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Clinical, Hematobiochemical and Trace-Elements Alterations in Camels with Sarcoptic Mange (*Sarcoptes scabiei* Var *cameli)* Accompanied by Secondary Pyoderma

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ABSTRACT

Sarcoptic mange is a common, zoonotic and important disease facing camel farming systems with grave economic losses. The present study was applied to estimate the effect of sarcoptic mange on clinical condition, hematobiochemical criteria and trace-element status among camels in Egypt. A total number of thirty dromedary camels *(Camelus dromedarius*) were investigated in the present study. The animals were divided into fourteen diseased camels affected with sarcoptic mange and sixteen apparently healthy camels. Complete case history and clinical examination included respiration, pulse rates and body temperature was applied. The main clinical manifestations included over thickening of the skin with scales, fissuring, intense itching, unthriftiness, weight loss, and debility. Clinical examination showed significant increase (P≤0.05) and (P≤0.01) for respiration and pulse rates respectively in affected camels. Hematological analysis in diseased camels showed a significant decrease in PCV (P≤0.05), Hb (P≤0.001), RBCs count (P≤0.01), MCHC (P≤0.001) and relative (%) lymphocytic level (P≤0.001) while significant increase was recorded for MCV (P≤0.01), TLC (P≤0.01), relative (%) neutrophils (P≤0.001) and eosinophils levels (P≤0.01). Results of biochemical constituents in affected camels showed a significant decrease (P≤0.001) in total protein, albumin, glucose and zinc levels while A/G ratio showed significant (P≤0.01) decrease. Both serum total iron and copper levels showed a significant (P≤0.05) decrease in diseased camels compared to healthy camels. Skin swab samples revealed *Staphylococcus spp*. in the majority of mange infected cases indicating secondary pyoderma. In conclusion, sarcoptic mange had a deleterious effect on physical, hematobiochemical condition and trace-element status in camels.

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INTRODUCTION

Camels considered as a vital species of livestock with good source of meat, milk and wool beside they can live in arid and semi-arid harsh environment. Camels as well as other domestic animals are in continuous exposure to many pathogenic infections **(Borji *et al.*, 2010)**. Many types of external parasites affect the health of camels including tick, sarcoptic mange, and fly infestations **(Oryan *et al.*, 2008).** Infectious diseases including parasitic infection have a great impact on the camel herd growth and productivity. Camel mange is a common major veterinary problem worldwide. It caused by *Sarcoptes scabiei* var *cameli* which recorded in one humped-camel (*Camelus dromedaries*). It is considered as a one of the most economic zoonotic contagious disease in tropical and subtropical areas **(Parsani *et al.*, 2008)**. In Sarcoptidae family, adult male mite soon died after mating and the adult female undergoes tunneling through the skin layers causing severe pruritus and pain. Female laid eggs then die while the eggs undergo hatching resulted in larvae which continue to feed on serum exudation and skin depris **(Dinka *et al.*, 2010).** Clinical signs included over thickening of skin with scales and fissuring due to perforation of the skin. Also, intense itching, unthriftness, weight loss, debility and high mortalities in young animals were recorded with grave economic losses **(Wilson, 2008)**. Almost all external parasites have a great impact on the

hematologic and biochemical criteria of the body including sever decrease in blood and serum constituents causing severe anemia **(Momenah, 2014).** Moreover, many cases with sarcoptic mange accompanied with secondary pyoderma caused by *Staphylococcus spp.* which find its entrance through abraded skin **(Zahid, 2015).** This type of mange has a great zoonotic impact on human health causing human scabies **(McCarthy, 2004)**. The present study was conducted to study the clinical, hematobiochemical and trace-element alterations in camels infested with sarcoptic mange complicated with secondary pyoderma in Egypt.

MATERIALS AND METHODS

Animals

This study was applied on thirty dromedary camels (*Camelus dromedaries*) belonged to Giza and Beni-Suef governorates in Egypt with different sex (20 males and 10 females) and age (one to eight years). Animals were divided into fourteen diseased camels affected with sarcoptic mange and sixteen apparently healthy camels (control). Complete case history and clinical signs were recorded. Clinical examination included respiration, pulse rates and rectal temperature was applied.

Samples

1. Fecal samples

Fecal samples were taken during clinical examination and the parasitological examination was applied using direct fecal smear and floatation techniques for exclusion of internal parasitic infection. Detection of parasitic eggs, oocysts, larvae or adult worms was suggestive for exclusion from the present study.

