Some Biochemical And Haematological Studies On Imported Sudanese Camels, In Quarantine, With Reference To The Fallahi Camels

Shehata, F.E[*]; Ali, M. A.[*], Laila, G.Rizk[**], and Helal, A.D[**]

Animal Health Research Institute (Shibin El Koum provincial lab., Chem Dept).
[**]Animal Health Research Institute (Dokki, Gize, Buffalo Dis. Dept.).

ABSTRACT

Thirty of apparently healthy male imported Sudanese camels, 7-10 years old (free from internal, external and blood parasites) were randomly chosen from the imported Sudanese camels after preliminary examination in the quarantine near abu-simble tourism city (Aswan Governorate, South Egypt). The camels were divided unto 3-equal groups, the first group represents the fatigued animals on time of arrival, where their samples are soon taken, the second group was allowed to rest for one week and allowed to drink from well's water of the quarantine, and the third group was allowed to rest for a week without drinking any water to be compared with a fourth apparently healthy fallahi Egyptian camels. Blood and serum samples were taken from camels of the four groups for determination of the concentrations of the different serum elements and for haematological, biochemical and immunoelectrophoretical investigations. Samples from well's water of the quarantine were taken for determination of the elements concentrations of well's water. Based on the available obtained results, it could be concluded that the determined elements of well's water are less than that of hygienic concentrations of the ground water elements except iron concentration (0.07ppm) which exceed that of the hygienic concentration (0.05 ppm). Camels drinking from well's water showed higher serum iron concentration, Manganese salts are recommended for imported camels to normalizing the higher serum iron concentration, and such well's water should be treated for precipitating its iron salts (unless hygienic water was supplied). The fatigued Sudanese camels showed lower values of serum sodium and potassium, so that their salts should be supplied to camels during the journey of transportation. The serum magnesium was decreased and the serum lead was increased in fatigued imported Sudanese camels (as the magnesium activates ATP-ase enzyme reaction for energy production and also Mg diminute the lead toxicity), so that Mg-salts supplementation are advisable to Sudanese camels during their journey. The fatigued camels showed renal dysfunction earlier than the hepatic dysfunction (perhaps due to the rapid glycogenolysis for energy production during walking with subsequent hepatocytic degeneration), so that high energy feed and hygienic water should be sufficiently supplied during their transportation. The immunoglobulins of fatigued Sudanese camels are still maintained similar to that of Egyptian ones, perhaps it may be attributed to their high serum Zinc level which of immunostimulant effect.

INTRODUCTION

The health status, nutrient digestibility, water intake and body weight besides the biochemical and behavioural parameters are affected by prolonged feed and water deprivation in the one humped dromedary camels *(1)*.

Both nutrient shortage and saline drinking water load lower the activity of the acetylcholinesterase (ACHE). The camel tolerate such stress factors better than sheep *(2)*. The RBCs, WBCs, haemoglobin (Hb) concentration, packed cell volume (PCV) and the serum calcium, phosphorus, magnesium, sodium, potassium, iron and copper were significantly decreased in the emaciated camels as a result of shortage of nutrients when compared with the healthy camels *(3)*. Camels are more adapted to salinity by reducing water consumption, and sheep tolerate high intake of salty water through

physiological adaptation mechanisms till 40 days *(4).*

After six kilometers camel race competition, plasma sodium increased in non-athletic camels than the athletic ones, while the non-esterified fatty acids were decreased in the non atheletic camels *(5).* The rapid glycogenolysis in the liver cells may induce some cellular damage with prolonged elevation of the total protein in the exercised camels. Splenic contraction may occur in the exercised camels leading to the elevation of RBCs, WBCs counts, monocyte percentage and Hb-concentration *(6).*

No significant effect of camels breeds on the levels of serum copper and zinc besides the activities of the creatine Kinase (CK), alanine and aspartic-transferases, but the physiological status influenced all the above parameters except CK enzyme activity *(7).* The rainy season may induce higher copper and zinc levels in plasma of camels *(8).* The higher glucagon level in camels than in other ruminants may explain the higher glucose level in camels than other ruminants and man *(9).*

