

## Clinical, Hematological and Biochemical Studies of Anaplasmosis in Arabian One-Humped Camels (*Camelus dromedaries*)

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**Abstract:** The objective of this study was to investigate the clinical, haematological and biochemical changes in natural infected camels (*Camelus dromedaries*) with blood parasite *Anaplasma marginale*. A total of 62 camels 5-10 years old from both sexes were investigated 52 camels were naturally infected with *Anaplasma marginale* 10 clinically normal camels served as control the results indicated that the clinically infected camels showed signs of pale mucus membranes, loss of appetite, emaciation, diarrhea and or constipation, rough hair coat, lacrimation, coughing. Ticks were noticed and detected on several locations at the camels body. High body temperature, respiratory and heart rates were also recorded in addition to a reduction on ruminal contractions. The statistical analysis appeared significant decrease in the TRBCs, HB and PCV, while a significant increase in MCV and ESR were encountered in infected camels. Macrocytic normochromic type of anemia was registered and the percentage of parasitemia ranged between (5-11%). There were no significant difference encountered in clotting factors indices. The results also, indicated a significant increase in WBC as a result of significant increase and decrease in lymphocytes and neutrophiles, respectively. The biochemical changes revealed significant increase in AST, ALT, total bilirubin, BUN and icteric index, however significant decrease in total protein values were encountered in infected camels.

**Key words:** Anaplasmosis, camel, hematological finding, *Anaplasma marginale*, *Camelus dromedaries*

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### INTRODUCTION

Anaplasmosis is an infectious, non contagious, tick born disease of domesticated and wild ruminants. Fever, progressive anemia, digestive disturbances, emaciation are the main characteristics of this disease (Radostitis *et al.*, 2000).

The disease has worldwide distribution, particularly in tropical and sub tropical regions. It has been also recorded in some temperate areas, the disease occur sporadically or as outbreaks leading to substantial significant economic losses (Smith, 1996). In Iraq, the disease has wide distribution especially, at the north areas (Alsaad, 2007a).

Studies of anaplasmosis in camels in these areas are very limited and little information had been provided. Although, different reports by Al-Ani (2004), Ajayi *et al.* (1984) and Wernery and Kaaden (2002) have been referred for the anaplasmosis in camels, but still this disease is a matter of important for the researchers, therefore the goal of this study was to investigate the clinical changes, hematological observation and some biochemical changes as well as the effect of anaplasmosis on clotting factors indices in camels naturally infected with *Anaplasma marginale*.

### MATERIALS AND METHODS

**Animals and study design:** The study were conducted on 62 Arabian (male and female) one-humped camels (*Camelus dromedaries*), 5-10 years old. The study was carried out in Ninawa province (Ninawa, Iraq). Fifty two camels were naturally infected with *Anaplasma marginale* and ten clinically normal camels served as control group. Careful clinical examination had been carried out in all animals and fecal samples were screened for parasitic load using standard technique.

**Blood collection and hematology:** Ten milliliter of blood were drained from each animal by Jugular Vein-puncture, from these 2.5 mL of blood mixed with EDTA used to determine Total erythrocyte Count (TRBCs), Hemoglobin (HB), Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin Concentration (MCHC), Platelets count (Plt), Mean Platelets Volume (MPV), Platelets Distribution Width (PDW), total and differential leukocytes count (Automatic Full Digital cell Counter, Beckman, USA) and Erythrocytes Sedimentation Rate (ESR) by wintrobe method (Meyer and Harvey, 2004), another 2.5 mL of blood mixed with Trisodium citrate were used to determine

Prothrombine Time (Prt) and Activated partial thromboplastin time (Aptt) (Coles, 1986). Clotting Time (CT) were also, estimated according to Bush (1975).

Thin blood smears stained with giemsa were used to identified the parasite. Blood serum samples were tested spectrophotometrically for Aspartate amino Transferase (AST), Alanine amino Transferase (ALT), total protein, total bilirubin, Blood Urea Nitrogen (BUN), fibrinogen, using available kits (Biomerex, France) and icteric index according to Coles (1986).

**Statistical analysis:** Statistical analysis were done using two way analysis of variance and t-test (Stell and Torrie, 1985).

### RESULTS

Clinically infected camels shown sings of paleness of mucus membranes, loss of appetite, emaciation, diarrhea with passing of watery fecal materials and/or constipation with dry feces, rough hair coat, lacrimation with discharging serious ocular discharge, on the other hand some diseased camels were suffer from coughing, ticks were detected on different regions of the body (Table 1).

Statistically significant increase ( $p > 0.01$ ) were encountered in body temperature, respiratory and heart rates, however ruminal contractions were reduced significantly (Table 2).

*Anaplasma marginale* appears as spherical granules near periphery of infected red cells and parasitami ranged between (5-11%) Fig. 1.

