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EPIDEMIOLOGICAL AND THERAPEUTICAL STUDIES ON GOAT DERMATOPHYTOSIS

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ABSTRACT

Fungal infection is common in both goats and human and it is caused by different species that infect superficial layer of skin and hairs. The skin scrapings examinations, fungal culture characters and fungal biochemical reactions were used to identify fungus in skin scraping samples of the examined goats. The isolated fungus from ringworm infected goats was *Trichophyton verrucosum*. The prevalence of Ringworm in (589) goats was (16.97%) and in Baladi and Zaribi goats separately was (15.26%) and (22.62%) respectively. The predisposing factors of caprine dermatophytosis were recorded as Season (Winter), Age (Senile and young), Sex (Female), Parasitic infestation(Internal and external parasitism) and Nutritional status(Starvation and mycotoxicosis). Systemic and topical fungicides were evaluated in 6 different groups of infected cattle. It was found that the efficacy of Trosyd, Vinegar, Betadine, Levamizole, Potassium Iodide and Griseofulvin was (77.77%, 44.44%, 75%, 25%, 62.5% and 100%) and (66.66%, 37.5%, 50%, 37.5%, 44% and 62.5%) in Baladi and Zaribi goats respectively. It was concluded that the best fungicide for treatment of caprine dermatophytosis in Baladi goats is Griseofulvin (100%) while in Zaribi is Trosyd (66.66%). .

Keywords: Caprine, dermatophytosis, epidemiology, diagnosis, fungicides.

INTRODUCTION

Caprine dermatophytosis (Ringworm) is a fungal infection of superficial, keratinized layers of epidermis and hair in animals (**Radostits et al., 2008**). Ringworm is known in most parts of the world including Egypt . The disease has been reported in most species of animals and in man. Of the almost 70 000 species of fungi that have been recognized and described, about 50 of these species are pathogenic for animals **(Rochette et al., 2003)**. Individual differences, race predisposition and

environmental conditions are important factors for the disease development. The mean incubation period is estimated to be 4-6 weeks. It has economic impact where hinders infected animals seal, may be associated with secondary bacterial infections, discomfort and unthriftiness (**Radostits et al., 2008**). Spores of fungus can survive in the environment up to 3 years and act as a source of human infections in Africa (**Nweze, 2010)**. Farmers could infected by contact with infected animals (**Spiewak and Szostak, 2000**).

Spread of ringworm is probably mainly due to the licking and grooming activities of the animal tongues, in young, weak and immune suppressed animals (**Arslani et al., 2007**). In addition, fungal spores, animals contact and infecting materials are involved in the transmission of the disease. Sick or asymptomatic animals may contaminate other animals,humans and environment. Extensive alopecia and/or circumscribed thick hairless skin patches are observed on the head, neck, flanks and limbs. Characteristic locations for lesions are recorded in thorax and limbs for female animals, ocular regions for young animals, dewlap and inter-maxillary space for male animals.

The lesions can persist for several weeks despite topical treatments with various anti-fungal drugs. Detection of disease agent on pathologic materials, microscopic examination, isolation and identification with culture are used for the diagnosis of the disease (**Arslani et al., 2007**). The aim of this study is to identify the causative fungi, to study the epidemiology and to evaluate fungicides for the treatment of caprine dermatophytosis.

MATERIAL AND METHODS

Animals

Five hundreds and Eighty nine (589) goats representing different age and sex groups including (452**)** Baladi and (137) Zaribi goats from farms and fields were clinically examined and the diagnosis of ringworm was proved by skin scraping and fungus culturing. The stress factors questionnaire was filled for each infected goats including (Season of year, Age of infected goats, Sex and breed of infected goats, Parasitic infestation and Nutritional status).

Samples

As described by **Al-Ani et al.,(2002)** and **Arslani et al., (2007),** the animals were stemming from various barns. The foreign matters into the lesions, contaminating fungus spores and the other factors such as particles of powder, sand and hay were removed by cleaning the lesions with 70% alcohol. After alcohol dried, The skin annular lesions were scraped peripherally, the hair tuft was also collected from the lesions. The half of skin scraping crusts and hairs was examined microscopically and the second half was cultured. The faecal samples were collected and examined for each infected animal.