Some blood biochemical and haematological studies were carried out on the Sudanese and Egyptian camels *(10).* The effects of working on the Egyptian camels were studied, it has been found that the exercise of camels could elevate the levels of serum urea, creatinine, total proteins, albumin, triglycerides and total and direct bilirubins besides the activities of AST and ALP enzyme *(11).* The AST enzyme activity, cortisol level and eosinophil percentage were increased together with the immunosuppressive action in the working camels when compared with the non-working camels *(12).*

The present study was designed to study the stress of the travel (walking) from the Sudan to Egypt, on some blood parameters, compared with those of the fallahi Egyptian camels. The effect of drinking the quarantine well water was evaluated.

MATERIAL AND METHODS

The imported Sudanese camels are firstly received in the quarantine of Abu-simble tourism city where for first preliminary examination (clinical signs besides, fecal and haematologicl examination for internal and blood parasites. Thirty apparently healthy adult male camels (7-10 year old) which were free from internal, external and blood parasites) were divided into three equal groups (gps. 1-3) (on the first day of arrival) gp (1) on the 1st day of arrival was considered fatigued after prolonged walking from Sudan to south Egypt, Gp (2) allowed to rest for 7 day and drink water from the deep well of the quarantine in the desert (about 15-20 km) near the Abu-Simble- tourism city, five daily water samples were collected from the well for five days for analysis of the different elements using atomic absorption spectrophotometry *(13),* Gp. (3) was rested for 7-days without drinking (Grp. 4), 10 fallahy apparently healthy adult male Egyptian camels was used for comparison with the Sudanese camels. Blood samples were collected on EDTA-disodium anti coagulant and serum was separated (gps. 1-4) for haematological studies (RBC, WBC and platelet counts besides haemaglobin concentration) *(14)* and serological serum protein electrophoresis by cellulose acetate method *(15)* and determination of some serum elements (cobalt, copper, lead, zinc, sodium, potassium, manganese, magnesium and iron) using atomic absorption spectrophotometry *(13),* determination of some serum biochemical constituents as: alanine aminotransferase (ALT) and aspartic aminotransferase (AST) enzyme activities *(16),* total protein *(17),* serum urea concentration *(18),* and serum creatinine concentration *(19).*

The obtained data were statistically analyzed using the analysis of variance (ANOVA) through F-Test *(20).*

RESULTS

(A) **Elements in the well's water of the quarantine of Abu-simble tourism city:-** The mean values (± standard errors) of the determined elements in the well's

water are presented in Table 1, the determined elements are: cobalt (co), copper (cu), lead (pb), sodium (Na), Potassium (K), manganese (Mn), Magnesium (Mg), Iron (Fe), Zinc (Zn) and chloride (Cl). All the element were determined in ppm, except the chloride which was determined in mmol/L.

Table 1. The concentrations of different elements in the water of the deep well of the quarantine of Abu-simble tourism city (Aswan governorate, South Egypt).

	Cobalt (Co) (ppm)	Copper (Cu) (ppm)	Lead (Pb) (ppm)	Sodium (Na) (ppm)	Potassium (K) (ppm)	Manganese (Mn) (ppm)	Magnesium (Mg) (ppm)	Iron (Fe) (ppm)	Zinc (Zn) (ppm)	Chloride (Cl) (mmd/l)
Concentrations in well's water	0.0023 ± 0.0003	0.0037 ± 0.0025	0.028 ± 0.003	0.403 ± 0.0097	0.688 ± 0.084	0.0055 ± 0.0003	0.228 ± 0.011	0.071 ± 0.006	0.0311 ± 0.002	3.00 ± 0.316

(B) Serum Elements (Table 2)

1. Cobalt (Co)

The serum cobalt was significantly increased in the two groups of Sudanese camels after one week resting period than that of fatigued ones (at time of their arrival). However cobalt was non significantly changed in the 3 sudanese camel groups than that of the normal Egyptian camel group.

