remedies have been shown to be efficacious as anti-fungal agents (Cam, 2009). The topical treatments are of greater value in the early stages of the outbreaks when the lesions are small and little in number. The iodine tincture 5-7% is the most effective fungicide. Hence, there several fungicidal drugs that are used for treatment as local application (Radiostits, 2007).

Trials of new drugs or alternative treatment regimens using the existing convectional drugs have been used in cattle with ringworm infection such as whit-field's topical ointment , containing six percent (6%) benzoic acid has antifungal and antibacterial properties, is used for the topical treatment of fungal infection (kaya, 2000). Ketoconazole is also used to treat cutaneous fungal infection in cattle. There is a dearth of information and practices on the clinical changes, immunity and treatment options using the combination of whit-field topical

ointment with iodine tincture and ketoconazole to treat ringworm infection. An alternative treatment option is very important to clinically treat ringworm infected crossbred calves.
Therefore, the objectives of these trials were:

- to evaluate the combination efficacy of whit-field ointment and povidone Iodine tincture for the treatment of ringworm infection in crossbred dairy calves
- to evaluate the therapeutic efficacy of ketoconazole and recovery responses in affected crossbred calves

Materials and Methods

Study Area

Holeta Agricultural Research Center (HARC) is located at 34 Km West of Addis Ababa at an elevation of 2400 m.a.s.l in the central high land of Ethiopia. The area is characterized by mild subtropical weather, with average minimum and maximum annual temperature of 6.3 and 22.1^{o}c, respectively. The area also experience bimodal rainfall pattern with a long rainy season extends from June to September while the short rainy season extends from March to April (CSA, 2009).

Study Crossbred Calves and Clinical Examinations

The study animals were crossbred dairy calves aged between one to five months in the farm. About 42 affected crossbred calves (21 Males and 21 Females) were included in the study. Complete clinical and general examinations of the diseased crossbred calves have been performed to evaluate the general state of calves and vital parameters. Accordingly, the clinical status of ringworm infection was categorized based on its location and size of lesions. Calves with the normal clinical parameters and having 2-4 lesions in the head, neck and other body parts were grouped as mildly infected (+), calves with mild loss of condition and 4-8 lesions on the head, neck and other parts of the body were grouped as moderately infected (++), and calves with prominent loss of weight and more than 8 multiple lesions in the head, neck and other parts of the body were categorized as severely infected (+++). The uniformity between the three groups of infected calves was attained according to the clinical condition. Hence, 8 calves in the slightly infected groups, (+), 18 calves in the moderate groups (++), and 16 calves in the severe groups (+++) were examined in the farm.

Experimental study design

The study was prospective and experimental double blind study designs. Crossbred calves suffered from clinical disease were allotted to two treatment regimens and the clinical trials have been conducted and recovery responses were monitored.

Therapeutic Regimens

All crossbred calves that have developed clinical sign of ringworm were examined and complete clinical examination was performed. The general state of infected calves, and vital parameters such as body temperature, pulse rate and respiratory rates were recorded. The screening of infected calves was done based on the appearance of lesions and alopecia. The affected calves were subjected to two therapeutic regimens (Regime I and Regime II). Each infected calves were randomly allotted to one of the two treatment options. In the treatment regimen I, the affected calves were topically treated with whit-field ointment and 2-5% of povidone iodine solution for 3 to 5 days and in the treatment regimen II, the affected crossbred calves were topically treated with ketoconazole for 3-4 consecutive days. Moderately and severely infected calves were treated by the first therapeutic regimens while calves with mild loss of condition and 4-8 lesions were allotted to the second therapeutic regimens. The uniformity between the three groups of infected calves was attained according to the clinical condition. Moreover, all the diseased calves have received a single long acting oxy-tetracycline treatment (1ml/20kg, IM, B.W) to mitigate other bacterial infections. Post clinical observations were performed in order to record the treatment outcomes and recovery states.

Clinical responses of affected calves and Evaluation of treatment options

The progression of lesions to advance or recovery state has been monitored and evaluated after sequential topical treatments. All treated calves were clinically examined and the two treatment regimens were evaluated to record treatment outcomes. During clinical trials and after termination of the trails, clinical data were collected.