Skin scraping

Skin scraping examination was carried out according to **Al-Ani et al.,(2002)** and **Arslani et al., (2007)**, the hairs obtained from the periphery of annular lesions were placed on a slide and steamed very briefly in a "clearing" solution of chloral lactophenol (two parts chloral hydrate, one part phenol, one part lactic acid), and examined under the microscope.

Culturing of fungus

Fungal culturing was done as described by **Al-Ani et al., (2002) and Arslani et al., (2007)**, other hairs were cut into small pieces, 1-3 mm. in length and inoculated onto Sabouraud dextrose agar and incubated at 35°C. Enrichment was added in the form of 0.05% meso-inositol and 0.005%0 thiamine chlorhydrate to each of the foregoing media in order to obtain rapid growth and larger colony size for the fungus if present.

Identification of the isolated fungus

The isolated fungus was identified according to (**CMPT, mycology plus), (fisher** and **cook, 1998)** and **(Al-Ani et al., 2002)** as following:

i-Colonial Morphology

The best incubation temperature for fungus isolation, the colony texture and shape and the thallus color were studied.

ii-Microscopic Morphology and Phase Contrast

The shape of fungus microconidia and macroconidia, the shape of fungus chlamydospores and hyphae were studied at 35°C on Sabouraud dextrose agar .

Biochemical Reactions: BCP, SDA and Urease

The fungus was studied biochemically to investigate its ability to hydrolyze Bromo Cresol Purple (BCP), its urease activity, its requirements of vitamins and its ability to perforate hair and grow better at 35°C.

Parasitological examination

The examined goats were examined visually for the detection of external parasites (Ticks and Flea). The collected goats faecal samples were examined by both concentration flotation and sedimentation techniques according to **Denham and Suswillo (1995).**

Evaluation of fungicides

Infected goats were classified into 6 groups, each was treated with fungicide. Six fungicides were evaluated including Trosyd lotion (Tioconazole 1%,Pfizer) topical dressing twice daily for 7 days, Potassium iodide(el-gomuhorea company, Egypt) in a dose rate of 1 gram/14 kg body weight daily for 7 days orally, Vinegar 5% (acetic acid, el-gomuhorea company) topical dressing twice daily for 7 days, Betadine lotion (Bovidone-Iodine 10%, Nile company for pharamaceuticals and chemical industries) topical dressing twice daily for 7 days, Levamizole (ADWIA pharmaceutical company) in a dose of 1 ml/10 kg body weight by subcutaneous injection twice with 7 days apart and Ultra-Griseofulvin (Griseofulvin 125 mg/ tablet) daily doses of 10 mg⁄kg orally for 7 days.

Fungicides were applied and evaluated weekly at one and two weeks after end of fungicide course by clinical improvement and skin scraping. The goat was considered recovered at the development of healthy hairs at the annular lesions of ringworm and disappearance of spores in microscopically examined hairs.

RESULTS

I-Clinical findings and epidemiology

In the infected goats, the severity of disease was varied, from small focal one cm lesions to extensive generalized skin involvement. Most often, the disease appeared as non-pruritic tail and perineum lesions in goats (photo-1 and 2). Lesions (Kerion) in goats consist of alopecia, scaling, erythema, and crusts. They typically involve the face, external ears, neck, or limbs, and may be annular in shape (**Scott, 2007**). Pruritus is not usual, but has been reported (**Chineme et al., 1981**). The ringworm lesions are more appeared often on the chest and limbs, ears, neck and

face. The initial lesions were discrete, grayish-white, crusty dry areas with a few brittle hairs. The lesion was noticeably higher than the surrounding skin. Infection spread from the center outwards and resulted in the circular lesion sized from 1 to 1.5 inches in diameter. Adjacent lesions might overlap and create larger infected areas. Some areas might become suppurative and thickly crusted. Lesions resembling light brown scabs might also be seen; when these scabs fall off leaving an area of alopecia.

