Some Blood Parameters Of One Humped She-Camels (*Camelus Dromedaries*) In Response To Parasitic Infection

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Abstract: A total of 24 she-camels 8-15 years old in three separate equal groups were examined. Group one (G1) was healthy and clinically normal, meanwhile, Group two (G2) was diseased by mange (Sarcoptic mites) while, the third group(G3) was diseased by heavy intestinal parasite mixed with mange. The diseased experimental she-camels were naturally infected for three months prior to the experiment till the end of it. The experimental she-camels was reared under a semi-intensive condition in a summer desert environment and fed the same. The aim of the research was to investigate the effects of such abnormal physiological conditions on whole blood hematological picture (Hb, PCV, TEC, MCV, MCHC, TLC and DLC), some biochemical parameters in blood plasma (total protein, albumin, globulin, A/G ratio, total bilirubin, glucose, AST and ALT), leptin and IGF-1. The heparinized blood was collected fortnightly, examined hematologically, then centrifuged to separate the blood plasma which stored at -20 Celsius for further examination of the biochemical measures. Results indicated that all the studied blood hematological parameters decreased ($P<0.05$) sharply with the parasitic infection for G2 and G3 camels, except an increase ($P<0.05$) of eosinophils and monocytes was detected. Blood plasma TP, albumin, globulin and glucose decreased ($P<0.05$) in G3 more than G2,being physiologically normal in G1. Activities of AST and ALT liver enzymes and bilirubin were increased by the parasitic infection ($P<0.05$) in G2 and G3 over the normal physiological range found in G1. Plasma IGF-1and leptin in the peripheral blood of the she-camels were decreased ($P<0.05$) in G3 more than G2 comparing to G1 in which it was normal. It is concluded that the both parasitic infections (G2 and G3) cause adverse effects and major changes in the studied blood hematological and biochemical parameters of the she-camels, such effects will be reflected on the she-camels health and production. All the measured blood parameters were the worst in G3. Thus, treatment of such a diseased conditions is a must to keep she-camels in a better physiological and hygienic status.

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Introduction

Camel *(Camelus dromedaries)* is an important component of the desert ecosystem. The total world camel population was estimated to be 19.334 million. Out of which Africa has 15.124 million (78.22 %), Asia 4.198 million (21.71%) and the remaining world has only 0.012 million (0.07%). Developing countries have 99.03% of this camel population (FAO, 2001). Camel is used as beast of burden by humans and provide them with milk and meat, also camel had enabled human to inhabit the desert.

Blood is the mirror of the beings health, it is an index for several metabolic processes of the body and reflect the status of the functioning organs of the body and health, hence production of the animal. On the other hand, the blood hemogram and its biochemical constituents are considered important information in relation to the health status of the camel.

Leptin is a protein hormone secreted by adipose tissues and acts on hypothalamus to regulate feed intake (Hossner, 1998 and Kim and Baik, 2004) and energy balance (Soliman *et al.*, 2002 and Koh *et al.*, 2008). Leptin is also associated with other biological processes such as reproduction, hematopoiesis, immune response and bone formation (Olusi *et al.*, 2003). It has been reviewed that an increase in the circulating Leptin concentration is involved in regulation of the metabolic rate, the macrophage function and the induction of immune cell proliferation or differentiation. Moreover, Leptin concentration in plasma has been reviewed as a direct reflection of the amount of body fat and reproductive function through its effect on nutritional and health status (Agrawal *et al.*, 2009).

The IGF-1 mediates the anabolic actions of somatotropin. Circulating somatotropin stimulates liver and other several tissues to secrete IGF-1 (Hadley, 2000 and Gatford *et al.*, 1996). The blood concentration of IGF-I is stable in peripheral blood due to binding to eight carrier proteins in bovine. Also, nutritional and health status are major factors affecting plasma IGF-1 concentration (Hadely, 2000).

Therefore, the present study aimed to

investigate some blood parameters (hematological and biochemical) in one humped she-camels *(Camelus dromedaries)* naturally diseased by either mange (Sarcoptic mites) or heavy intestinal parasites (nematode infection) in compare to healthy she-camels.

