



**Prevalence and Causal Factors Analysis Associated with Ringworm Infection among One-humped Camel (*Camelus dromedarius*) in Tamboul, Sudan**

**H.A Habeeballa<sup>1</sup>; M.E Abdella<sup>1</sup>; Mzahir S. Mohamed<sup>1</sup>; Mohamed, Y.A Babiker<sup>2</sup> and A. D. Abakar<sup>3\*</sup>**

1. Department of Medicine and Therapeutics, Faculty of Veterinary Medicine, University of Al-Butana, Sudan email [habeebmelect30@yahoo.com](mailto:habeebmelect30@yahoo.com).
2. Department of Parasitology, Medical Science Programme, Wadmadani College of Medical Sciences and Technology. Email [myab624@yahoo.co.uk](mailto:myab624@yahoo.co.uk).
3. Department of Medical Parasitology, Faculty of Medical Laboratory Sciences, University of Gezira. E-mail: [adamd@uofg.edu.sd](mailto:adamd@uofg.edu.sd).

\*Corresponding author A.D Abakar email: [adamd@uofg.edu.sd](mailto:adamd@uofg.edu.sd).

**ABSTRACT:** Ringworm is a zoonotic skin disease and one of the most frequently occurring in human and his domesticated animals. It is estimated that 20% of the world population is affected with dermatophytosis. Cameline dermatophytosis has a great public health and economic impact that leads to the emaciation, low milk and meat production, and poor hide quality. The present study aimed to determine the prevalence of dermatophytosis among One-hump camels raised in Albutana plain. 800 camels of different age, sex, breed and location in different seasons that provided from all over Sudan to Tamboul livestock market were recruited in the study. Skin scrapings were collected from clinically suspected camels and examined using Potassium hydroxide (KOH) technique to determine arthrospores in positive cases. 275 (34.4%) cases were infected with ringworm. The clinical feature of infected animals was presented by circular small disc-shaped and/or irregular alopecia with white, grey or brown crusts distributed on various part of the body, and sometimes granulomatous lesions were also observed. Microscopic examination of positive slides revealed significance variation ( $p \leq 0.05$ ) in types of arthrospores detected among infected camels. The distribution of arthrospores were in the following order; ectothrix (31%), ecto-endothrix (16%), endothrix (14.3%), ectothrix and Favic hyphae (12.3%), ectothrix, endothrix and favic hyphae co-existence (7%), endothrix and favic hyphae (6%) and favic hyphae (5%). Analysis of disease determinants showed significant variation of season on dermatophytosis prevalence ( $p = 0.00$ ), the higher incidence was recorded in winter (33%) followed by autumn (31.7%) and summer (27%). Other factors like age, sex and location showed no significance effect on dermatophytosis infection. Direct examination based on KOH is rapid and reliable technique for diagnosis of ringworm infection, it could be recommended as a field test that leads to prevention and elimination of zoonotic dermatophytes.



**Keywords:** Dromedary, Ring worm, Prevalence, Tamboul, Sudan

© 2019 Sudan University of Science and Technology; All rights reserved

## INTRODUCTION:

Camels are very important animals, there are around 25 million of one-humped camels (*Camelus dromedarius*) worldwide, and 80% of them are in Africa. Somalia and Sudan have the highest population (FAO, 2009). According to camel population, Sudan is the second largest country worldwide with in camels' population, been estimated as more than four million (Ministry of Animal Resources, 2013). 25.7% from total camels in Sudan were found in Eastern region mainly in Albutana plain and Red Sea hills (Darosa, 2005). The zoophilic dermatophytes infections have considerable zoonotic importance (Cabañes, 2000), they are frequently reported with highly occurring rates in animals and humans (Pal, 2007b; Seebacher *et al.*, 2008; Nweze, 2011 and Dave *et al.*, 2014), 20% of the world population is affected with the disease (Pal and Dave, 2005). Dermatophytosis especially among camels, can occur in sporadic as well as in epidemic form, and has a great public health and economic significance (Pal and Thapa, 1993; Dalis *et al.*, 2014; Dave *et al.*, 2014). Ringworm cause reduced weight lower milk yield and poor hide quality for the leather industry as it makes the hides unsuitable (Moretti *et al.*, 2013), additionally, the high cost of treatment and lack of control measures all account for its particular relevance (Bond, 2010). In the last few decades, there have seen a significant rise in the incidence of

chronic dermatophyte infections of skin, which have proven difficult to be treated (Suganthi, 2017). Humans at risk for acquiring the disease were; animal owners, animal attendees, and field veterinarians (Salem *et al.*, 2018), the most common carriers of these microorganisms are particularly domestic animals such as cows, goats, sheep and camels (Shams-Ghahfarokhi, 2009).