II-Skin scraping and hairs examination

The microscopic examination of skin scraping and hair tuft showed fungus spores (small rounded refractile bodies) around hair shaft surrounded by sheath as in photos (3 and 4).

Photo-1: Kerion at goat tail

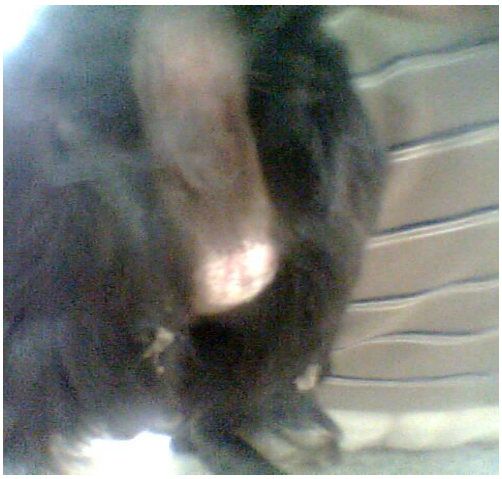
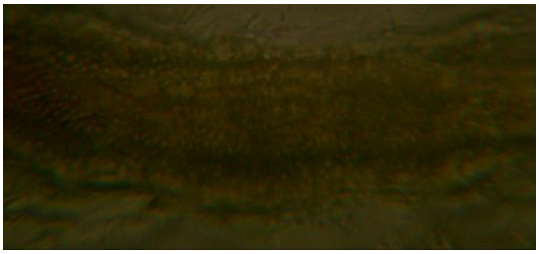
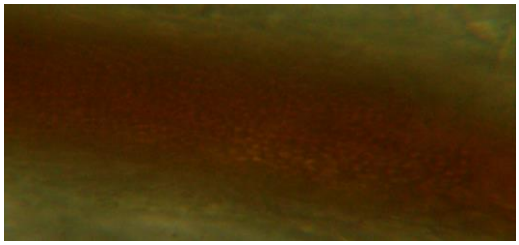


Photo-2: Kerion at perineum of buck



(A)



(B)

Photo-3: Trichophyton spores around hair shaft of goat (A and B)

III-Identification of the isolated fungus

The isolated fungus was identified as following

III-a-Colonial Morphology

Growth rate of the fungus was slow and better at 35°C. Within seven days the inoculated hairs were surrounded by an entire irregular, gray, moist sheath of mycelium. The colonies later became disc-shaped, waxy or glabrous, of heaped or flat texture ,of white, grey or yellow thallus color; some colonies appeared to have a few fluffy hairs in the center. The older colonies usually penetrated deeply into the media.

III-b-Microscopic Morphology and Phase Contrast

The isolated fungus was characterized by pyriform microconidia and few rat tail shaped macroconidia were found with characteristic chains of chlamydospores at 35°C and antler hyphae were formed on SDA.

IV-Biochemical Reactions: BCP, SDA and Urease

The isolated fungus was biochemically characterized by its hydrolysis effect on BCP ; it was positive urease; it needed thiamine and inositol ; not caused hair perforation and its growth was improved at 35°C.

The skin scraping, Colonial Morphology, Microscopic Morphology, Phase Contrast and Biochemical Reactions confirm that the isolated fungus was *Trichophyton verrucosum*.

V- Epidemiology

Out of 452 Baladi goats and 137 Zaribi goats, ringworm infected animals were 69 (15.26%) and 31 (22.62%) respectively. For all goats (589) the prevalence was (16.97%). As illustrated in table-1 and 2.

The following Predisposing factors were recorded for caprine ringworm depending on the collected data of questionnaire:

Season: Winter
Age: Senile and young goats
Sex : Female goats (during lactation and pregnancy)
Parasitic infestation: Internal and external parasitism
Nutritional status: Starvation and mycotoxicosis

IV- Parasites: results of parasitic examination of Ringworm infected goats are illustrated in table (3). *Eimeria spp.*, *Moniezia spp.*, *Nemtodirus* spp., *Trichuris* spp. (photo-3) , *Fasciola* spp, *Paramphistomum* spp were detected in faeces of Ringworm infected goats. Out of 100 Ringworm infected goats, 74 animals were suffering from parasitic infestations.