2. Copper (Cu)

The serum Cu was significantly decreased in the Sudanese camels after resting period than that of fatigued ones, but it increased significantly in fatigued camel than that of the normal Egyptian camels.

3. Zinc (Zn)

Serum zinc was significantly increased in fatigued Sudanese camels (the highest concentration) than that of the other three Sudanese and Egyptian groups of camels. Zn decreased significantly in the two groups of Sudanese camel after rest than that of Egyptian camels.

4. Lead (Pb)

Serum lead was significantly increased in fatigued Sudanese camels (the highest concentration) than that of the other two Sudanese (after rest) and Egyptian (normal) groups of camels. The Pb decreased significantly in Sudanese camels after rest than that of Egyptian camels.

5. Sodium (Na)

The serum Na was significantly increased in the Sudanese camels drinking well's water of the quarantine (during one week resting period) than that of fatigued ones. The Na increased in Egyptian camels than that of the Sudanese camels.

6. Potassium (K)

As in case of Na, the potassium was significantly decreased in the serum of all Sudanese camels than that of the normal Egyptian camels. Drinking of well's water not changed the K- levels in Sudanese camels than that of fatigued ones, but it increased in camels drinking well's water than camels not drinking any water.

7. Manganese (Mn)

The serum manganese was significantly increased in fatigued Sudanese camels than that of other Egyptian camels and Sudanese ones (after rest).

8. Magnesium (Mg)

The serum Mg significantly increased in resting camels than of fatigued ones, but it decreased in Egyptian camels than that of the other three Sudanese groups of camels.

9. Iron (Fe)

The serum Fe significantly increased in all Sudanese camels than of Egyptian ones. Also, Fe significantly increased in Sudanese camels that drinking well's water than that not drinking any water. The serum concentrations of the different serum elements in Sudanese and Egyptian camels are tabulated in Table 2.

Table 2. The concentrations of different serum elements of normal Egyptian and Sudanese camels before and after resting from traveling with or without drinking well's water of Abusimble tourism city quarantine.

Group	Cobalt (Co) (ppm)	Copper (Cu) (ppm)	Zinc (Zn) (ppm)	Lead (Pb) (ppm)	Sodium (Na) (ppm)	Potassium (K) (ppm)	Manganese (Mn) (ppm)	Magnesium (Mg) (ppm)	Iron (Fe) (ppm)
Control (normal Egyptian camels)	0.1775 ab ± 0.0097	0.330 a ± 0.054	5.840 a ± 0.618	0.2925 a ± 0.011	0.373 a ± 0.075	15.635 a ± 0.508	0.070 a ± 0.0071	0.170 a ± 0.008	1.110 a ± 0.036
Sudanese camels (fatiqued)	0.2150 a ± 0.016	3.711 b ± 0.290	23.180 b ± 0.985	0.5561b ± 0.063	0.248 b ± 0.022	13.887 b ± 1.020	7.280 b ± 0.707	1.975 b ± 0.127	1.8825 b ± 0.145
Sudancse camel (after rest, drinking well's water)	0.1325 b ± 0.0084	0.780 c ± 0.081	0.8825 c ± 0.016	0.115 c ± 0.0078	0.315 c ± 0.032	12.843 c ± 0.707	0.0375 a ± 0.004	3.1825 c ± 0.280	11.525 c ± 0.061
Sudancse camel (after rest, not drinking water)	0.1575 b ± 0.037	1.8825d ± 0.138	1.675 c ± 0.226	0.030 c ± 0.003	0.025 d ± 0.004	13.738 b ± 0.617	0.1375 a ± 0.013	4.1575 d ± 0.343	2.478 d ± 0.576
F- Test	*	*	*	*	*	*	*	*	*
LCD(P≤ 0.05)	0.047	0.373	1.519	0.099	0.045	0.880	1.205	0.528	0.336

N.B: Different litters in columuns denote the significant changes between means at(p≤ 0.05) 2-* = significant changes between means (p≤ 0.05) 3-LSD = least significant changes (p≤ 0.05).

