A Review on Camel Dermatophilosis

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Abstract: Dermatophilosis is a skin disease caused by a bacterium called Dermatophilus congolensis. The disease affects many species of domestic and wild animals and occasionally, humans. It is most prevalent in the tropics. The lesions are characterized by an exudative dermatitis with scab formation. The disease causes severe skin matting resulting in hide depreciation, overall decrease in animal productivity and, in severe cases, mortality in susceptible weak animals may be as high as 50% in the absence of treatment. Although only recently described researches, camel dermatophilosis is recognized as widespread in several camel rearing countries in the tropics. Natural D. congolensis infection of camels was first reported in Kenya in semi-arid conditions. Camel dermatophilosis was found to be one of the most serious skin problems faced by camel herders and in several camel rearing areas where D. congolensis and Microsporum gypseum infections have both been recorded as mixed infections in a camel dairy farm. Camel calves were more likely to be infected than adults. Lesions began as hair matting and later developed into hard crusts. Fatality ranged from 10 to 30%. The most effective control measure of this disease was thought to be through control of tick infestations. Several treatment regimens were tried in other animal species but with varying degrees of success. The only control method of this disease practiced in dromedary camels was the regular washing with 1% potassium aluminium sulphate solution. The review details some aspects of the clinical picture, epidemiology, chemotherapy and control measures of the disease in camels.

Key words: Camel • Dermatophilosis • D. congolensis

INTRODUCTION

Dermatophilosis, a bacterial skin disease caused by the bacterium actinomycete, Dermatophilus congolensis is the most important infectious skin disease of ruminants in the Caribbean Islands [1-3] and in many West, Central and East African countries (4; 5). The disease was first reported by von-soceghem (1915) in cattle in the Belgian Congo [6]. It is considered as one of the main constraints to increased cattle productivity in these African countries and Caribbean Islands [7]. Eventhough the disease affects a wide variety of animals and occasionally humans, the most commonly affected species are cattle, sheep and horses and rarely dogs and cats in many parts of the world [8].

The disease in cattle and sheep is commonly called cutaneous streptotrichosis and mycotic dermatitis respectively and in horse rain scald, although other local names exist including senkobo skin disease in central Africa, kirchi in nigeria and saria in malawi. Dermatophilosis is a name common to the disease in all species [9]. Dermatophilosis was first described in dromedary camels in the Ol-Maisor farm in Laikipia, Kenya [10]. The disease is non pruritic and is characterized by exudative, proliferative or hyperkeratotic dermatitis, accompanied by the production of crusts and follicullitis. It invades the skin and causes skin disease [11]. The disease had been reported to be more severe in ruminants and was of particular importance in tropical and subtropical regions [12].

Several factors are involved in the pathogenesis of Dermatophilosis; among them are mechanical injury to the skin, rainfall, tick infestation, concurrent diseases and stress that compromise the host immune system. It is generally accepted that in the rainy season, owing to devitalizing effect on the skin barriers, the high relative...
humidity has a significant influence on the maturation and motility of the infective zoospores and it has been claimed to be a major predisposing factor in the spread and epidemiology of Dermatophilosis [11].

The organism can exist in quiescent form with in the epidermis until infection is exacerbated by climatic condition. Epidemics usually occur during the rainy season [13]. Shearing, dipping, or introducing an infected animal in to a herd or flock can spread infection. The disease is transmitted by direct contact with infected animals or indirectly via contaminated objects or flies [14]. Moisture facilitates release of zoospores from preexisting lesions and their subsequent penetration of the epidermis and establishment of new foci of infection. High humidity also contributes indirectly to the spread of lesions by allowing increases in the number of biting insects particularly flies and ticks, that act as mechanical vectors [9]. Diagnosis made based on clinical appearance of the lesion on the affected animal and demonstrating the causal organism from the lesions beneath the scabs [15].

The outcome of treatment is influenced by the severity and extent of lesions. Parenterally administered antibiotics such as long acting oxytetracyclines are usually effective [16]. Control and prevention measures are based on minimizing the effect of predisposing factors and early treatment of clinical cases [17].