Dermatophytes are classified into three genera, namely *Epidermophyton*, *Microsporum*, and *Trichophyton* (Kuttin *et al.*, 1986; Fadlemula *et al.*, 1994; Pal and Lee, 2000; Ghoke *et al.*, 2006). They grow best in warm and humid environments and are, therefore, more common in tropical and subtropical areas of the world (CFSPH, 2013). Camel's long-haired skin presents a proper habitat for the growth of dermatophytes (Agab, 1993). The lesions of the disease characterized by circular area of alopecia, scaling, crusts, erythema and pruritus present at various degrees, affect the skin and cause deterioration of the quality of hide. Dermatophytosis may also prevailing in cold climates (Nooruddin and Singh, 2009). Spores may remain viable in suitable environments for up to 12-20 months, certain types of spores (e.g., microconidia) might be dispersed by airborne means (The center for food security public health, 2013).

Diagnosis of dermatophytosis based on microscopy examination of direct



specimen are also still important (Graser *et al.*, 2008), early detection of the disease may further aid in the prevention, spreading and elimination of highly important zoonotic dermatophytes (Putty *et al.*, 2018).

Few and scattered data concerning the prevalence of dermatophyte infection among camels were reported, in a survey during one year, include 498 young camel calves under two years old in eastern region, ringworm infection account for only 43.6% of examined animals (Fadlelmula *et al.*, 1994). The present study reports on detection and prevalence of dermatophyte infection among dromedary camels in Tamboul over one year- survey period.

## MATERIALS AND METHODS:

### *Study area:*

The present investigation was conducted at Tamboul livestock market, it is one of the biggest markets of camels founded in Sudan, located at latitude 14° 52' N and longitude 33° 31' E, 150 km towards the south the capital of Sudan; Khartoum.

The study was designed to be observational and analytical and aimed to determine the prevalence of dermatophytes infection among camel herds raised in Al butana plain using direct examination technique.

### *Study population and sample size:*

Eight hundred camels of different age, sex and location in different season provided to Tamboul livestock market or Tamboul abattoir from all over Sudan, and represented by different breeds and ecotypes were included and clinically

examined, out of 800 suspected animals, 300 skin scrapings samples were taken for the detection of the dermatophytes spp. Sample size required was calculated based on the formula  $N = Z^2 pq/d^2$  and prevalence of ringworm probability was taken according to (Fadlelmula *et al.*, 1994), that revealed 43.5% of camels in Eastern Sudan were affected with ringworm (Dermatophytosis).

### *Sample collection:*

Cotton swabs, soaked in 70% ethanol, were used to clean the infected area. Lesions were scrapped using a sterile scalpel and specimens were collected in sterile petri-dishes. All specimens were labeled for age, sex, location, and date of collection, and then transferred to the laboratory for diagnosis ringworm.

### *Direct KOH Examination:*

On a clean glass slide, a part of each specimen was placed, added to it few drops of 20% Potassium Hydroxide (KOH) to digest the keratin material, then covered with a clean glass and gently heated for one minute, the slide was microscopically examined used 10X objective lens for the presence of arthrospores (Shinkafi and Manga, 2001).

### *Statistical Analysis:*

Data collected from this study was analyzed statistically using Statistical Package for Social Science (SPSS) program, version 16. Results was summarized as means  $\pm$  S.D and levels of significance was taken at ( $P \leq 0.05$ ).

## RESULTS:

### *Clinical examination:*

Cases infested by ringworm were clinically diagnosed and confirmed by circular small disc-shaped (Figure 1 and Figure 2) and/or irregular alopecia with white or brown crust distributed on various part of the body (Figure 3 and

Figure 4). In some cases, the crust in alopecia revealed dry, hard, grey color, larger in size and even granulomatous lesions spreading over the whole body surface of infected camels (Figure 5). Other lesions, leaving behind as ash like deposit over the whole skin of infected animals were observed (Figure 6).