2.Skin scraping samples

Skin scrapings were collected from the periphery of the lesions using blunt scalpel. Before scraping, the skin lesions were cleaned using 70% alcohol with all human protective procedures. Each sample was mixed with potassium hydroxide 10% with gentle warming of slides then transferred to microscopic examination **(Walter *et al.*, 2011)**.

3.Skin swap samples

From each mange positive camel, skin swab was taken from the lesions after the skin scrap has been taken. Bacteriological smear were prepared from each swab and stained with gram stain for detection different bacterial species associated with mange infection.

4.Blood and serum samples

Eight ml blood samples were collected from jugular vein of each camel on two tubes. First tube consumes 2 ml blood and contains ethylene diamine tetra-acetic acid (EDTA) for hematological examination. Second plain tube contain 6 ml blood without anticoagulant for serum separation and estimation of biochemical constituents and trace-elements included total protein, albumin, glucose, copper, zinc and total serum iron according to specific test kits instructions supplied by spectrum-diagnostics, GmbH, Egypt.

Statistical analysis

The data was added to Excel sheet and results were recorded as mean and standard error. Diseased cases data were compared with healthy control data by aid of student T- Test using SPSS® program version 16. P value ≤0.05 was considered significant.

RESULTS

The present study spot the light on the effect of sarcoptic mange associated with secondary pyoderma on the physical examination, hematological constituent and biochemical criteria included some important trace-elements among Egyptian dromedary camels. The main recorded signs were severe itching, biting and rubbing its body against hard objects. Moreover, skin lesions were scattered all over the body included head, fore limbs and rump with alopecia, skin over thickening, fissuring, scales formation and serum exudation was prominent (Figure 1 A and B). Skin scraping samples showed positive infection with *Sarcoptes scabiei* var *cameli* adult mite (Figure 2 A) and its eggs (Figure 2 B and C). Concerning clinical examination results (Table 1), statistical analysis showed that there was significant increase (P≤0.05) and (P≤0.01) for respiration and pulse rates respectively in affected camels compared to apparently healthy camels. There was non-significant mild elevation in rectal temperature in diseased camels.

Table1.Clinical examination parameters in infected camels compared with apparently healthy group.

Parameter (mean ± Se)		Control group	Diseased group
Clinical examination	Respiration rate (time/min)	10±0.42	12±0.68 [c]
	Pulse rate (pulse/min)	41±1.01	46.5±1.27 [b]
	Rectal temperature (°C)	37.8±0.10	37.9±0.11

b: P≤0.01) and c: P≤0.05)

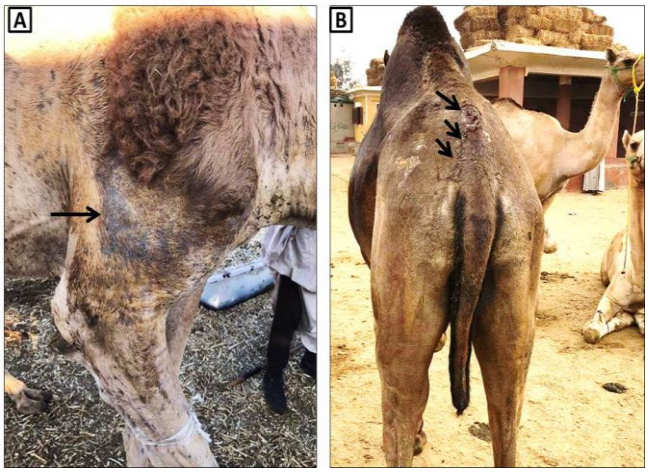

Fig. 1. Clinical pictures showed mange in camels. A: alopecia in shoulder region (arrow). B: scales, fissuring and serum exudation at rump region.

Regarding hematological constituents (Table 2), statistical analysis showed significant (P≤0.001) decrease in hemoglobin concentration, mean corpuscular hemoglobin concentration (MCHC) and relative (%) lymphocytes level in affected camels. The same significance (P≤0.001) was recorded for increase in relative (%) neutrophils count. RBCs count showed significant (P≤0.01) decrease in infected group while the same significance (P≤0.01) was recorded for increase in mean corpuscular volume (MCV), WBCs count and relative (%) eosinophilic count. Packed cell volume (PCV) showed significant (P≤0.05) decrease in infected group compared to apparently healthy group. No significant changes were recorded in other parameters.