Materials and methods

The present work was conducted on a commercial farm in Cairo-Alexandria desert road and Cairo University Research Park (CURP), Cairo University, Giza, Egypt. The she-camels were reared under a semi-intensive production system in a summer desert environment. The clinical examination of the experimental she-camels were done by the farm veterinarian. All the experimental samples were examined in the CURP laboratories.

1-She-camels

The experiment lasted for three months using a total of 24 she-camels of the same age and the same physiological status. The she-camels were classified into three equal groups (8 she-camels each). The first group (G1) is healthy she-camels, clinically normal, free from external, internal and blood parasites and used as a control group. The second group (G2) is naturally diseased with Sarcoptic mites (mange group, G2). This group showed symptoms of itching, pruritus, erythema, corrugation of the skin and alopecia. The third group (G3) is heavily infected with intestinal parasite (nematode, G3). This group showed symptoms of weakness, soft feces with indigestible food particles, debilitation and lack of stamina. Besides, those she-camels showed skin lesions with symptoms of itching, pruritus, erythema and alopecia.

Both diseased conditions of the dromedary she-camels were naturally infested for 3 months before the start of the experiment till the end of the research without taking any treatment. The she-camels were adequately fed [complete feed mixture at 1% of body weight + Berseem (*Trifolium alexandrinum*) hay at 2kg/day + rice straw (*ad libitum*)] , beside that grazing on some naturally grown scattered desert plants.

Experimental she-camels were 8 to 15 years old according to the dentition formula given by Rabagliati (1924) *cited in* Al-Qarawi *et al.* (2000).

Water was offered to all she-camels once daily (7 a.m.) for *ad libitum* consumption except the day of blood sampling was offered at (10 a.m.). Experimental camels were kept at night in open shelters.

2-Blood sampling and analysis

Blood samples were withdrawn from all the experimental she-camels fortnightly (at 9 a.m.) before the morning drinking and feeding or grazing. Blood samples were allowed to flow gently from the jugular vein into clean-dry labeled heparinized 10 ml Falcon tubes. These samples were used in the same day for the examination of the blood total erythrocytes count (TEC) and total leuckocytes count (TLC) were done according to (Feldman *et al*, 2000), Packed cell volume (PCV: Frankle and Reitman, 1963) and hemoglobin (Hb: Benjamin, 1965). For the differential leukocyte count, three blood smears were taken from each blood sample and stained with Geimsa (Bancroft *et al.*, 1996).

The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were determined according to Wintrobe *et al.* (1976)

MCV (fl) = (PCV (%) x 10)/ TEC ($x10^{12}$/L),

MCH (pg) = (Hb (g/dl) x 10)/ TEC (x1012/L),

MCHC (%) = (Hb (g/dl) x 100)/ PCV (%),

Blood plasma was separated by centrifugation (5000 rpm/ 20 minutes) using Pasteur pipette. This plasma was kept frozen at –20 ^{o}C for subsequent determination of total protein (TP: Henry *et al*., 1974 and Tietz, 1983), albumin (alb: Doumas *et al.*, 1971), glucose (Bahram and Trinder, 1972), total bilirubin (Sherlock, 1951), aspartate amino transferase (AST) and alanine amino transferase (ALT) Reitman and Frankle (1957), but globulin (Glob) and albumin globulin ratio (A/G) were calculated.

Blood IGF-I was measured using immune-radiometric Assay (IRMA) method with a sensitivity of 1 ng/dl, whereas the inter- and intra-assays coefficients of variability were 8.2 and 5.6%, respectively according to Tsitouras *et al.* (1995). While, leptin assay was performed according to Considine *et al.* (1996) using ELISA reader (BIO TEK ELX808), applying Leptin sandwich ELISA kit (DRG Instruments GmbH, Germany). According to the manufacturer's guidelines, the standard curve was ranged between 0 and 100 ng/ml and the sensitivity value of the curve was reported to be 1.0 ng/ml. The intra and inter assay coefficients of variability (CV) were 5.95 and 11.55%, respectively.