Statistical analysis

Data generated from field study were recorded and coded using Microsoft Excel spreadsheet and analyzed using STATA version 13 for Windows (Stata Corp. College Station, TX, USA).The clinical examination results and the therapeutic responses were recorded and tabulated.

Results

The clinical examination of diseased calves showed poor body condition, and the body temperature, respiratory and pulse rates were ranged from 37.5-38.8^{0}c, 17-32 rates/min and 60-80 rates/min respectively. The skin lesions were roughly circular on the head and neck regions and there was no itching condition. The findings from clinical diagnosis indicated that majority of the crossbred calves had moderate and severe lesions on their different body parts (Figure 1). Effective cures of the affected calves were observed post treatment. Lesions started to subside gradually and the hair started to grow again during the recovery processes. Hence, topical application of ketoconazole resulted in recovery and the clinical cures had achieved after treatment representing 85.71% cure rates. Moreover, in combined treatment of whitfield and Iodine tincture, the clinical cures had achived after treament representing 95.23% cure rates (Table 1 and 2). The results also showed that rapid and effective cure of affected calves occurred with applications of topical chemicals at 3-4 days interval.

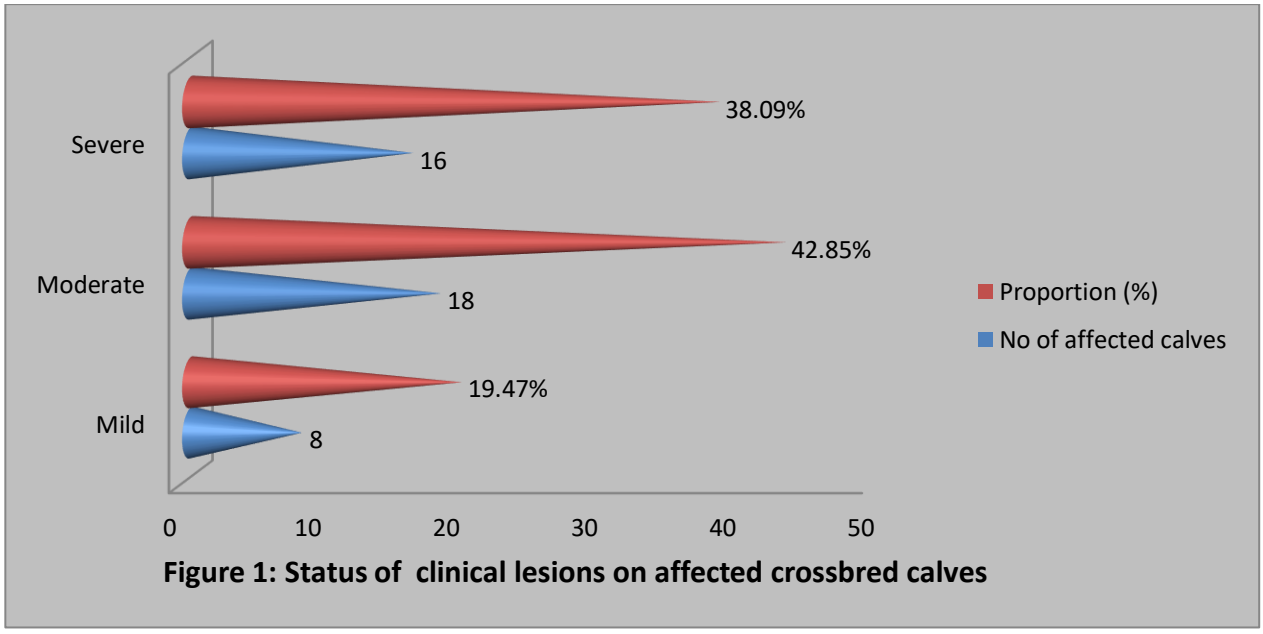

Figure 1: Status of clinical lesions on affected crossbred calves

Table 1: Results of the ketoconazole treatment trials in the diseased crossbred calves

Calf sex	Infected cases	No of calves treated by ketoconaloze ointment	No of Cured calves	Total no of the cured casese post treament
Male	21	11	10	90.9%
Female	21	10	10	100%

Curing rate	42	21	18	85.71%

Table 2: Whitfield and Iodine tincture treatment trials in the diseased crossbred calves

Calf sex	Infected cases	No of calves treated by whitfield and Iodine tincture	No of Cured calves	Total no of the cured cases post treament
Male	21	11	10	90.91%
Female	21	10	10	100%
Curing rate	42	21	20	95.23%

All calves treated with regime I treatment (Whit-field and povidone Iodine 5%) leads to clinical cure rate and completely recovery. The topical application of ketoconazole as regimen II, treatment also leads recovery of affected calves (Table 3).