The disease often creates economic problems by creating severe skin matting resulting in hide depreciation, overall decrease in animal productivity and severe case mortality in susceptible weak animals [18]. The disease also results in gradual loss of condition, impaired reproductive performance and decrease in milk production and marked increase in the somatic cell counts in milk [19,20]. Therefore, the disease has great economical importance, especially in the tropics, whereas in temperate countries it affects mainly sheep and horses causing minor economical losses [21]. Severe outbreaks of the disease have long been closely associated with the presence of the tropical bont tick Amblyomma variegatum [22,23]. In man, however, the disease causes nail infection and it's clinical spectrum ranges from an asymptomatic infection to a pustular eruption of the skin [24].

Therefore, the objective of this seminar paper is:

- To review camel Dermatophilosis

**Dermatophilosis**

**Epidemiology**

**Etiology:** *Dermatophilus congolensis* is a gram positive, non acid fast, aerobic actinomycete. It has two characteristic morphologic forms: filamentous hyphae and motile zoospores. The hyphae are characterized by branching filaments (1-5µm in diameter) that ultimately fragment by both transverse and longitudinal septation in to pockets of coccoid cells. The coccoid cells mature in to flagellated ovoid zoospores (0.6-1µm in diameter) Andrew et al. [12].

**Geographic Distribution:** Dermatophilosis occurs in all areas of the world and can be epizootic in tropical and subtropical areas of the world [9,25]. Survey of large number of cattle in Africa revealed prevalence rates approaching 15% with a 100% infection rate in some herds at the time of peak seasonal prevalence. In temperate climates the disease is usually sporadic but can still have considerable economic importance where predisposing factors pertain [9]. High prevalence in sheep flock occurs in high and medium rainfall areas [26]. The disease was found to be more prevalent in the wet season (21.2%) compared to its prevalence in the dry season (14.5%) and the calves were found to be more susceptible (23.1%) compared to the adults (19%).

**Host Range:** Dermatophilosis occurs in cattle, sheep, goat, horse, dog, cat, donkey, human and occasionally in deer, pig, camel and wild life species [14]. Dermatophilosis was first described in dromedary camels in the Ol-Maisor farm in Laikipia, Kenya [10].

**Source of Infection:** The principal source of infection for Dermatophilosis is the infected animals, including the healthy carrier and the apparently recovered animals. In endemic areas, up to 50% of apparently healthy cattle may be carrier of the bacterium, while persist in the ostie of hair follicles [27]. *Dermatophilus congolensis* is not highly invasive and does not normally breach the barriers of healthy skin. These barriers include the sebaceous gland on the body of sheep and the physical barrier of the wool. On the feet and face these barriers are easily and commonly broken by abrasive terrain or thorny and spiny forage and food stuffs. *Dermatophilus congolensis* may infect these lesions and may be transmitted mechanically by feeding flies to result in minor infection on the face and feet. This carriage form of the disease is common in most herds and minor lesions are evident at the junction of the haired and non haired areas of the nares and of the claws and dewclaws. They are no of clinical significance to the animal except that they provide a source of more serious infection when other areas of the skin surface are predisposed to infection [15].
Mode of Transmission: Transmission occurs from the carriage lesions by contact from the face of one animal to the fleece or skin of another and from the feet to the skin during mounting. Dermatophilosis is transmitted by the cocoid forms, which results from the multidimensional division of the hyphae known as a zoospore. The zoospore is motile and released when the scabs are exposed to moisture. Transmission can be direct or indirectly through contaminated water or grass. Insect transmission which has been demonstrated with flies and ticks is believed to be a principal means of spreading zoospores [14].

Risk Factors: Environmental and Managemental Factors
Cattle: In temperate zones, outbreak in herds and severe disease in individuals are uncommon but can occur associated with high rainfall with attack rate of 50%. The use of periodic showers or continual misting to cool cattle during hot periods is a risk factor for infection in dairy herds [9]. In tropical zone, climate is the most important risk factor in tropical and subtropical regions. For example, rain fall can act indirectly to increase the range and activity of potential arthropod vectors. These arthropod vectors are important in the endemic tropical and subtropical areas than in temperate zones [9,27]. The disease has highest incidence and severity during the humid and high rainfall season. The seasonal occurrence is associated with concomitant increase in tick and insect infestation [9].