3-Fecal sampling and analysis

A total of 24 rectal fecal samples was collected individually in a clean plastic covered cups for the detection of the gastrointestinal parasites during the same day of collection by the concentration flotation technique using saturated salt solution according to Coles (1986).

4-Skin scrapings

A total of 24 skin scrapings was taken from the periphery of the skin lesions to investigate the presence of the causative agent of the mange according to Coles (1986).

Statistical analysis

The data set was subjected to the analysis of variance as repeated measurements (split plot in time) according to Neter *et al.* (1985) using SAS (SAS, 2000). Differences among means were tested using Duncan, 1955. The statistical model was to study the changes in she-camels blood hematology and biochemistry as affected by the parasitic infection.

$Y_{ij} = \mu + P_i + E_{ij}$

Whereas: Y_{ij} = Observation measured, μ = Overall mean, P_i = parasitic infection (i = 1 clinically normal she-camel, i = 2 diseased she-camel by mange (Sarcoptic mites) , i = 3 diseased camel by ha heavily intestinal parasitic infection (nematode), E_{ij} = Experimental error assumed to be randomly distributed (0, σ_e^2).

Results and discussion

1-Clinical examination of the experimental she-camels

The first group (G1) she-camels was clinically normal and healthy. The examination of the fecal samples did not show any parasites. Also, skin scrapes samples did not show any external parasites.

The second group (G2) she-camels had various degrees of alopecia, itching and corrugation of the skin. Furthermore, examination of skin scrapings confirmed the presence of Sarcoptic mites. Those, she-camels were emaciated, with pale and anemic membranes but their body temperature was in the normal limits.

She-camels of the third group (G3) suffered from weakness, soft feces with indigestible food particles, debilitation and lack of stamina. Those camels showed also skin lesions with symptoms of itching, pruritus, erythema and alopecia with anemic membranes. Laboratory examinations of skin scrapes confirmed Sarcoptic mites, while fecal samples examination revealed the presence of heavy infestation with gastrointestinal parasites (nematodes).

2-Blood haemogram of the experimental she-camels

The blood hematological parameters of the she-camels (G1, G2 and G3) in relation to both parasitic infections are showed in Table 1. Total erythrocyte count (TEC) was the highest in G1, decreased in G2, while reached its minimal values in G3, ($p< 0.05$). The same trend was observed for blood hemoglobin, PCV, MCV, MCH, MCHC and TLC ($p< 0.05$). The blood hematological normal values measured for G1 she-camels were agreed with the reports of Higgins (1986), Karram *et al.* (1991) and Baraka (1995). The obvious effects of the parasitic effects on the blood hematological parameters either in G2 or G3 she-camels were in agreement with those reported by Zoethout and Tuttle (1950) in human, Padmaja (2012) and Wintrobe *et al.* (1976) in animals. Both of them reported that normal and healthy mammals had considerable higher hematological values than those having abnormal physiological or hygienic conditions. Either external parasites (eg. mange) or internal parasites (eg. nematodes) shares the she-camels their blood nutrients and affects the formation of blood.

Regarding the erythrocytic indices (MCV, MCH, MCHC, ..), several researchers reported a decline in these indices in camels due to such stressors of parasitic infections (Partani *et al.*, 1995 and Sayed, 1998).