There was significant reduction ( $p > 0.01$ ) in the mean values of TRBC, HB and PCV, in infected camels and significant increase ( $p > 0.01$ ) in MCV and sedimentation rate of RBCs, anemia was of macrocytic normochromic type. Results also indicated significant increase ( $p > 0.05$ ) in total leukocytes count, which were due to significant increase ( $p > 0.05$ ) lymphocytis and significant decrease ( $p > 0.05$ ) neutrophils (Table 3 and 4).

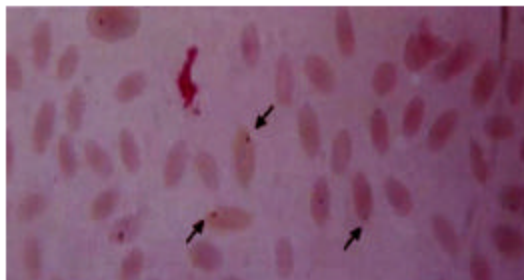


Fig. 1: *Anaplasma marginale* inside red cells

Moreover, there was no significant difference were encountered in clotting factors indices among infected and control groups of camels (Table 5).

Table 1: Clinical sings of infected camels with anaplasmosis

Clinical sings	No. of affected camels	(%)
Pale mucus membranes	38	73.07
Loss of appetite	33	63.46
Diarrhea and/or constipation	17	32.69
Rough hair coat	11	21.15
Lacrimation	12	23.07
Coughing	15	28.84
Emaciation	28	53.84
Presence of ticks on body regions	40	76.92

Table 2: Body temperature, respiratory and heart rate and ruminal contractions of infected camels and control group

Parameters	Control $\pm$ SE	Infected $\pm$ SE
Body temperature ( $^{\circ}$ C)	38.6 $\pm$ 0.64	39.8 $\pm$ 1.4***
Respiratory rate $\text{min}^{-1}$	9.4 $\pm$ 2.11	17.8 $\pm$ 4.32***
Heart rate $\text{min}^{-1}$	32.2 $\pm$ 3.6	48.6 $\pm$ 6.4***
Ruminal contractions $\text{min}^{-1}$	3.41 $\pm$ 1.24	1.53 $\pm$ 1.28***

\*\*\* $p < 0.01$

Table 3: Blood parameters of infected camels with anaplasmosis and control group

Parameters	Control $\pm$ SE	Infected $\pm$ SE
RBC $\times 10^6$	7.92 $\pm$ 1.36	4.82 $\pm$ 1.82***
HB (g $\text{dL}^{-1}$ )	12.7 $\pm$ 2.43	8.41 $\pm$ 1.56***
PCV (%)	29.4 $\pm$ 4.58	22.3 $\pm$ 3.76***
MCV $\text{fL}$	37.68 $\pm$ 4.52	48.2 $\pm$ 3.36***
MCHC $\text{dL}^{-1}$	42.6 $\pm$ 7.81	42.53 $\pm$ 6.11
ESR (mm 8 $\text{h}^{-1}$ )	11.63 $\pm$ 3.52	20.78 $\pm$ 5.34***

\*\*\* $p < 0.01$

Table 4: Total and differential leukocytes count of infected camels with anaplasmosis and control group

Parameters	Control $\pm$ SE	Infected $\pm$ SE
WBC $\times 10^3$	11.54 $\pm$ 1.74	13.61 $\pm$ 1.62***
Lymphocytes (%)	45.8 $\pm$ 2.3	50.3 $\pm$ 2.18*
Neutrophils (%)	49.3 $\pm$ 1.33	44.2 $\pm$ 2.13*
Monocytes (%)	3.5 $\pm$ 0.3	3.7 $\pm$ 0.39
Eosinophils (%)	2.11 $\pm$ 0.9	2.3 $\pm$ 0.71
Basophils (%)	0.7 $\pm$ 0.3	0.7 $\pm$ 0.22

\* $p < 0.05$ , \*\*\* $p < 0.01$

Table 5: Clotting factors indices of infected camels with anaplasmosis and control group

Parameters	Control $\pm$ SE	Infected $\pm$ SE
Pt $\times 10^3$	452 $\pm$ 20.44	449 $\pm$ 17.62
MPV $\text{fL}$	3.26 $\pm$ 0.81	3.22 $\pm$ 0.74
PDW (%)	14.37 $\pm$ 1.9	14.82 $\pm$ 1.7
CT $\text{min}^{-1}$	3.5 $\pm$ 1.25	3.6 $\pm$ 1.36
Prt $\text{sec}^{-1}$	111 $\pm$ 4.6	110 $\pm$ 3.8
Aptt $\text{sec}^{-1}$	11.36 $\pm$ 1.8	11.84 $\pm$ 1.68
Fibrinogen $\text{mg dL}^{-1}$	307 $\pm$ 6.53	310 $\pm$ 5.11

Table 6: Biochemical parameters of infected camels with anaplasmosis and control group