Table 2. Hematologic changes in diseased camels compared with apparently healthy group (control).

Parameter (mean ± Se)		Control group	Diseased group
Hematological parameters	PCV (%)	38.2±0.81	35.6±0.85 [c]
	Hb (g/dl)	15.3±0.39	13±0.39 [a]
	RBCs count ($\times 10^6$ /µl)	11.53±0.38	9.91±0.36 [b]
	MCV (fl)	33.4±0.73	36.2±0.59 [b]
	MCH (pg)	13.4±0.17	13.2±0.18
	MCHC (%)	40.2±0.48	36.6±0.48 [a]
	TLC ($\times 10^3$/ µl)	12.41±0.49	19.11±1.78 [b]
	Neutrophils (%)	51±0.74	61±2.21 [a]
	Lymphocytes%)	40±0.83	28±2.40 [a]
	Monocytes (%)	5±0.62	4±0.37
	Eosinophils (%)	3.7±0.24	5.1±0.33 [b]
	Basophils (%)	0±0.00	0±0.00

a: P≤0.001), b: P≤0.01) and c: P≤0.05)

It is clear from the first glance that all biochemical parameters are markedly affected in diseased camels (Table 3). Statistical data revealed significant (P≤0.001) decrease in serum total protein, albumin, glucose and zinc levels. Albumin globulin ratio (A/G) recorded significant (P≤0.01) decrease in diseased cases while copper and total iron levels showed significant (P≤0.05) decrease compared to apparently healthy group.

Regarding bacteriological examination, skin swabs from the lesions caused by *Sarcoptes scabiei* var *cameli* showed mixed infection by *Staphylococcus spp.* in most of the cases and *Corynebacterium spp.* only in two cases (Fig. 2D).

Table 3.Serum biochemical parameters and some trace-elements in diseased and healthy (control) camels .

Parameter (mean ± Se)		Control group	Diseased group
Biochemical parameters	Total proteins (g/dl)	6.9±0.10	5.8±0.14 [a]
	Albumin (g/dl)	3.7±0.07	2.7±0.08 [a]
	Globulin (g/dl)	3.1±0.12	3.1±0.14
	A/G ratio	1.2±0.06	0.91±0.56 [b]
	Glucose (mg/dl)	118.8±2.67	101±2.06 [a]
	Copper	83.7±1.34	77.5±2.52 [c]
	Zinc	100.1±2.32	87.5±1.48 [a]
	Total iron	108.3±1.73	97.1±4.17 [c]

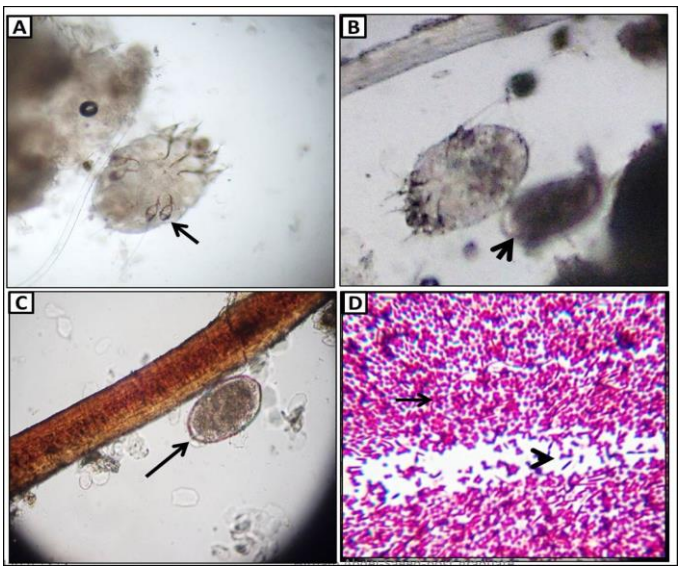

Fig. 2. Different microscopical findings of skin scrap and swab samples in camels with mange. A: *Sarcoptes scabiei* var *cameli* adult mite (arrow) showed that posterior legs not exceed body margins. B&C: presence of eggs of *Sarcoptes scabiei* var *cameli* characterized by thick wall and large embryo (arrows) in affected camels. D: *Staphylococcus spp.* and *Corynebacterium spp.* in skin swab samples stained with Giemsa stain and associated with mange infection in camels.