Tick infestation, particularly with *Amblyomma varigatum*, *Hyaloma asticum* and *Boophilus microplus*, is strongly associated with the occurrence of extensive lesions of Dermatophilosis, which can be minimized by the use of Acaricides. The lesions of Dermatophilosis on the body do not occur at the predilection sites for ticks and it is thought that the importance of tick infestation relates to a tick produced immune suppression in the host rather than mechanical or biological transmission [15].

There was a lot of debate regarding the role of ticks, particularly *A. Variegatum*, in the epidemiology of animal dermatophilosis. In the Caribbean, seroepidemiological studies using ELISA for screening of sera for the presence of antibodies to Dermatophilus congolensis were conducted to clarify the epidemiology of this disease in that region with special attention to the role of *A. variegatum* tick. It was found that seropositive cattle were present in islands not infested by *A. variegatum* and even clinical dermatophilosis was never or rarely seen [28]. It was also found that there was no difference in prevalence of seropositive animals between tick-infested and non-infested areas in the islands studied. These findings confirm previous experimental data showing that *A. variegatum* was not necessary for the transmission of *Dermatophilus congolensis*. However, the high concentrations of prostaglandin E2 (between 151 and 377 ng/ml) and prostacyclin (between 124 and 134 ng/ml) found in the saliva of female *A. variegatum* strongly suggested that the tick could favour the development of the lesions through an immunomodulating activity of its saliva [28].

The disease was found to be more prevalent in the wet season (21.2%) compared to its prevalence in the dry season (14.5%) and the calves were found to be more susceptible (23.1%) compared to the adults (19%). Clinically the disease in affected camels appeared as hair matting especially on the rump, neck, flanks and lower abdomen with no lesions on the legs. When matted hair is removed, lesions showed hyperaemia with pus exudation.

Lesions may also show hairless brownish crusts with irregular sizes. The disease in camels of the Sudan was discovered in two herds of which 50% to 70% of the animals below two years of age were affected whereas in other 13 herds the prevalence of the disease was lower. Generally, among camels the disease affected mostly growing calves above one year old (34%) compared to adults (8.9%) and the lesions were more severe involving most parts of the body than in the adults. However, very young suckling calves (less than 6 months old) were not affected. In the adults lesions were mostly observed on the hind limbs and abdomen with a morbidity rate of 12.5%. Case fatality rate among infected dromedary calves in the Butana region of Sudan was found to be ranging between 10 to 30% [29]. Whereas no mortality was noticed among affected adult camels. This skin disease ranked second, after diarrhea, as the most common disease among growing calves in Butana region of eastern Sudan [30].

The disease is more widely spread in camels than originally thought. Again, there is a strong debate about the role of ticks, particularly the bont tick *Amblyomma variegatum*, on the epidemiology of this disease in camels since this tick species was not found in camels among which several other tick species were recovered [31]. In Saudi Arabia, however, a mixed infection of *Dermatophilus congolensis* and *Microsporum gypseum* was described in camels for the first time. In a dromedary herd population of 559 animals, 131 (23.4%) were found to be affected with discrete circumscribed crusty hairless lesions. The disease was also more
prevalent among young and growing calves than older ages. *D. congolensis* and *M. gypseum* were diagnosed by direct microscopy, isolation and histopathology [32]. It worths mentioning that during this outbreak in Saudi Arabia, affected camels were not infested with ticks. This observation contrasts the situation in Sudan and Kenya where the affected camel herds had very high tick loads. This finding is consistent with other conclusions which suggested that agents, other than tick infestation, are involved in the pathogenesis of *D. congolensis* in camels as well as in bovines [31,33]. Camel pastoralists in Butana region of Sudan regularly complained about this disease problem and enquire about the available preventive and curative measures against the disease [31,33]. There is a particular tendency for lesions to occur on the rump and back in female and males probably due to the introduction of infection through minor skin abrasions caused by mounting, other penetrating lesions caused by ear tags or biting flies can also result in minor lesions. Intercurrent disease, stress and trauma to the skin produced by thorny bushes can act risk factors [9].