**Figure (1):** Circular small disc-shaped with crust in thigh region.



**Figure (2):** circular small disc- Alopecia and white Alopecia and crust in hip region.





**Figure (3)** Irregular alopecia with white crust



**Fig 4** Irregular alopecia with brown crust distributed on shoulder, thorax and abdomen distributed on various parts of the body.



**Figure (5):** Dry, hard, gray and granulomatous crust spreading over the whole body surface.



**Figure 6:** Crust like ash over the skin (hump area).

Confirmation of clinically suspected camels by microscopic KOH examinations showed that different types of arthrospores were distributed with different frequencies among suspected camels (Table1). Types of arthrospores and hyphae identified were depicted in Fig7 through 15. There was high

frequency of ectothrix (31%), followed by ectothrix endothrix (16%) and endothrix (14.3%), then ectothrix Favic hyphae (12.3%) and ectothrix +endothrix + favic hyphae (7%), endothrix +Favic hyphae (6%) and Favic hyphae (5%).

**Table 1:** Frequency distribution of arthrospores in camels infected with ringworm using KOH direct examination technique:

Type and location of arthrospores	Frequency	Percentage
Ectothrix	93	31%
Endothrix	43	14.3%
flavic hyphae	15	5%
ecto + Endothrix	48	16%
ecto and flavic hyphae	37	12.3%
endo and flavic hyphae	18	6%
ecto endo and flavic hyphae co-existence	21	7%
Negative (-ve)	25	8.4 %
Total	300	100%

**Prevalence of dermatophytes among infected camels:** As depicted in Table.2, out of the 300 clinically suspected

camels, 275 there found infected by arthrospores with an overall prevalence of 91.7% (275/300) and 8.3% (25/300)



were negative for dermatophyte infection.

**Table 2:** Prevalence of dermatophyte infection among clinically suspected camels (n=800)

NO. of suspected camels	No. of positives (+ve)	No. of negatives (-ve)
300	275 (91.7%)	25 (8.3 %)

Seasonality has significant effect on dermatophytosis infection. Ringworm revealed significant higher prevalence incidence ( $p < 0.05$ ), in winter (33%), followed by autumn (31.7%) and summer (27%) were positive (Table 2).

**Table 3:** Prevalence of dermatophytosis among examined camels according to season

Season	No. of +ve	No. of -ve	Total	p. value
Summer	81 (27%)	19 (6.3%)	100	0.000
Autumn	95 (31.7%)	5 (1.7%)	100	
Winter	99 (33%)	1 (0.3%)	100	
Total	275 (91.7%)	25 (8.3 %)	300	

Analysis of dermatophytes prevalence according to age showed that there were 66 (22%) positive cases among age group <5 years, 153 (51%) among age group 6-10 years, and 55 (18.3%) among age group 11-15 years. Only 1 (0.3%) of clinically suspected animals among age

group >15 years were infected. The high positivity was seen among age group 6-10 years (51%). Chi-square showed no significant variation effect of age on camels infected with ringworm ( $p = 0.959$ ) Table 3.

**Table 4:** Prevalence of dermatophytosis among examined camels according to age (n=800)

Age group	No. of +ve	No. of -ve	Total	p. value
<5 years	66 (22%)	6 (2%)	72	0.959
6-10 years	153 (51%)	14 (4.7%)	167	
11-15 years	55 (18.3%)	5 (1.7%)	60	
>15 years	1 (0.3%)	0 (0%)	1	
Total	275	25	300	

**Prevalence of ringworm among suspected camels according to sex:**

The effect of gender on the prevalence of ringworm among clinically suspected camels was depicted in Table (5). The infection rate was 10.7% among males

and 81% among females. Results showed no significant variation ( $p = 0.209$ ) effect of sex on incidence ringworm in camels raised in Al Butana plain.

**Table 5:** Prevalence of dermatophytosis among suspected camels according to sex

Sex	No. of +ve	No. of -ve	Total	p. value
Male	32 (10.7%)	1 (0.3%)	33	



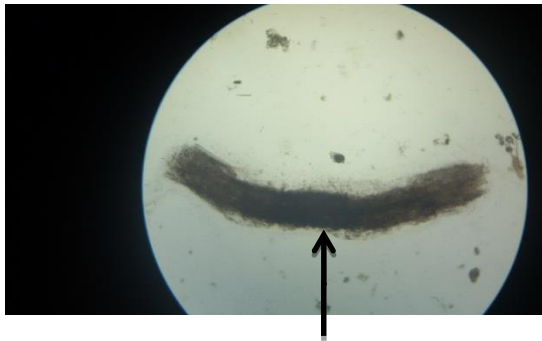
Female	243 (81%)	24 (8%)	267	0.209
Total	275	25	300	

The Prevalence of ringworm among suspected camels according to location gave no significant difference between infected animals the infection rate was as

follows: 41% from Kassala region, 32% from Darfur region and 18.7% from Albutana region, (Table 6).