IIV-Evaluation of locally and systematically applied fungicides in infected goats are illustrated in table-4.

Table – 1: Distribution of goats infected with Ringworm.

	Goats	Baladi		Zaribi		Total
		Number	%	Number	%	
	Infected	69	**69.00**	31	**31.00**	100
	Non-infected	383	**78.32**	106	**21.67**	489
	Total	452	**76.74**	137	**23.25**	589
INFECTED	**Less than one year**	37	**67.27**	18	**32.72**	55
	1-2 years	7	**77.77**	2	**22.22**	9
	2-5 years	6	**66.66**	3	**33.33**	9
	Elder than 5 years	19	**70.37**	8	**29.62**	27
	Male	23	**62.16**	14	**37.83**	37
	Female	46	**73.01**	17	**26.98**	63
	Total	69	**69.00**	31	**31.00**	100

Table-2: Prevalence of Ringworm among goats

Goats	Infected		Non infected		Total
	Number	%	Number	%	
Baladi	69	**15.26**	383	**84.73**	**452**
Zaribi	31	**22.62**	106	**77.37**	**137**
Total	100	**16.97**	489	**83.02**	**589**

Table-3: Ringworm and parasitic infestation

Goats	Baladi		Zaribi		Total
	Ringworm	*Parasitic infestation	Ringworm	*Parasitic infestation	
Less than one year	37	26	18	16	55
1-2 years	7	3	2	1	9
2-5 years	6	4	3	2	9
Elder than 5 years	19	16	8	6	27
Male	23	19	14	11	37
Female	46	30	17	14	63
Total	69	49	31	25	100

**Eimeria spp., Moniezia spp, Nemtodirus spp., Trichuris spp, Fasciola spp, Paramphistomum spp were detected in faeces of some Ringworm infected goats.*

Table 4: Evaluation of fungicides for treatment of goats infected with ringworm

Fungicides		Goats					
		Baladi			Zaribi		
Name		Treated	Recovered	%	Treated	Recovered	%
Topical	Trosyd lotion	9	7	77.77	9	6	66.66
	Vinegar	9	4	44.44	8	3	37.5
	Betadine lotion	8	6	75	8	4	50
Systemic	Levamizole	8	2	25	8	3	37.5
	Potassium iodide	8	5	62.5	9	4	44
	Griseofulvin	8	8	100	8	5	62.5
Total		50	32	64	50	25	50

DISCUSSION

Ringworm infections in domestic animals are a major veterinary and public health problem. The infection mostly occurs by direct and indirect contact with spores of the fungus. Several species of the causative fungi were recorded all over the world. Once spores arrive to skin of immune suppressed animals, they germinate and attack the shafts of the

hair and the surface layers of the skin. Exudate oozes from the damaged skin and mixes with debris from skin and hair, thereby forming a crusty scab. Lesions are most frequent on the head and neck, but they may be found over the entire body in severe cases. Scabs may fall from older lesions and leave a hairless area in the center, one that has a ring of exudate at the edge.

The skin scraping, fungal culture and fungal biochemical properties were used to identify the fungus species. The causative agent of Ringworm in examined goats is T*. verrucosum* that agrees with that recorded a variety of dermatophytes have been cultured from ringworm in goats including *Microsporum canis* and *M. gypseum*, *Trichophyton mentagrophytes*, *T. schoenleinii* and *T. verrucosum*, and *Epidermophyton fl occosum* (**Philpot et al.,1984; Scott,1988**).

Yaharaeyat et al.,(2009) and **Arslani et al.,(2007)** mentioned the role of immune suppression in the infection with *Trichophyton verrucosum* in animal dermatophytosis and it brings on persistent dermatomycosis infections. The infection was observed in immune suppressed goats that included parasitized, pregnant, too old or too young, in female more than male and in Zaribi more than Baladi goats. The immune system is ill-developed in young cattle (55%) and it is also working poor in too old ones (27%) that interpret high infection rate in both too young and too old . The stress tolerance ability of the Baladi goats and their stronger immune system may explain the higher incidence of Ringworm in Zaribi goats (22.62 %) than Baladi (15.26%). The use of female for breeding and fattening of male goats on rich and balanced ration and stress of pregnancy and lactation may explain higher susceptibility of females (63%) than males (37%) for Ringworm infection.