**Camel:** Biting flies (Stomoxys calcitrans) are thought to act as mechanical vectors of the infection and House fly (Musca domestica) can carry infection. Skin damage from trauma or from ectoparasites can predispose disease as does wetting from rainfall or from frequent washing [34].

**Host Factor:** There is breed differences in susceptibility to Dermatophilosis. In Africa, the N’dama and Muturu cattle breeds and native sheep are resistant, while Zebu, White Fulani and European breeds are susceptible. Within breed differences in susceptibility are also apparent and genetic markers have been identified in Zebu. Susceptibility in cattle can be influenced by genetic selection. Sheep that have strong or medium wool strains are most susceptible. Open fleeced sheep and sheep with a low wax and high suint content in their fleece are more prone to infection [9].

**Pathogen Factor:** Dermatophilus congolensis does not live well off the body and in the normal environment and is susceptible to the external influences of PH and moisture fluctuations. In the laboratory it can survive for four years otherwise sterile broth culture and for at least 13 years in dry scab material [9].

**Pathogenesis:** The natural skin serves as effective barrier to infection. Minor trauma, or maceration by prolonged wetting, allows establishment of infection and multiplication of the organism in the epidermis. The formation of typical pyramidal shaped crust is caused by repeated cycles of invasion in to the epidermis by hyphae, bacterial multiplication in the epidermis, rapid infiltration of neutrophils and regeneration of epidermis. The organism in the scab is the source for repeated and expanding invasions which occurs until immunity develops and the lesion heals. The scab then separates from the healed lesion but is still held loosely in place by hair fibers. In sheep, the extensive maceration of the skin that can occur with prolonged fleece wetting can result in extensive skin lesions under the fleece. In cattle, tick infestation suppresses immunity function and promotes the spread of the lesion. Secondary bacterial may occur and give rise to extensive suppuration and severe toxemia [27].

**Clinical Findings:** Dermatophilosis is seen in animals at all ages and both sexes are also susceptible to infection [35].

In cattle, the lesion commences as a circumscribed moist patch, often with raised or matted hairs, giving a characteristic “Paint brush” appearance. Descrete lesions occur in the initial stages which coalesce to form large areas of hyperkeratotic scab and crust. Distribution of the gross lesion usually correlates with the predisposing factors that reduce or permeate the natural barrier of the integument. Typical lesions consists of circular, dome shaped scab 2-9cm in diameter. Scab may be of variable thickness and on removal show a concave underside coated in thick, yellowish exudates, leaving a row, bleeding epidermis [12].

Death usually occurs particularly in calves because of generalized disease with or without secondary bacterial infection and secondary fly or screw worm infestation [15]. In sheep, lesions are not commonly visible because they are obscured by the fleece but crusts can be palpated as hard mass at the surface of the skin. Heavy mortalities can occur in very young lambs where there can be extensive lesions over the body [27].

Lesions in horse are similar to those in cattle, the lesions are matted together over the lesion and an exudative dermatitis produces a firm mat of hairs and debris just above the skin surface. If this hair is plucked the entire structure may lift off, leaving a characteristic ovoid, slightly bleeding skin area [34].

**Pathological Lesions**

**Clinical Pathology:** The causative organism may be isolated from scraping or a biopsy section and is much easier to isolate from acute case than chronic ones [27].
Typical branching organisms with double row of zoospores can be seen in a stained impression smear made directly from the ventral surface of a thick scab preserved firmly on to a slide. The organism can be also demonstrated by fluorescent antibody test (FAT), enzyme linked immuno sorbent assay (ELISA) and counter immuno electrophoresis (CIE) also been used to detect serological evidence of infection with Dermatophilus congolensis [36].