**Table 6:** Prevalence of ringworm among clinically suspected camels according to location

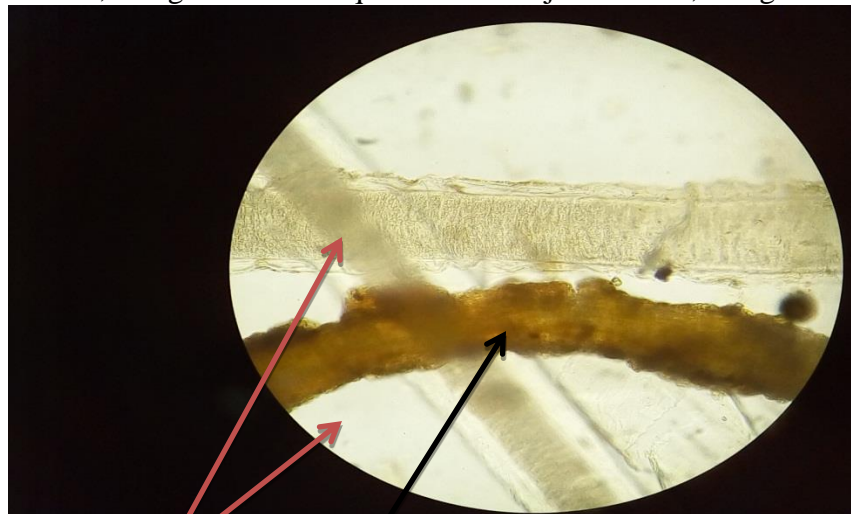
Location	No. of +ve	No. of -ve	Total	p. value
Butana region	56 (18.7)	8 (2.7%)	64	0.117
Kassala region	123 (41%)	6 (2%)	129	
Darfur region	96 (32%)	11 (3.7%)	107	
Total	275	25	300	



