



# Epidemiological investigations in Sarcoptic mange in camels with special reference in treatment

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**Abstract** This study was conducted in the kingdom of Saudi Arabia during the period from (August 2019 to August 2020) to investigate the sarcoptic mange infestation level in one humped camels (*Camelus dromedarius*), and to assess the effect of the age and season on the mange infestation, to assess the effect of the mange infestation on the appetite and body condition score (BCS) and to develop a good an applicable treatment protocol. 250 female camels were examined clinically and parasitologically, skin scraping revealed that *Sarcoptes scabiei var. cameli* mite was found in 28% of the examined animals, data analysis of the selected parameters showed that there was an effect for the age and season on the mange infestation, on the other hand there was no effect for the mange infestation on the appetite and BCS. Administration of Doramectin injection and Deltamethrin spray together founded to be the best treatment protocol for the sarcoptic mange infestation

in camels, this finding indicates that using the acaricides alone is not enough for the disease eradication and must combined with treatment of the contaminated environment to prevent the reinfection from surrounding areas and achieve the highest cure level.

**Keywords** Sarcoptic mange · Camels · Diagnosis · Doramectin · Deltamethrin

## Introduction

Sarcoptic mange is considered one of the most common parasitic diseases in camels (Higgins 1983), Compared to chorioptic mange (Higgins 1985; Singh and Momin 2008). This disease has an economic and zoonotic importance (Schillinger 1987), it Caused by *Sarcoptes scabiei var. cameli* (Curasson 1947) which is a tiny rounded burrowing mite belong to family Sarcoptidea, the female measures 330–660  $\mu\text{m} \times 250\text{--}400 \mu\text{m}$  and the male 200–240  $\mu\text{m} \times 150\text{--}200 \mu\text{m}$  (Longstaffe 1984), the life cycle lasts for 4–5 weeks (Richard 1987). This disease is highly contagious as it spreads rabidly between the animals directly through contact with the diseased animals and indirectly through contact with fomites (rugs, blankets, ropes) (Rose 1940; Scott and Miller 2003). It can be transmitted to the humans as well by direct contact with the infected animals (Bandi and SaiKuMar 2013). The most obvious clinical sings are intense pruritus, hair loss, emaciation and anemia (Leese 1927). It is started by pruritic nodules in the areas of thin skin like the head, base of the neck, axilla and thighs (Abu-Samra et al. 1981), after that these nodules leads to scratching, followed by hair loss, then after time these areas become dry, hard and characterized by crusts information, fissures developed in these

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crusts causing hemorrhage and emaciation, furthermore itching disturb the animals and distract them from eating which leads to increased weakness and loss of condition (Fassi-Fehri 1987). These consequences directly affect the animal production represented in decrease in the milk production, weight loss and increase the susceptibility to second bacterial infections (Megersa et al. 2012). In addition, it can lead to occasional mortalities in untreated and young animals as well Wilson (2008) which finally leads to economic losses. Most of the farmers imply the treatment when the infestation occurred, the first tool in mange eradication is administration of different acaricides formulation for example, the most common antiparasitic drugs used in mange treatment in bovine over the last 20 years is Ivermectin (0.2 mg/kg) given twice at 7 days interval (Radostits et al. 1994; Şuteu 1995). In recent years, Doramectin was used in large scale in mange eradication at a dosage of 0.2 mg/kg, repeated after 7 days (Şuteu and Cozma 2004) or as a single injection at 300 µg/kg (Bates et al. 1995). It achieve higher efficacy when combined with Ivermectin (Bala and Rath 2006). The second tool in mange eradication is good control measurements represented by good housing management, good sanitation and feeding, manure disposal and separation between the diseased and susceptible animals (Smith 2005).

## Materials and methods

### Animals and data collection

This study was conducted between August 2019 and August 2020. A total number of 250 female Arabian one humped camel (*Camelus dromedarius*) in Dammam city in kingdom of Saudi Arabia were clinically investigated, their age ranged between 3 months and 12 years old. Sampling and examination were conducted in hot and cold seasons to investigate the effect of the seasons on the spreading of the disease.

### Clinical examination

The animals were examined clinically for skin lesions in different body areas. Appetite state and BCS were recorded.

### Parasitological examination

After clinical investigation, all animals showing skin lesions were parasitologically examined according to the published protocol (Köhler-Rollefson et al. 2001), deep skin scraping from the skin of the clinical lesions were collected in a clean numbered petri dishes, mixed with 10%

potassium hydroxide, transferred to centrifuge tubes and wormed in a water bath for 1 h to help in the tissue digestion, after that the tubes were centrifugated at 2000 rpm for 3 min or at 3000 rpm for 1 min, the supernatant fluid was discarded, a drop from the sediment was transferred to a microscope slide, then covered with cover slide and examined under light microscope for adult mites detection and their eggs.