**Isolation Procedures:** The organism grows well on blood agar. Plates are inoculated from clean serous exudates or made directly from the ventral surface of a thick scab from the lower aspect of moistened scabs. The organism preserved firmly on to a slide. The organism can be also not fastidious and grows well on un enriched media demonstrated by fluorescent antibody test (FAT), enzyme such as tryptose agar. The organism also grows well in linked immuno sorbent assay (ELISA) and counter various broth media but, there is no growth on sabouraud dextrose agar (SDA) [38].

**Cultural Characteristics:** Pin point colonies surrounded by small zones beta hemolysis are evident after twenty four hour incubation at 37°C. After incubation for three to four days, colonies are considerably larger. There may be wrinkled or smooth, convex and varying in color from grayish white to bright orange [25].

**Molecular Diagnostic Method:** Polymerase Chain Reaction; Polymerase chain reaction can be carried out for the detection of the Dermatophilus congolensis genome isolated from the suspected samples. The amplification process requires the following major steps: Template DNA is initially denatured at 95°C for 1 min followed by denaturation at 94°C for 30 sec, annealing at 60°C for 30 sec and extension at 72°C for 1 min and a final extension at 72°C for 7 min. The following elements are also required to prepare the reaction mixture and to run the PCR machine. The known forward primer 5'-ACATGCAAGTCGAACGATGA-3' and the reverse primer 5'-ACGCTCGCACCCTACGTATT-3', magnesium ion as a nuclease free water. Then the PCR products after some cycle are allowed for electrophoresis in an agarose gel containing 10 µL of 10 mg per mL ethidium bromide at 80 volts for 45 min. One hundred base pair DNA marker can be used as a molecular size marker. DNA amplifications were examined and photographed using UV transluminator [39].

**Differential Diagnosis:** The differential diagnosis for Dermatophilosis includes Ring worm, Staphylococcal dermatitis /Folliculitis/, Scabies and Pediculosis [9].

**Economic and Zoonotic Importance:** In sheep, damage to the fleece causes severe losses up to 30% loss of value of wool and 40% loss of skin value and may be so extensive in lambs that spring lambing has to be abandoned. Other losses in sheep are caused by interference with shearing and a very great increase in susceptibility to bowl flies [9].

In Africa the disease in cattle and camel causes great losses and many deaths and the disease ranks as one of the four major bacteriological diseases with equivalent
importance to Contagious Pleuro Pneumonia and Brucellosis. Goat in the same area also suffers a high incidence. Losses are from direct animal loss, decreased work ability of affected oxen, reproductive failure from vulval infection or infection on the limbs of males preventing mounting, death from starvation of calves of dams with udder infection, loss of animal meat and milk production and down grading of the hides [9].

Humans who are exposed to infected animals or contaminated animal products (example, slaughter house workers, butchers, hunters, dairy farmers, veterinarians) acquire the infection [40]. In humans, Dermatophilosis appear as eczemoid cells, multiple pustules, or even furuncles, localized predominantly on the hands and forearms. In most cases, the lesions heal spontaneously within two to three weeks [41].

**Treatment and Control:** A study of the effect of tick control on the prevalence of dermatophilosis in indigenous cattle was conducted in Ghana [7]. It was proved that tick control using the synthetic pyrethroid acaricide and insecticide deltamethrin as a pour-on containing 1% deltamethrin in an oil base ("Spot On"; Pitman Moore Limited, U.K.) was effective in tick control and, consequently, dermatophilosis prevalence in the studied herd. Moreover, the use of the amidine acaricide, amitraz ("Triatix"; Pitman Moore Limited, U.K.), was also found effective in tick and dermatophilosis control in Ghana [7]. However, it was concluded that the timing of strategic tick and dermatophilosis control was critical to its success [7].

Currently there are no prospects for a vaccine and acaricide or antibiotic control is hampered by the development of chemo-resistance [42]. Vaccination trials using various methods and routes such as inoculation by several routes of whole bacterial cultures, inactivated or not and mixed or not with an adjuvant, have all failed [42].