DISCUSSION

Sarcoptic mange is a very common important disease among camels that has a potential zoonotic risk for humans. It cause severe economic losses presented by weight loss, debility and low production. Many studies investigated this disease in more than one hundred of species included humans **(Bornstein *et al.*, 2001)**. The recorded clinical manifestations of sarcoptic mange of camels in the present study included hypotrichosis, itching, thick skin, fissuring and serum exudation. Many studies made by **Gorakh *et al.*, (2000) and Giadinis *et al.*, (2011)** with similar findings in farm animals. Results of skin scraping samples examination in the present study confirmed the presence of adult mites and eggs with their specific morphological characteristics resembled that described by **Awol *et al.*, (2014)**.

Clinical examination in diseased camels revealed significant increase for both respiration and pulse rates. These findings disagreed to some extent with **Hassan *et al.*, (2019)** who recorded decreased rates in camels affected with mange. This may depend on many factors included the time of the study, hydration status and degree of pain and spread of lesions on the body of camels.

Hematological constituents considered as a mirror indicator of health and index of metabolic performance in the body. The present results showed significant decrease in PCV, Hb, RBCs count, MCHC and relative lymphocytic levels while significant increase was recorded for MCV, TLC, relative neutrophils and eosinophils levels. Decreased levels occurred as a result of blood loss through tunnels that made by burrowing mite. Some studies agreed with the present findings **(Sayed, 1998** and **Hassan *et al.*, 2019)**. **Parmar *et al.*, (2005)** recorded low level of neutrophils and high lymphocytic level. This may explained as there was no complication with secondary bacterial infection.

Increase in TLC in camels with sarcoptic mange was recorded by **Ibrahim *et al.*, (1981)** and attributed to severe inflammatory process. **McCarthy *et al.*, (2004)** recorded neutrophilia in cases with sarcoptic mange that complicated with secondary pyoderma which come in accordance with the present study. In the line with present results. **Al-Salihi *et al.*, (2013)** recorded high eosinophils level among mange infected camels and this was explained by massive eosinophilic response that was elicited as a result of increase of mast cells.

Regarding biochemical constituents and trace-elements status, the present study showed significant decrease in total protein, albumin, A/G ratio and glucose level. In the same context, **Nayee, (1990); Parmar *et al.*, (2005) and Hassan *et al.*, (2019)** attributed the decrease in total protein, albumin and A/G ratio to serum loss through exudation and extravasation of fluids to interstitial tissues and tunnels made by mites. The present work revealed a decrease in serum globulin levels which can be explained by exhaustion of globulin in circulation by multiple sites of inflammation all over the body. **Momenah, (2014)** support the decrease in serum glucose level in the present work due to decreased feed intake, inappitance resulted from irritation made by burrowing mites. Trace-elements included total iron, copper and zinc showed significant decrease in diseased camels in the present work. **Chaudhary and Iqbal, (2000)** agreed the decrease of total iron in the present study. It may due to sequestration of iron into cells as a defensive mechanism during infection.

Another explanation that deficiency of iron occurred as a result of copper deficiency that led to defective uptake process of iron. Many studies **(Brighthope 2004; Shoieb *et al.*, 2016 and Hassan *et al.*, 2018)** come in agreement regarding decrease in serum copper and zinc. These findings can be explained by many facts included decreased appetite and feed intake, increased the phagocytic activity of immune cells and anti-oxidant defense exhaustion during infection lead to rapid depletion of serum copper and zinc.

It was noticed that in many infected cases, secondary pyoderma was evident as Staphylococci found its entrance through the abraded skin. **McCarthy *et al.*, (2004)** isolated *staphylococcus spp.* from the fecal material of sarcoptic mite and gave evidence that sarcoptic mites shared the occurrence of secondary pyoderma during infection of camels.

CONCLUSIONS

Sarcoptic mange markedly affects the clinical condition, hematobiochemical criteria and trace-elements status in camels. Infection causes elevation of respiratory and pulse rates. Also, it causes severe anemia with leukocytosis and neutrophilia. Mange causing severe drop in all serum proteins and main trace elements included total iron, copper and zinc. Secondary pyoderma occurred adjacent to sarcoptic mange infection in camels as the mites are a potent source of *staphylococcus spp.*

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CONFLICT OF INTEREST

Author declared that they have no conflict of interest

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