### Antiparasitic treatment protocols

Positive seventy animals were divided into 4 groups, and each group was subjected to a special treatment protocol as explained in Table 1.

## Results

### Parasitological examination of skin scraping

Reveal detecting of *Sarcoptes scabii var. camelii* mite under light microscope in 70 camels out of 250 as showed in Table 2. It was defined depending on their main morphological features as shown in Fig. 1: four pairs of short and stumpy legs and the third and fourth leg pairs do not project outside the body margins (Nayel and Abu-Samra 1986; Arora 2003).

Clinical lesions in infested camels are showed in Figs. 2 and 3.

## Discussion

Sarcoptic mange infestation in one-humped camels is often considered as the 2nd most important clinical disease of camels, after Trypanosoma infestation (Mochabo et al. 2005; Palanivelrajan et al. 2015). It is highly contagious chronic debilitating disease with high morbidity rate. Infested camels showing inappetence and milk production is decreased. The aim of this study is to assess different treatment protocols in sarcoptic mange eradication in camels and evaluate the effect of age and season on mange infestation degree. Although the economic and zoonotic importance of sarcoptic mange in camel, there are few research were done in this field in Saudi Arabia. The present study which was carried out there showed the prevalence of sarcoptic mange infestation in 250 female camels. We found that 28% of the examined camels (70 out of 250) infested with sarcoptic mange, as explained in Table 2, this low prevalence was agreed with other studies recorded 25% prevalence in Sudan by Hakem (2019) and agreed with other studies in Ethiopia recorded: 17.6 and 35.4% prevalence rate (Awol et al. 2014; Regassa et al. 2015). On

**Table 1** Animals treatment groups

Groups	1st	2nd	3rd	4th
Number of camels	20	20	15	15
Antiparasitic agents	Moxidectin (Cydectin, Japan) (0.5 mg /kg) Pour on Treatment repeated after 14 days	Doramectin (Dectomax, Pfizer, Egypt) (200 µg/kg) Intramuscular (I/m) injection Treatment repeated after 14 days	Moxidectin (0.5 mg/kg) Pour on + Deltamethrin (Butox-50, Intervet) (spray) to the diseased animals and all the surrounding environment Treatment repeated after 14 days	Doramectin (200 µg/kg) Intramuscular(I/m) + Deltamethrin (spray) to the diseased animals and all the surrounding environment Treatment repeated after 14 days

**Table 2** Parasitological examination of skin scraping

Examined animals	Positive cases	Negative cases	% of sarcoptic mange infestation
250	70	180	28%



**Fig. 1** *Sarcoptes scabii var. camelii* mite under light microscope

the other hand, the prevalence rate was higher (47%) in a study were done in Egypt by Ahmed et al. (2020) and higher (55.2%) in a study in were done in Sudan by Nayel and Abu-Samra (1986). The significance of sex on sarcoptic mange infestation was discussed in many researches, Kotb and Abdel-Rady (2015) found that there was no significant correlation between sarcoptic mange and sex, and their results were agreed with Megersa et al. (2012) who found that there is no significant difference in the infestation degree between males and females camels, on the other hand these results were not agreed with Awol et al. (2014) who found a significant difference between infested males and females. In our study we did not discuss



**Fig. 2** Irregular hairless area with thickness in the skin in the hind quarter of camel

the effect of gender on mange infestation because we investigate only female camels as we couldn't investigate the male camels because; their number is very fewer than the females and they have higher level of attention and care than the females (special feeding and higher cleaning standers), as they used in the breeding, so they have a very little chance for mange infestation or any other skin diseases. Furthermore, sampling is very difficult from males.

From the results explained in Table 3 we observed that the mange infestation was affected also with the season; the positive animals in the hot season were 30 and in the cold season were 40 camels. Our result was coincided with Tikaram and Ruprah (1986) who found that the sarcoptic mite survive more better at the temperature of 20–27 °C than at 31–39 °C, and their results supported by Kotb and Abdel-Rady (2015) who recorded a prevalence of (25%) in the winter season while a prevalence of (12.5%) in the summer, this result not agreed with Ashraf et al. (2014) who reported that, the mange infestation had a high prevalence in hot rainy months. As explained in Table 4 it