Rearing and breeding resistant breeds of animals is among the best methods for controlling dermatophilosis in animals. However, most of the resistant indigenous cattle breeds are not sufficiently productive to satisfy the desired production objectives in the semi arid rural countries particularly in Africa. Attempts to improve the productivity of local livestock breeds through cross breeding with highly productive exotic breeds ended with catastrophic results due to dermatophilosis. Strict control of the bont tick, *Amblyomma variegatum*, through dipping of cows in acaricides or dusting of sheep with potassium aluminium sulphate were met with relatively satisfying results [42].

A trial was conducted to evaluate the efficacy of using 10% formalin administered intravenously at the dosage of 20 ml per 100 kg body weight with and without a combination with long-acting oxytetracycline for the treatment of naturally occurring bovine dermatophilosis in a group of Frisian crossbred cattle in Ghana. The best result was found with using formalin combined with the long-acting oxytetracycline when the affected animals fully recovered after 1.5 treatments compared to the use of long-acting oxytetracycline alone which showed relapse after four months [43]. In Germany when an adult female Bornean orangutan was affected with deramtophilosis, symptoms resolved only transiently after corticosteroid treatment. However, after antibiotic treatment and withdrawal of all corticosteroids, complete recovery of affected animals and return to normal activity patterns was noticed [44]. The efficacy of Lamstreptocide A and B was studied on nine natural cases of bovine and caprine dermatophilosis employing standard histopathologic and bacteriological methods. The lesions of five of the treated cases dried up and there was marked peeling-off of scabs of a severely affected case exposing erythematous underlying tissue at 3 weeks post application of the product and three mild cases have recovered. An in-vitro sensitivity test of the product revealed a slowing down of growth of *Dermatophilus congolensis* at concentrations in excess of 1% by agar-streak method. There was no inhibition of growth of the bacterium by an agar-impregnated sensitivity method [45]. In Australia, a lytic phage with species-specific activity was isolated from wool samples of sheep infected with the actinomycete *Dermatophilus congolensis*. This isolated phage reduced the cell numbers of *D. congolensis* in vitro. Thus, the use of this phage as a bio-control agent of dermatophilosis was suggested [46]. In an outbreak of bovine dermatophilosis in Guadeloupe, when 100% morbidity rate and 45% mortality rate took place, drastic treatments were applied using antibiotics and local disinfection associated with the removal from pastures into covered stables allowed the recovery from the disease [47]. Very recently, two new triterpenic acids, namely oleanolic and ursolic acids, were isolated for the first time from the alcoholic extract of Mitracarpus scaber possessing antimicrobial effects on *Dermatophilus congolensis*.

These two triterpenic acids were also active on dermatophilosis in African animals. These acids were quantified in *M. scaber* using a new simple and rapid high performance liquid chromatography method compatible
with M. scaber detection. There is a great hope that this new development will contribute significantly in the chemotherapy of animal dermatophilosis [48]. Very recently, topical application of povidone-iodine and parental injection of long-acting oxytetracycline revealed 100% and 66.7% cure rates (respectively) in equines [49].

The only control method of this disease practiced in camels (Camelus dromedarius) was the regular washing with 1% potassium aluminium sulphate solution [33]. However, this method was not efficient when applied on camels in Saudi Arabia (Agab, unpublished data). In the Llama, on the other hand, it is recommended to use topical antibiotics only or to use disinfectants and/or systemic penicillin or trimethoprim-sulfadiazine for the treatment of dermatophilosis [50].

Recently, the use of phytotherapy was tried for the treatment of animal dermatophilosis by applying ointments prepared with ethanolic extracts of leaves of Senna alata, Lantana camara and Mitracarpus scaber as topical treatments on dermatophilosis lesions. It was observed that the lesions healed completely in all the affected animals without recurrence unlike the results observed by using oxytetracycline, terramycin long-acting or procaine-penicillin antibiotics commonly used parenterally for the treatment of dermatophilosis in many African countries [51]. These phytotherapies, when applied once a day for 8-15 days provoked the falling off of the crusts after 3-4 days of treatments and hair growth was noticed on the treated areas with complete healing without scarring within 3-4 weeks after the end of the treatment.