Table 3: Results of the therapuetic efficacies

s/ no	Categories of lesions	Descriptions of clinical lesiosn	Treatment regimens		Treatment Outcomes
			Regime I	Regime II	
1	Severe cases	+++	SCL	NL	Regression and Healing
2	Moderate cases	++	SCL	NL	Regression and Healing
3	Mild cases	+	NL	NL	Regression and Healing

SCL: slight clinical lesion, NL: no lesions was seen

Discussion

Ringworm infection could be a major health problem in the dairy farms particularly in crossbred young animals. This study was in line with the previous report of (Cam *et al*., 2007) that described young calves were vulnerable to ringworm infection. The diagnosis of ringworm in the study farm was based on clinical signs and the affected calves had normal body temperature, pulse and respiratory rates. The main clinical signs observed among the affected calves were circular, circumscribed and thick crusty lesions raised above the skin and areas of alopecia in severely affected calves. The lesions were most commonly found on the head, neck, around eyes and face. These observations were in agreement with other studies (Cam *et al*., 2007, Akbarmehr, 2011). But in severe cases, the lesions were found over the entire bodies which were also reported by (Kirmizigul *et al*, 2009). The reasons for the occurrence of more lesions around the face in crossbred calves were not clearly known. However, the habit of licking and grooming by calves could predispose this part to infection. The study revealed that young calves were particularly susceptible to ringworm infection. This finding was in consistent with (Lund *et al*., 2014) who reported that ringworm infection is more persistent in young calves, sick animals, immune suppressed animals, poorly fed and high density groups. This could be as a result of the poorly developed immune system and the high PH of the skin in young animals (Radostits *et al*., 2007). Although dermatophytosis is self-limiting disease, treatment of such cases can enhance recovery; decrease the spread of lesions and the risk of transmission. Antifungal drugs act by increasing the fungal cell wall permeability permitting the intracellular elements to escape and death of the fungal cell occur. Removing the scales with whit-field and tincture iodine 5% makes the drug in contact with the skin and thus can perform its action in a proper way making complete recovery state following treatments.

Therapeutically, treatment of the infected crossbred calves using long acting oxytetracycline was done in order to halt multiplication of bacterial infections. The topical treatment was achieved at the fourth post treatment representing 100% cure rate. However, Gebreyohannese (2013) mentioned that the topical treatment had limited efficacy in the treatment where these applications did not penetrate the scab to the active lesions. Other authors such as Dickson *et al* (2010) reported that the application of topical antiseptics had limited problem as the drug has no action on the hyphae found inside wholly follicles, but, it could reduce the spread of the infection through destruction of the pathogen present in the crust. The whit-field ointment has a keratolytic and antifungal activity and this was in line with the reports of (kaya, 2000 and Radiostitis 2007).Topical treatment by whit-field and iodine tincture achieved a complete clinical and mycological cure indicating the treatment was effective when used in combination form. The lesions had regressed to some extent suggesting that the combinations were highly effective in the treatment of ringworm. However, this treatment might not be practical in some cases where large areas of the skin are affected. Ketoconazole topical treatment achieved a clinical and mycological cure indicating that the application was only partially effective when used alone. The combination treatments are important to raise the protective immunity of calves against the infection and the cell mediated part of the immune response is stimulated in order to acquire sufficient immunity against ringworm infection which is required to establish a fast recovery rate in crossbred calves. In conclusion, this study showed that the application of whit-field ointment and iodine tincture was effective treatment for ringworm infection. As the disease is common in young stock in crowded conditions, control should focus on provision of good housing condition, disinfections and cleaning of the premises during the grazing season, and immediate isolation and treatment of infected calves.

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