**Fig. 3** a and b Irregular hairless area with thickness in the skin in the neck of camel

is clear that the age affect the mange infestation as the prevalence percentage was highest (33.3%) in the age between 3 and 7 years and lowest (21.4%) in the young camels between 3 months and 3 years, but the difference is not so big in camels between 7 and 12 years as they affected by (27.8%) compared to the camels between 3 and 7 years, that means the young camels were less susceptible to mange infestation than the older animals and this outcome agreed with other study done by Ahmed et al. (2020) and agreed also with the results of Qamar et al. (2019) who showed the same that the older camels more than 5 years are more susceptible to the infestation, but these results were not agreed with other study done by Kotb and Abdel-Rady (2013) and Regassa et al. (2015) who demonstrated

that the young camels are more susceptible to the infestation. On the other hand, some studies Megersa et al. (2012) and Kotb and Abdel-Rady (2015) stated that the age has no significant effect on the mange infestation. The BCS was used an indicator for the health condition which normally affected by the animal appetite and as shown in Table 5 there was a correlation between the appetite and BCS, the animals had a good appetite (60) had also good BCS (56), but this results showed that most of the infested animals had a good appetite and subsequently good BCS, so the mange infestation here didn't affect the appetite and BCS, the fewer number (10) camels had a poor appetite and only (14) animals had bad BCS, really this results not agreed with other studies; Kotb and Abdel-Rady (2013) which showed that the mange infestation affect the appetite significantly, (74.32%) of the infested animals had poor appetite while (25.67%) had good appetite, furthermore poor BCS was reported in (55.40%) and they confirmed this results in their following study Kotb and Abdel-Rady (2015) as they found (75%) of the infected animals has in appetite and (25%) had normal appetite, moreover (72,5%) of infested animals had bad BCS demonstrated by Ahmed et al. (2020).

The significance of different treatment protocols on mange infestation was demonstrated in Table 6, we found that there was no difference between the 1st group (20 camels) which was treated with moxidectin pour on, and the 2nd group (20 camels) which was treated with doramectin (I/m) injection in the improvement level as both of them clinically and parasitologically showed 20% infestation percentage at Day 14, but the infestation level increased again as the animals reinfested again from the surrounding environment and this explanation was agreed with Cadiergues et al. (2004), it reached to 40, 35% at day 28 and 70, 75% at day 56 in the 1st and 2nd group subsequently. The 3rd group (15 camels) which exposed to moxidectin pour on and deltamethrin spray to the diseased animals and the surrounding environment had the wrothest improvement level as it showed clinically and parasitologically 80% infestation percentage at day 28 and 93% at day 56. The 4th group which exposed to doramectin (I/m) injection and deltamethrin (spray to the animals and

**Table 3** Effect of season on sarcoptic mange infestation level

Season	Examined animals	Positive animals		Negative animals	
		No	%	No	%
Hot months (May–October)	120	30	25	90	75
Cold months (November–April)	130	40	30.7	90	69.3

**Table 4** Effect of age on sarcoptic mange infestation level

Age	No. of examined animals	Positive animals		Negative animals	
		No	%	No	%
3 months–3 years	70	15	21.4	55	78.6
3–7 years	90	30	33.3	60	66.7
7–12 years	90	25	27.8	65	72.2
Total	250	70	28	180	72

**Table 5** Effect of sarcoptic mange infestation on appetite and BCS in 70 positive animals

Appetite	Normal	60 Animals
	Poor	10 Animals
BCS	Good	56 Animals
	Low	14 Animals

surrounding area) had the best improvement level 100%, as no positive animals in all the days of examination. Our results agreed with Kotb and Abdel-Rady (2015) as they used the same treatment combination and they also had 100% cure level. This treatment program prove that it is the best one in the mange infestation treatment as the moxidectin is a powerful acaracide compatible to Şuteu and Cozma (2004) and Abdally (2010) who found that

doramectin had highly efficient effect against mange infestation in contrast of Amitraz, but we can't use it alone, as we must treat the contaminated environment to prevent the reinfection and achieve the better cure rate.

### Conclusion

According to the results of this study, the owners should be advised to use this combination (doramectin + deltamethrin) in mange eradication in camels. Normally usage of 2 drugs appeared to be more expensive and exert extra costs for the owners but the economic advantage will come from preventing the usage of one drug more than one time and keeping the animals in a good

**Table 6** Effect of different therapeutic treatment protocols on sarcoptic mange infestation in camels

Groups	Treatment protocol	No. of examined animals	Clinical lesions and parasitological examination	Day of examination			
				0	14	28	56
1st	Moxidectin	20	Positive clinical lesions	20	4	8	14
				100%	20%	40%	70%
			Positive skin scraping	20	4	8	14
				100%	20%	40%	70%
2nd	Doramectin	20	Positive clinical lesions	20	5	7	15
				100%	25%	35%	75%
			Positive skin scraping	20	5	7	15
				100%	25%	35%	75%
3rd	Moxidectin + Deltamethrin	15	Positive clinical lesions	15	6	12	14
				100%	40%	80%	93%
			Positive skin scraping	15	7	12	14
				100%	46.7%	80%	93%
4th	Doramectin + Deltamethrin	15	Positive clinical lesions	15	0	0	0
				100%	0%	0%	0%
			Positive skin scraping	15	0	0	0
				100%	0%	0%	0%

health by avoiding the economic losses caused by mange infestation.

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**Data Availability** The data used in this manuscript is publicly available.

#### Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interests.

**Code Availability** The code will be made available under request to the corresponding author.

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