**Figure 7:** ectothrix under microscope 10X objective lens, using KOH technique.

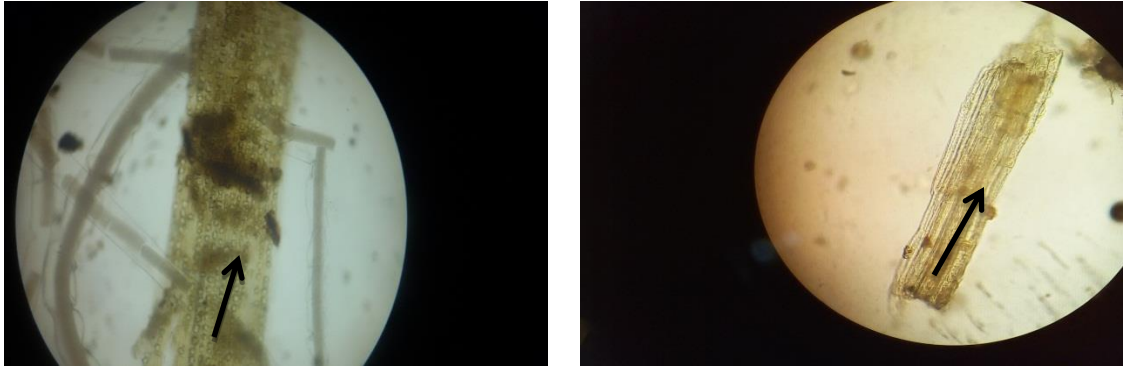


**Figure 8:** ectothrix under microscope 10X objective lens, using KOH technique.





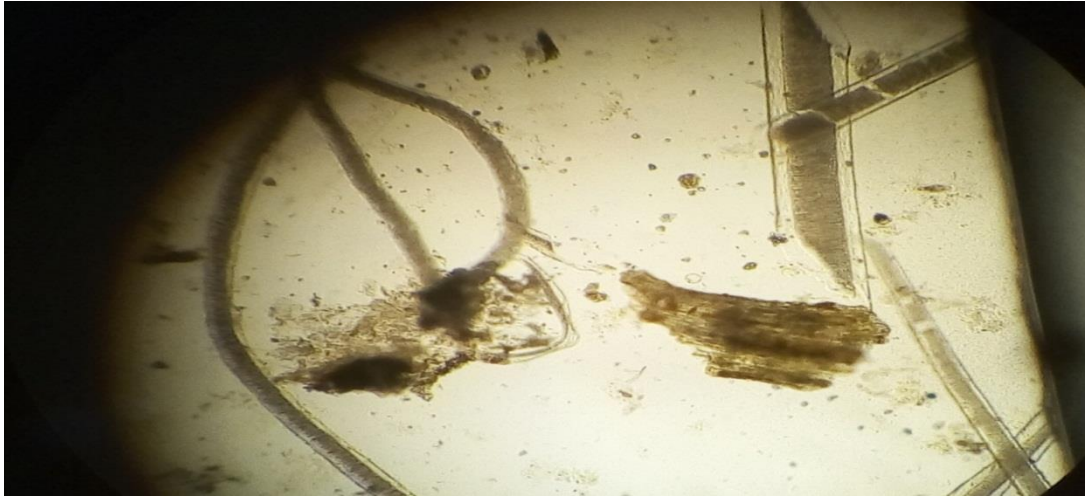
**Figure 9:** ectothrix+ endothrix under microscope 10X objective lens.



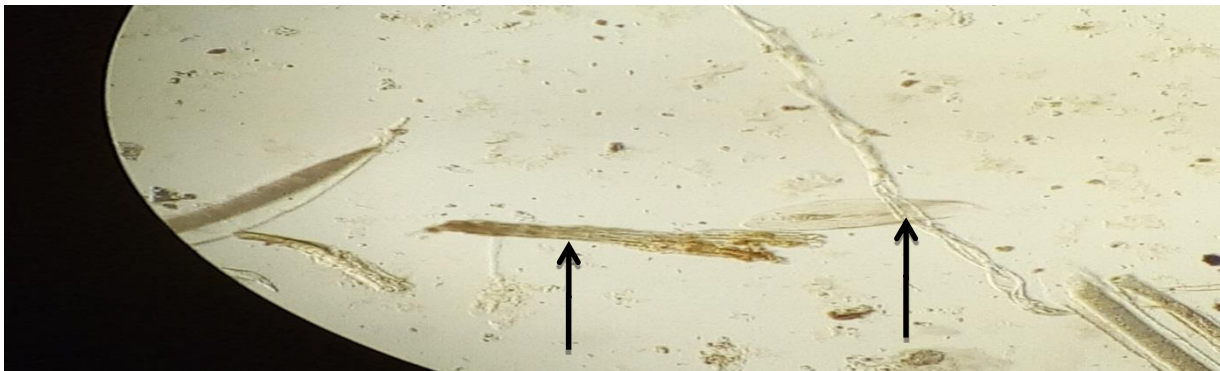
**Figure 10:** endothrix under microscope 10X **Figure 11:** endothrix under microscope 10X objective lens.



**Figure 12:** non-infected hair and (favic hyphae + ectothrix).



**Figure 13:** noticed different types of arthrospores there are Ectothrix, Endothrix and Favic hyphae under microscope 10X objective lens used KOH Method.



**Figure 14:** endothrix + favic hyphae under microscope 10X objective lens.



**Figure 15:** arthrospores hyphae type; Favic hyphae under microscope 10X objective lens.

#### DISCUSSION:

Camel breeding is essential economic activity among agro-pastoral communities in Sudan. camel remains the source for the supply of daily meat and milk in the study area. Moreover, the animal is used in ceremonial festivals, providing important trade between the area and different parts of the Sudan and contribute significantly in the improvement of individual income. Consequently, knowledge on shin diseases is essential for health, production and husbandry of the dromedary. The present study was investigated ringworm infection in camels raised in Albutana plain used KOH technique, also some predisposing factors were studied and data was analyzed statistically.

The examination of suspected camels revealed that in the positive cases, the clinical characteristics and lesions

described were comparable with findings by other investigators; Tuteja *et al.*, 2013, Al-Ani, 2004, Wisal and Salim 2010, Enany *et al.*, 2013 and Eissa *et al.*, 2013.