Table 1 Blood parameters

	Experimental she-camels		
	G1	**G2***	**G3***
TEC x 10^6	$8.130^a \pm 0.12$	$6.711^b \pm 0.14$	$6.256^c \pm 0.16$
Hb, g/dl	$14.54^a \pm 0.33$	$12.30^b \pm 0.28$	$10.93^c \pm 0.24$
PCV %	$29.28^a \pm 0.40$	$27.94^b \pm 0.34$	$26.98^c \pm 0.30$
MCV, fl	$46.86^a \pm 0.68$	$41.71^b \pm 0.59$	$33.30^c \pm 0.51$
MCH, pg	$23.24^a \pm 0.35$	$18.34^b \pm 0.31$	$13.46^c \pm 0.27$
MCHC %	$49.63^a \pm 0.91$	$44.02^b \pm 0.79$	$40.50^c \pm 0.68$
TLC x 10^3	$11.008^a \pm 0.34$	$10.797^a \pm 0.29$	$9.226^b \pm 0.26$
TLC differentiation (DLC)			
N %	$43.11^a \pm 1.84$	$41.00^a \pm 1.60$	$40.68^a \pm 1.38$
E %	$4.67^a \pm 0.46$	$5.08^a \pm 0.40$	$5.13^a \pm 0.34$
B %	$0.00^a \pm 0.0$	$0.17^a \pm 0.06$	$0.00^a \pm 0.0$
M %	$3.44^a \pm 0.41$	$4.17^b \pm 0.35$	$4.18^b \pm 0.30$
L %	$50.78^a \pm 1.89$	$49.58^a \pm 1.63$	$49.00^a \pm 1.41$

Means within the same row having different superscripts differ significantly ($P<0.05$)

*G2 diseased she-camels with mange (Sarcoptic mites), *G3 diseased she-camel with intestinal parasitic infection and mange

Inspection of leukocyte differentiation indicated that neutrophils (N), basophils (B), and lymphocytes (L) types were less in the parasite infected groups (G2 and G3) than those of G1 group, while eosinophils (E) and monocytes (M type) were higher ($p< 0.05$) in G2 and G3 than G1 she-camels. The results of DLC were in agreement of Padmaja (2012), Partani *et al.* (1995), Karram *et al.* (1991) and Al-Ani *et al.* (1992).

Table 2 Blood plasma constituents of the clinically normal (G1) and diseased (G2& G3) she-camels.

Plasma constituents	Experimental she-camels		
	G1	G2	G3
Total Protein, g/dl	$9.31^{a} \pm 0.40$	$7.54^{b} \pm 0.34$	$6.92^{c} \pm 0.30$
Albumin, g/dl	$4.03^{a} \pm 0.30$	$3.27^{a} \pm 0.25$	$3.47^{b} \pm 0.22$
Globulin, g/dl	$5.28^{a} \pm 0.39$	$4.27^{b} \pm 0.34$	$3.45^{b} \pm 0.29$
A/G ratio	$0.76^{a} \pm 0.14$	$0.77^{b} \pm 0.21$	$0.99^{b} \pm 0.10$
Glucose, mg/dl	$136.28^{a} \pm 6.02$	$88.59^{b} \pm 5.21$	$64.88^{c} \pm 4.51$
AST, RFU	$80.11^{a} \pm 2.2$	$90.08^{a} \pm 1.9$	$120.81^{a} \pm 1.67$
ALT, RFU	$56.11^{a} \pm 1.65$	$69.25^{a} \pm 1.43$	$76.25^{a} \pm 1.24$
Total bilirubin, g/dl	$1.38^{a} \pm 0.07$	$1.77^{a} \pm 0.06$	$1.98^{b} \pm 0.05$

Means within the same row having different superscripts differ significantly ($P<0.05$)
*G2 diseased she-camels with mange (Sarcoptic mites), *G3 diseased she-camel with intestinal parasitic infection and mange

3-Blood plasma constituents of the experimental she-camels

3-1-Blood Biochemistry

Blood plasma constituents of the she-camels as affected by the parasitic infection are presented in Table 2. Total protein concentration was the lowest in G3 she-camels, while it was the maximum in G1 she-camels ($P<0.05$). This was mainly due to a similar trend of increased plasma globulin concentration for being healthy and in part due to an increase in plasma albumin in healthy and clinically normal she-camels. Plasma A/G ratio was similar in G1 and G2 camels being lower ($P<0.05$) in G3 camels. These results are in agreement with those of Chaudhary, *et al.* (2003), Magda *et al.* (2002) and Faye *et al.* (1995) who observed that serum total proteins increased in healthy older camel due to progressive increase in globulins due to lymphoid system maturity. The same authors also observed that plasma albumin was higher in adult healthy camels than in camel calves due to higher liver activities.