(C) Serum Biochemical Constituents

1. Alanine aminotransferase (ALT) enzyme activity

The fatigued Sudanese camels showed non-significant increase of ALT enzyme level than that of Egyptian camels, but it increased significantly after one week resting period than that of either fatigued and Egyptian groups of camels.

2. Aspartic aminotransferase (AST) enzyme activity

The Sudanese camels drinking well's water with one week resting period showed only significant increase of AST levels than that of other groups of Sudanese and Egyptian camels.

3. Serum creatinine

All Sudanese camels showed significant increase of the serum creatinine than that of the normal Egyptian camels, and the highest concentration was showed by the fatigued Sudanese camels.

4. Serum Urea

Egyptian camels showed higher serum urea concentration than that of Sudanese camels in most cases.

5. Total Protein

The serum total protein was increased in Egyptian camels than that of Sudanese ones (except the group after rest that drinking well's water). The serum biochemical constituents are tabulated in Table 3.

(D) Haematological Study

1.Red Blood Corpuscle (RBCS) count and Haemoglobin (Hb) concentration

No significant variations of RBCs count and Hb concentrations between all Egyptian and Sudanese camels.

2. White blood corpuscle (WBCs) count

The fatigued Sudanese camels showed significant increase of WBCs counts than that of other groups of camels, but after resting period Sudanese camels showed significant

decrease of WBCs than that of fatigued and normal Egyptian groups of camels.

3. Blood Platelets Count

Only Sudanese camels after resting period that not drinking from well's water showed significant increase of blood platelets than that of the other 3-groups, The serum biochemical parameters are tabulated in Table 4.

Table 3. Some serum biochemical constituents of Egyptian and Sudanese camels, before and after resting period with and without drinking well's water of the quarantime of Abusimble tourism city.

Groups	ALT-Enzyme activity (u/l)	AST-Enzyme activity (u/l)	Serum creatinine concentration (mg/dl)	Serum urea concentration (mg/dl)	Total protein (g/dl)
Control (normal Egyptian camels)	2.800 a ± 0.657	35.00 a ± 4.45	0.968 a ± 0.059	59.668 a ± 1.970	6.40 a ± 0.126
Sudanese camels (fatigued)	3.800 a ± 0.335	46.32 a ± 4,003	1.869 b ± 0.059	41.432 bc ± 1.835	5.40 b ± 0.145
Sudanese camels (after rest, drinking well's water)	9.800 c ± 1.885	69.68 b ± 7.64	1,732 bc ± 0.168	34.000 c ± 3.37	7.60 c ± 0.258
Sudanese camels (after rest, not drink water)	8.00 c ± 0.510	40.68 a ± 2.286	1.620 c ± 0.059	59.000 ab ± 7.228	6.00 d ± 0.316
F-Test	*	*	*	*	*
LSD (P≤ 0.05)	3.381	15.402	0.184	16.123	0.268

N.B: Different litters in columuns denote the significant changes between means at (p≤ 0.05) 2-* = significant changes between means (p ≤ 0.05) 3-LSD = Least Significant Difference (p≤ 0.05).

Table 4. Some Haematological Parameters of Egyptian and Sudanese Camels of the Different Groups

Groups	RBCS Count (X 10^6/Cu mm)	HB Concentration (g/dl)	Platelets Count (X 10^5/ µl)	WBCS Count (X10^3 count cumm)
Control (normal Egyptian camels)	3.400 a ± 0.165	10.100 a ± 0.605	260.00 a ± 13.565	9.968 a ± 0.850
Sudanese camels (fatigued)	3.400 a ± 0.170	10.168 a ± 0.964	284.00 a ± 5.99	11.580 b ± 3.200
Sudanese camels (after rest, drinking well's water)	3.700 a ± 0.117	11.068 a ± 0.622	282.40 a ± 10.51	7.680 c ± 0.821
Sudanese camels (after rest, not drink water)	3.456 a ± 0.062	10.300 a ± 0.288	400.00 b ± 8.25	5.300 d ± 0.165
F-test (P≤ 0.05)	-	-	*	*
LSD (P≤ 0.05)	NS	NS	25.548	1.132

N.B: Different litters in columuns denote the significant changes between means at (p≤ 0.05) 2-* = significant changes between means (p ≤ 0.05) 3-LSD = Least Significant Difference (p ≤ 0.05).