Animal breeders have observed that dermatophilosis susceptibility seems to be determined genetically. Therefore, recently new control methods based on the identification of molecular genetic markers of resistance or susceptibility to dermatophilosis in cattle was developed. A functional candidate gene approach was used to analyze the DNA polymorphisms of targeted genes encoding molecules implicated in known mechanisms of both non-specific and specific immune responses existing in the pathogen/host interface mechanisms. A haplotype marker of susceptibility was found and validated and used for selection and elimination of susceptible animals. This technique resulted in reducing the prevalence rate of dermatophilosis from 0.76% to 0.02% over five years. However, a cross-breeding plan was suggested to study the genetic transmission of the genotypic and phenotypic characters of susceptibility to dermatophilosis and those individuals at highest risk of contracting the disease will be eliminated [52; 53]. The properties of this system are now under study, including the heterozygote advantage and the frequency dependence theories and their involvement in the biological mechanisms at the host/pathogen interface [53].

Research is still in progress regarding the understanding of the immunological mechanisms involved in the development and the resolution of dermatophilosis at the skin level in order to develop efficient vaccines. Efforts to identify markers correlating with resistance or susceptibility to the disease through analysis of polymorphic systems at the DNA level were on progress. It is highly recommended that all research groups working on dermatophilosis should be better identified with their research priorities and better collaboration with other research groups working on the same field is highly needed to achieve a better and fast advancement of research on this disease.

**Prevention:** There are options important for the prevention and control of Dermatophilosis as stated by [9, 15, 27, 54, 49, 41] respectively like avoidance of skin trauma and management practices that promote transmission, treatment with antibiotics, grooming of infected animals to remove crusts that contain the organism, disposal of the crust appropriately to prevent further contamination of the environment, establishment of breeds resistant to *Dermatophilus congolensis* and for humans, use of protective clothing, gloves and personal hygiene.

**CONCLUSION AND RECOMMENDATION**

Dermatophilosis is contagious zoonotic skin disease with wide host range and most commonly affects cattle, sheep, horses and camel. The principal causative agent is *Dermatophilus congolensis* which is a member of the aerobic actinomycete. Dermatophilosis has a worldwide distribution and the disease is reported most frequently in relatively low latitude areas with tropical and subtropical climates with high ambient temperature and torrential rain patterns. The disease is non pruritic and is characterized by exudative dermatitis with scab formation. A number of factors are involved in the pathogenesis of Dermatophilosis. Some of them are trauma or damage to the skin, rainfall, tick infestation and stress that compromise the host immune system. Diagnosis of Dermatophilosis can be made based on clinical appearance of the lesion on the affected animal and demonstrating the causal organism from the lesions beneath the scabs. Parenterally administered antibiotics
such as long acting oxytetracyclines are usually effective. The control and prevention measures of Dermatophilosis are aimed at minimizing the effect of predisposing factors and early treatment of clinical cases.

Humans can acquire the infection of Dermatophilosis who are exposed to infected animal or contaminated animal products and in most cases the lesions heal spontaneously within two or three weeks. Dermatophilosis often creating economic problems by creating severe skin matting resulting in hide depreciation, overall decrease in animal productivity and severe case mortality in susceptible weak animals. Despite the high significance of camel dermatophilosis, no direction of collaborative research efforts on this serious disease did exist in the affected countries.

**Recommendations:**

- It is important to call for collaborative efforts and securing enough funds to establish a joined research programme on this disease in camel since there was no direction of collaborative research efforts on this serious disease did exist in the affected countries.

- The control measures and chemotherapy of the disease in camels need special effort as the disease is widely spreading among camel populations in several camel keeping countries.

- More investigations on the immunology and genetically determined susceptibility or resistance to diseases transmitted or associated with ticks are needed as this could be a promising and sustainable way to control these diseases.

- Factors that bring mechanical injury to the skin should be avoided and management practices that promote transmission should be avoided.

- In areas where tick infestation is present acaricides should be given.

**REFERENCES**