In this study, it was reported that 34.4% (275/800) of cases were infected with ringworm, this result agrees with result recorded by (Fadlelmula *et al.*, 1994), he noted that 43.5% were diagnosed with ringworm in a survey of camel ringworm in Eastern Sudan. The current result showed less percentage than that reported by (Mahmoud, 1993) who recorded 48% were positive for fungal infection (ringworm), while more than that done by (Wisal and Salim, 2010) who revealed the incidence of dermatophytes infection was 11.2%. These different results may due to different environmental condition, research areas and predisposing factors.





Direct Microscopy showed that Ectothrix, Endothrix and Favic hyphae also more than one arthrospore in the skin scrapings was recorded. This result in agreement with the result reported by Wisal and Salim (2010) and similar to Eissa *et al.*, 2013 who recorded the presence of arthrospores either outside the hair (Ectothrix) or inside the hair shaft (Endothrix). The result also agreement with (Mycopathol,2016) who showed that skin scrapings in 10 % potassium hydroxide solution under light microscope revealed thin, septate hyphae, and arthrospores morphologically simulating to dermatophytes.

Analysis of causal factors for ring worm infection among camels clarifies the effect of season on dermatophytosis, was found to be of high significant variations ( $p = 0.00$ ), the incidence was high during winter season (33%). This result is similar to (Ashraf, 2014) who showed that the prevalence of ring worm was high during winter (59%) and the rainy season. Other findings documented prevailing of dermatophytes infection on other seasons. FadlMulla *et al.*, (1994) recorded increased incidence of the disease among camels during rainy season than the hot dry months of the year. Likewise, other authors revealed that dermatophytosis were particularly common in cold climates (Nooruddin and Singh, (2009); Eissa *et al.*, 2013). ElAshmawy and Ali, (2016) noticed dermatophytosis predominates during the winter and can rapidly develop into an epidemic.

In the current study, it is worth mentioning that the gender of infected animals has no significant effect the on

dermatophytosis prevalence. This finding was strongly supported by Wisal and Salim, (2010) who noted no significant difference in the susceptibility of male and female camels to ringworm infection.

According to age, our result also recorded no significant variation ( $p>0.05$ ). this finding in in contrary with conclusion drawn from study of Najla and his collogues that revealed younger animals had a higher rate of infection (Najla *et al.*,2016). Moreover, Agab, (1993) showed ringworm occurrence predominates in camels less than 3-year age. Wisal and Salim (2010) who noticed the high susceptibility of young camels is probably due to the low immunity of young camels or due to the suitable microclimate of the skin of young camels to ringworm. Enany *et al.*, (2013) recorded young camels, between 1-2 years old or less, were more commonly affected than mature healthy camels. This different result may be due to the culture of camels' owners, they don't classify camels in housing according to age, they do not isolate ringworm infected camels from the healthy camels, and additional to that no effective treatments was provided.

The effect of location on the prevalence of dermatophytosis showed no significant difference in study area ( $p>0.05$ ). This result confirmed that the ringworm was widely spread and epidemic in different region of Sudan. To our knowledge, no limits to animal's movement (free range system) play important role in the distribution of the



ringworm infection all over Sudan, as this was the first study to record dermatophytosis infection in the area.

#### CONCLUSION:

KOH Technique is rapid, economic and reliable diagnostic tool worth using in routine diagnosis of ringworm infection. Strategic application of antifungal, especially during winter and rainy season, is highly recommended for control of ringworm. Wide area survey regarding interaction between ringworm infection and dietary problems is strongly recommended.

#### REFERENCES:

- Agab,H, (1993). *Epidemiology of Camel Diseases in Eastern Sudan with Emphasis on Brucellosis*, MSc Thesis. Sudan: University of Khartoum.
- AL-Ani, F.K (2004). Camel management and disease, Baghdad University Republic of Iraq, first edition.
- Ashraf, S.H (2014). Prevalence of Common Diseases in Camels of Cholistan Desert, *Pakistan Journal of Infection and Molecular Biology*, 2(4): 49 – 52. <http://dx.doi.org/10.14737/jimb.2307-5465/2.4.49.52>
- Bond, R. (2010). Superficial veterinary mycoses. *Clin Dermatol.* 28: 226-236.
- Cabañes F. J. (2000). Dermatophytes in domestic animals. In *Biology of dermatophytes and other keratinophilic fungi* chapter: 13 Revista Iberoamericana de Micología, Bilbao.