(E) Serum protein electrophoresis

1. Albumin

The serum albumin concentration did not showed any significant changes between the four groups of Egyptian and Sudanese camels.

2. Alph-1 (α -1) globulin fraction

The α-1 globulin fraction of Sudanese camels that drinking from well's water during-resting period only significantly increased than that of the other 3-groups of camels.

3. Alpha-2 (α-2) globulin fraction

After resting period, the Sudanese camels showed significant increase of α-2 globulins than that of Egyptian and fatigued Sudanese camels.

4. Beta (β) globulin fraction

The β- globulins are significantly increased in the all three Sudanese groups of camels than that of normal Egyptian camels. The lowest value of β-fractions was showed by the fatigued group of Sudanese camels.

5. Gammaglobulin (γ) fractions (immuno-globluins)

The highest γ-fractions was showed by Sudanese camels (after resting and drinking from well's water), the lowest γ-fractions could be detected in Sudanese camels (after resting period, which not drinking from well's water). γ-fractions of fatigued Sudanese camels not significantly decreased than that of the Egyptian camels.

6. Albumin/Globulin (A/G) Ratio

The fatigued camels and the group after resting period that drinking well's water showed the higher A/G ratio than that of the other two groups of camels. The lower A/G ratio was detected by Sudanese camels after resting without drinking well's water.

Table 5. Serum protein fractions of Egyptian and Sudanese camels, before and after resting period, with and without drinking from well's water of the quarantine of the abusimble tourism city

Groups	Albumin (g/dl)	Alpha-1 ($\propto_1$) glonbulins (g/dl)	Alpha-2 ($\propto_2$) globulins (g/dl)	Beta (β)globulins (g/dl)	Gamma (γ)globulins (g/dl)	Albumin/ globulins (A/G) ratios
Control (normal Egyptian camels)	2.967 a ± 0.084	0.026 a ± 0.0025	0.224 a ± 0.022	2.054 a ± 0.084	1.325 a ± 0.094	0.760 a ± 0.063
Sudanese camels (fatigued)	3.753 a ± 0.057	0.038 a ± 0.0015	0.211 a ± 0.011	0.972 b ± 0.043	1.213 ac ± 0.111	1.220 b ± 0.054
Sudanese camels (after rest, drinking well's water)	2.742 a ± 0.083	0.099 b ± 0.0030	0.411 b ± 0.013	1.566 c ± 0.111	1.771 b ± 0.058	0.970 c ± 0.035
Sudanese camels (after rest, not drink water)	2.771 a ± 0.116	0.036 a ± 0.0031	0.432 b ± 0.023	1.632 c ± 0.080	1.158 c ± 0.037	0.540 d ± 0.022
F-Test	-	*	*	*	*	*
LSD (P≤ 0.05)	N.S.	0.0035	0.037	0.133	0.132	0.075

N.B: Different litters in columuns denote the signigicant changes between means at (p≤ 0.05) 2-* = significant changes between means (p≤ 0.05) 3-LSD = Least Significant Differnce (p≤ 0.05).

DISCUSSION

The long travelling from Sudan to south Egypt (mostly by walking), the effect of one week resting period in the quarantine, the Egyptian environmental changes from that of Sudanese environments (as water, temperature, soil, air, season, feeding .....etc) may affecting the bodies of imported camels. The possible Egyptian pollutants or any factors or absence of pollutants or any factors previously

affected the Sudanese camels before and/or after transportation time may affecting the bodies or behaviors of animals. Additionally, the different genetic contents or breeds, might affecting some parameters of bodies of the imported Sudanese camels. Such mentioned factors should also put in consideration when comparing such parameters of the imported Sudanese camels with that of the Egyptian ones.