Plasma glucose concentration was the highest ($P<0.05$) in G1 camels, decreased ($P<0.05$) in G2 to be the minimal in G3 group. These results can be explained by the fact that the parasite shares the available nutrients in the plasma pool with animals themselves.

Plasma transaminases activities (AST & ALT) are increased in both types of the parasitic infections (G2 and G3), also, total bilirubin are tended to be increased due to the same cause. These results are in accordance with those of Sarwar *et al.* (2004), Coles (1986) and Abdo *et al.* (1985). They observed that plasma AST and ALT activities varied according to the liver function which in turn varied according to the physiological and the health conditions of the animal.

3-2- Blood Hormones

Data on blood plasma leptin and IGF-1 of the clinically normal (G1) and diseased (G2 and G3) she-camels are reported in Table 3.

3-2-1- Leptin hormone

The obtained results of leptin hormone for the experimental she-camels in G1, G2 and G3 showed the stressing effects of both types of parasites on the she-camels. The overall mean of Leptin concentrations in she-camels in G1 was higher ($P>0.05$) than those of G2 and G3 being the minimum in G3 group.

The reduction in leptin concentration in the peripheral blood of the she-camels infested with either mange as external parasite or mange plus intestinal nematode could be explained by the effects of these parasites as stressors of the animal physiology. Also, summer desert environment on these animal adds more stress. Mann *et al.* (2000) reported that Leptin reached a nadir in late summer (August to September.), while being at its peak in late winter (January to March). This is because of the critical role of Leptin in regulating energy metabolism (Block *et al.,* 2003) and reducing dry matter intake (Hansen, 1997; Drew, 1999 and Ronchi *et al*., 2001) under summer condition. Leptin is also associated with other biological processes such as reproduction, hematopoiesis, immune response and bone formation (Olusi *et al*., 2003).

3-2-2- Plasma IGF-1

The concentration of blood plasma IGF-I was significantly higher in the peripheral blood of G1 she-camels than that found in G2 and G3 she-camels. The observed increase in IGF-I concentration for she-camels in G1 group compared to the parasitic infected groups G2 and G3 could be explained by the liver activity in normal she-camels. The blood plasma

IGF-1 in G1 group is higher than that in G2 and G3 groups. Hadely, 2000 and Gatford *et al.*, 1996 stated that nutritional and health status are major factors affecting plasma IGF-1 concentration due to their effects on the liver function and activity which is the main source of circulating IGF-1 in blood. The IGF-1 values in the peripheral blood of the examined control camels and the infested camels with parasites are in the same range reported in camel serum by Mojtaba *et al.* (2014).

Table 3 Blood plasma leptin and IGF-1 of the clinically normal (G1) and diseased (G2 and G3) she-camels.

Blood hormones	Experimental she-camels		
	G1	G2	G3
Leptin (ng/ml)	$4.24^{a} \pm 0.10$	$2.10^{b} \pm 0.70$	$1.78^{b} \pm 0.90$
IGF-1 (ng/ml)	$276.71^{a} \pm 80.4$	$210.00^{b} \pm 81.3$	$180.00^{b} \pm 99.1$

Means within the same row having different superscripts differ significantly ($P<0.05$)
*G2 diseased she-camels with mange (Sarcoptic mites), *G3 diseased she-camel with intestinal parasitic infection and mange

Conclusion

Camel blood is a mirror of the physiological or adverse conditions (age, sex, pregnancy, prolonged poor grazing, and chronic parasitic infection). All these effectors exert changes in the hematological and biochemical blood parameters. These changes could be used to monitor the normal physiological and health status in camels in such a situations. Keeping camel under human control (such as adequate nutrition, treatment of internal and external parasites and monitoring of physiological status and health) is very crucial and important for camel wellbeing.

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