Center for food security public health, (2013), *Dermatophytosis*, Iowa state University, faculty of veterinary medicine, [www.cfsph.iastate.edu](http://www.cfsph.iastate.edu) Email: [cfsph@iastate.edu](mailto:cfsph@iastate.edu).

CFSPH. (2013). *Dermatophytosis*. Center for Food Security and Public Health, Iowa State University, Ames, Iowa, USA. Pp.1- 13.

Dalis,J.S., Kazeem,H.M., Kwaga,J.K.P. and Kwanashie, C.N. (2014). An outbreak of ringworm caused by *Trichophyton verrucosum* in a group of calves in Vom, Nigeria. *African Journal of Microbiology Research*, 8: 783-787.

Darosa, A. El. M. (2005). Studies on some camel production traits and health in Butana area, Sudan. Ph. D. Thesis. University of Khartoum.

Dave, P., Mahendra, R. and Pal, M. (2014). Growing significance of *Microsporum canis* in tinea of animal handlers. *Journal of Environmental and Occupational Science*, 3: 193-195.

Eissa, B., Ezzat, M., El-Sawah, A. and EL-Hamoly, M. (2013). survey on common causative agents of Dermatophytosis in different animals in EL-bieda-Libya n Faculty of Veterinary medicine, Omar Almkhtar University, *Benha Veterinary Medical Journal*, 24(2): 108 -115.

ElAshmawy, W. R. and Ali, M. E. (2016). Identification of



- Different Dermatophytes Isolated From Cattle, Cats and Horses Suffered From Skin Lesions, Department of Internal Medicine and Infectious Diseases, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt, *Alexandria Journal of Veterinary Sciences*, **49** (2): 126-132 ISSN 1110-2047, [www.alexjvs.com](http://www.alexjvs.com) DOI: 10.5455/ajvs.224778.
- Enany, M. E., khafagy, A. R., Madiha S. Ibrahim<sup>1</sup>, Marwa M. Azab and Dalia T. Hamad (2013). Identification of dermatophytes isolated from ringworm lesions of camels, *Department of Microbiology, Faculty of Veterinary Medicine, Suez Canal University, Ismailia Egypt. And Damhour University, El Bostan, Egypt*.
- Fadlemula, A., Agab, H., Le Horgne, J. M., Abbas, B. and Abdalla, E. (1994). First isolation of *Trichophyton verrucosum* as the etiology of ringworm in the Sudanese camels (*Camelus dromedarius*). *Rev Elev Medicine Veterinarie Pays Tropicaux*, **47**: 184-187.
- FAO (2009). Food and agriculture organization of the United Nations. <http://faostat.fao.org>.
- Gorakh, M, Sena, D.S, Sahani, M.S (2006). Haemato-biochemical changes in camels infested with mange during winter and summer season. *Journal of Camel Practice and Research*. **13**(2): 173-174.
- ISSN: 0971-6777 URL: <http://www.camelsandcamelids.com>.
- Graser Y., Scott J. and Summerbell R. (2008). The New Species Concept in Dermatophytes a Polyphasic Approach. *Mycopathologia*. **166**(5-6): 239-256.
- Kuttin, E.S., Alhanaty, E., Feldman, M., Chaimovis, M. and Muller, J., (1986), Dermatophytosis in camels. *Journal of Medical and Veterinary Mycology*, **24**: 341-344.
- Mahmoud, A.L (1993). Dermatophytes and other associated fungi isolated from ringworm lesions of camels. *Folia Microbiol (Praha)*. **38**(6): 505-8.
- Ministry of animal resources (2013). department of statistic and information, Khartoum, Sudan.
- Moretti, A., Agnetti, F., Mancianti, F., Nardoni, S., Righi, C., Moretta, I., Morganti, G., Papini, M. (2013). Dermatophytosis in animals: epidemiological, clinical and zoonotic aspects. *Ital. Dermatol. Venereol.*; **148**: 563-572.
- Mycopathol, (2016). First mycological investigation of dermatophytosis in camels due to *Trichophyton verrucosum* in Ethiopia, *Res*. **54**(1): 89-92, 2016; (ISSN 0971-3719).
- De Hoog GS. (2000). Atlas of Clinical Fungi, 2nd ed. Utrecht:





- Centraalbureau voor Schimmelcultures; 2000.
- Najla M., Baghza, Abdulelah H., Al-Adhroey, Abdullatif D. Ali, (2016). Isolation and Identification of Potential Zoonotic Dermatophytes from Domestic Camels in Dhamar Area, Yemen, 1Department of Microbiology, Faculty of Medicine and Health Sciences, *American Journal of Health Research*. Vol. 4, No. 3, 2016, pp. 46-50.
- Nooruddin, M. and Singh, B. (2009). Dermatophytosis in Buffaloes, Cattle and their Attendants. *Mycoses* 30: 594-600.
- Nweze, E.I. 2011. Dermatophytosis in domesticated animals. *Revue Institute Medical Tropical Sao Paulo*, 53: 94-99.
- Pal, M. and Lee, C.W.2000. *Trichophyton verrucosum* infection in a camel and its handler. *Korean Journal of Veterinary Clinical Medicine*, 17: 293-294.
- Pal, M. and Thapa, B.R.1993. An outbreak of dermatophytosis in baking deer (*Muntiacus muntjak*). *Veterinary Record*, 133: 347- 348.
- Pal, M., (2007b). *Veterinary and Medical Mycology*. 1st Ed. Indian Council of Agricultural Research, New Delhi, India.
- Pal, M. and Dave, P.2005. Tinea faciei in a goat handler due to *Microsporum canis*. *Revista Iberoamericana de Micologia*, 22: 181-182.
- Putty, K. Jyothi, J. S. Sharanya, M. Reddy, M. S. Ram Sandeep, G. S. Abhilash, M. Yadav, J. V. Purushotham, P. Naidu, I. K. Chowdhary, A. U. Rani, K. S. Pavani, V. Vishwas, K., Reddy, B. M., Srinath, Ch., Swapna, P., Sreeja, A., Kumar, E., Reddy, Y. N and K. akshmi, D.L. (2018) PCR as a Rapid Diagnostic Tool for Detection of Dermatophytes, Department of Veterinary Microbiology, Telangana Veterinary University, Rajendranagar, Hyderabad-500030, Telangana, India, *International Journal of Current Microbiology and Applied Sciences*, ISSN: 2319-7706 Volume 7 Number 04 Journal homepage: <http://www.ijemas.com>.
- Salem, M., Al-Bulushi S., Eljalii, I., Fadlelmula A. and Housawi F., (2018) , A Regional Study on Dermatophytes Infection in Arabian Dromedary Camels (*Camelus dromedaries*) in Al-Hassa Governorate in the Eastern Province of Saudi Arabia, 1Department of Medicine and Infectious Diseases, Faculty of Veterinary Medicine, Cairo University, Egypt. *Current Journal of Applied Science and Technology* Article no.CJAST.41288.



- Seebacher, C., Bouchara, J. and Mignon, B., (2008), Update on the epidemiology of dermatophyte infection. *Mycopathologia*, 166: 335-352.
- Shams-Ghahfarokhi M., Mosleh-Tehrani F., Ranjbar-Bahadori S., and Razzaghi-Abyaneh M., 2009 “An epidemiological survey on cattle ringworm in major dairy farms of Mashhad city, Eastern Iran,” *Indi. Jour. of Microbio.*, 1: 31–36.
- Shinkafi, S.A. and Manga S. B., 2001 “Isolation of dermatophytes and screening of selected medicinal plants used in the treatment of dermatophytoses,” *I. J. M. R.*, 2: 40–48.
- Suganthi. M., (2017). Pathogenesis and clinical significance of dermatophytes: A comprehensive review, *Innovations in Pharmaceuticals and Pharmacotherapy*, Department of Microbiology, Government Kilpauk Medical College, Chennai, Tamilnadu, *India IPP*, 4(1): 62-70. [www.innpharmacotherapy.com](http://www.innpharmacotherapy.com).
- Tuteja, F.C. Patil,N.V. Nagarajan, G. Narnaware,S .D. Dahiya, S.S. R.K. Singh, Pathak, K.M. and Singh, S. (2013), camel dermal mycoses caused by dermatophytes, Indian Council of Agricultural Research, Krishi Bhawan, N. Delhi, National Research Centre on Camel, Jorbeer, Shivbari, P.B.-07, Bikaner-33400.
- Wisal A.G., and Salim M.O., (2010). “Isolation and identification of dermatophytes from infected camels,” *Sudan J. Vet Res.*, 25: 94–53.