The fungicides are more preferable than vaccine for control and treatment of ringworm because that no transfer of immunity against ringworm from vaccinated dam to progeny and the severity of skin lesions induced by challenge with a virulent culture of *T. verrucosum* was the same in calves born for the vaccinated and the non-vaccinated cows (**Rybnika et al.,2001**).

The systemic and topical fungicides were evaluated to treat *T. verrucosum* infection in goats. The mode of actions and also efficacies of fungicides are variable. It was found that the best systemic fungicide was *griseofulvin* that had efficacy of (100% and 62.5%) in Baladi and Zaribi goats respectively. Griseofulvin inhibits nuclear division of fungus cell (**Adams, 2001**). Oral griseofulvin was reported to be effective in treatment of ringworm in goats at 25 mg/kg/day for three weeks (**Chineme et al.,1981**), on other hand it was concluded as expensive therapy and was not justified (**Scott,1988**).

Some studies indicated that clinical adverse effects could have been seen in therapy with various systemic anti-fungal agents. Several case reports of mild to severe hepatic injury, including icteric and fatal cases, have been published (**Chien et al.,1997**). For instance, adverse effects of griseofulvin are gastro-intestinal symptoms, allergic reaction,photo-dermatitis, hepatic and renal dysfunctions **(Rochette et al.,2003)**. Similarly, ketoconazole adverse effects are hepatic dysfunction or asymptomatic increases of serum transaminases activities (**Chien et al., 1997; Schepens , Spanoghe, 1981**). So oral griseofulvin must be applied with certain limitations and in cases of generalized fungal infections.

The best topical fungicide was Trosyd (*Tioconazole 1%)* that had efficacy of (77.77% and 66.66 %) in native and frezian cattle respectively. The non recovered treated cattle could be explained by presence of fungal resistance to fungicides that were recorded by **Wabacha et al.,(1998),** they observed deeply and persisted lesions of dermatophytosis during more than 17 weeks and most of the calves did not respond to topical treatment with various antifungal drugs within the anticipated period of 9 weeks. **Gabal (1986)** also reported that skin lesions of bovine dermatophytosis needed long course of fungicides to reach complete healing, the lesions were resolved after 12 topical thiabendazole mixture (thiabendazole- DMSO-salycylic acid) applications and all lesions were healed completely after 16 applications.

Both *potassium iodide* and *betadine* are source of iodine which prevents fungus growth. The efficacy of potassium iodide was (62.5% and 44%) and of betadine (75% and 50%) in Baladi and Zaribi goats

respectively.*Vinegar (acetic acid)* is destructing fungus cells by its acidic pH especially in young goats where is skin pH was alkaline that enhance fungus growth, its efficacy was (44.44% and 37.5%) in Baladi and Zaribi goats respectively.Although *levamizole* is not classified as fungicide but it has effect for treatment of dermatophytosis. This effect could be explained by that the levamizole is anthelminetic, eliminate parasitic infestation with nematodes and it has non-specific immune stimulant effect by activating T-cells so it increase and restore cell mediated immunity (**Renoux et al., 1976**) and (**Adams, 2001**). Collectively, levamizole improve immune system to overcome fungus infection. Its efficacy for treatment of caprine dermatophytosis was recorded as (25% and 37.5%) in Baladi and Zaribi goats respectively.

CONCLUSION

Caprine dermatophytosis is caused by *Trichophyton verrucosum,* is more prevalent in Zaribi than Baladi goats, in winter than other seasons, in senile and young than adult goats, in female than male goats, in goats suffered from parasitic infestations and in Starved goats and goats suffered from mycotoxicosis. The best fungicide for treatment of caprine dermatophytosis in Baladi breed is griseofulvin (100%) while in Zaribi breed is Trosyd (66.66%).

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