Parameters	Control $\pm$ SE	Infected $\pm$ SE
AST (U $\text{L}^{-1}$ )	102 $\pm$ 11.31	180 $\pm$ 8.61***
ALT (U $\text{L}^{-1}$ )	13 $\pm$ 3.21	26.3 $\pm$ 5.17***
Total bilirubin (mg $\text{dL}^{-1}$ )	0.46 $\pm$ 0.17	0.67 $\pm$ 0.38***
BUN (mg $\text{dL}^{-1}$ )	13.36 $\pm$ 1.48	20.28 $\pm$ 7.13***
Icteric index (mg $\text{dL}^{-1}$ )	3.75 $\pm$ 0.72	5.81 $\pm$ 1.2***
Total protein (g $\text{dL}^{-1}$ )	6.7 $\pm$ 1.26	4.8 $\pm$ 0.61***

\*\*\* $p < 0.01$

Results of biochemical changes indicated significant increase ( $p > 0.01$ ) in AST, ALT, total bilirubin, BUN and icteric index however, significant decrease ( $p > 0.01$ ) were encountered in total protein values of infected camels (Table 6).

## DISCUSSION

The clinical signs observed in infected camels were in agreement with those described by Sayed (1998), Maghaddar (2002) and Higgins (1984) as paleness of mucus membranes were exhibited the development of anemia and reduction of hemoglobin concentration and total erythrocytes count was due to destruction and removal of infected erythrocytes by the reticulo-endothelial system (Van Houten *et al.*, 1992; Al-Ani *et al.*, 1992) diarrhea and/or constipation, which were observed in infected camels may occur due to digestive disturbances (Kholer-Rollefson *et al.*, 2001) presence of ticks in (76.92%) of infected camels indicated that it's the important transmitters of *Anaplasma* sp. (Amanda *et al.*, 2006; Mohammed *et al.*, 2007) increase body temperature may indicated liberation of endogenous pyrogens due to cellular lysis stimulating thermoregulatory centers of the hypothalamus (Higgin, 1986).

With respect to hemogram there was a significant decrease in TRBC, HB and PCV, reflecting macrocytic normochromic type of anemia, similar results were recorded by Mohammed *et al.* (2007) and Maghaddar (2002). The cause of anemia during blood parasitic infection may be multifactorial, the direct effect of the parasite to the infected erythrocytes may be incriminated or decrease life span of RBCs and also suppression of hemopoietic system (Mahran, 2004) also, Mohammed *et al.* (2007) and Al-Ani *et al.* (1992) added that anemia in infected camels with blood parasites is due to extensive erythrophagocytosis initiated by parasitic damage to erythrocytes and the anti-erythrocytic auto antibodies changes in bone marrow are an indication to bone marrow depression. Examination of stained blood films in the current research revealed that *Anaplasma marginale* appears as spherical granules near periphery of infected erythrocytes, these results were similar to those shown by Maghaddar (2002). Leukocytosis, which accompanied by increase in the lymphocytes were in agreement with that reported by Middleton (1999) and Rezakhani *et al.* (1997). The increase in WBC is due to stimulation of lymphoid tissues and stem cells in the bone marrow by the parasite and their toxins (Omuse, 1987), added that leukocytosis occur as a result to lymphoid

depletion and disorganization with massive lymphocytes, lymphocytosis especially, in anaplasma infected camels agree with that recorded by Mahran (2004), whose stated that lymphocytosis was marked during the formation of antibodies in response to antigen and during anaplasma infection. Increase in ESR values were in agreement with Jain (1993) whose refer to the correlation between the sedimentation of RBCs and intensity of anemia and increase settling of RBCs will take place when anemia are more intense.

There were no significant difference encountered in clotting factors indices in current study, similar results were detected by Alsaad (2007b) and Pantanowitz (2003).

Results of biochemical changes indicated significant increase in AST, ALT, total bilirubin, BUN, icteric index and decrease level of total protein, those results were also recorded by Kataria and Bhatia (1991) and Boid and Luckins (1985), whose stated that damage to the skeletal or heart muscles, hepatic tissues and erythrocytes may resulted in considerable increase in the level of AST and ALT due to the fact that bulk of those tissues through out the body could be considered as an ample reservoir of enzymes liable to be released and detected during pathological situation (Mamma, 1990) added that hyperbilirubinemia, which were seen in camels anaplasmosis resulting from excessive destruction of RBCs and the indirect hepatocellular damage increase level of BUN may indicated indirect damage of renal tissue and the presences of globins catabolites liberated from hemoglobin lysis by reticulo-endothelial system through the process of erythrophagocytosis (Qarawi, 1999; Kataria and Bhatia, 1991). There were significant reduction seen in total protein values in this study, which were agree with Brakat *et al.* (2000) and Sayed (1998), whose stated that decrease protein levels during blood parasitic infection may occur due to digestive disturbances, destruction of proteins due to fever as well as less production from liver.

## CONCLUSION

Anaplasmosis were affected camels and exhibited different clinical signs, a significant changes were noticed between the infected and control camels in hematological and biochemical values with no differences were indicated in blood clotting indices.

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