The current study revealed that the water of the quarantine's well analyzed for some trace and macro elements, the concentrations (per ppm, except chloride per mmol/l) of elements of well's water are :0.0023 (cobalt), 0.0037 (copper), 0.028 (lead), 0.403 (sodium), 0.688 (potassium), 0.0055 (manganese), 0.228 (magnesium), 0.071 (iron), 0.031 (zinc) and 3.00 mmol/l (chloride). It was found also that the hygienic concentrations (per ppm, except chloride per mmol/l) of the different elements (except cobalt) of the ground water are: 1.00 (copper), 1.00 (lead), 50 (sodium), 1-2 (potassium), 0.01 (manganese), 50 (magnesium), 0.5 (zinc), 0.05 (iron), 13.5 ppm (chloride) ***(21)*** and equal or less than 2.00 ppm(cobalt) ***(22).*** By finding Interco relationships between the concentrations of elements of well's water and that of their hygienic healthy concentrations, it could be detected that the determined concentrations of well's water are less than that of hygienic concentrations (except iron concentration which exceed that of hygienic one). In serum of Sudanese camels, the copper (cu) and magnesium (mg) elements are significantly increased in Sudanese camels which drinking from well's water than that of Egyptian camels inspite of their concentration in well's water were more less than that of hygienic concentration. This result perhaps attributed to other factors such as: pervious nutritional, absorption, storage and metablic factors of the Sudanese camels according to church and pond ***(23),*** but the remaining five determined serum elements (except iron) of camels drinking well's water were found to be decreased than that of the normal Egyptian camels.

The serum cobalt (Co) was significantly increased in the imported Sudanese camels after one week resting period than that of fatigued camels on the day of their arrival. Splenic contraction occurred in working camels leading to increased RBCS count and haemoglobin (HB) concentration ***(6)*** and as the Co is a component of HB, which in turn it need Co for increasing HB and RBCS that carrying O_2 for oxidation reaction necessary for energy production during working or exercise ***(24),*** so that the decreased serum Co in fatigued camels perhaps attributed to its consumption for HB -biosynthesis. The HB showed also a slight increase of its concentration and RBCS count in the fatigued Sudanese camels. The samples from the Sudanese camels in the current work are taken in may (2008), the beginning of rain season in Sudan and Ethiopia, and this perhaps explain the higher serum Cu and Zn in Sudanese camels than that of Egyptian ones which increased in rainy season according to ***Mohamed (8).***

Zn is a constituent of numerous metalloenzymes and insulin hormone, it is required for normal protein, carbohydrate and nucleic acid metabolisms ***(23)***. Zn-oxide therapy induced immunostimulant effect ***(25).*** So that, the increased serum zn in fatigued Sudanese camels perhaps the cause of keeping their immunoglobulins (γ- fractions) levels to their normal values compared to Egyptian camels. Such γ-fractions were also improved by one week resting period in camels drinking from the well's water than that of other camel's groups as indicated by the present work.

The present investigation revealed that the serum lead is significantly increased in fatigued Sudanese camels than that of camels of the other 3- groups. The reduced serum lead (one week post resting period) indicating the possible exposure of camel to air polluted with lead during their traveling on or near roads of autobuses, where these automobiles burning gasoline containing tetraethyl lead by their tractors ***Buck (26).***

The serum sodium (Na) and potassium (K) are significantly increased in Egyptian camels than that of Sudanese ones, and also they increased in Sudanese camels drinking well's water during rest than that of fatigued camels. The shortage of feed and water containing sufficient Na and K during importation period perhaps the cause of decreased Na and K in Sudanese camels than that of Egyptian ones, that the drinking well's water by Sudanese camels elevate Na and K than that of camels not drinking water from this well. A critical osmotically active substance of blood plasma is Na, and that of intracellular content is K-ions. K provides for a stable osmotic pressure of intracellular fluid, acetylcholine synthesis, generation of rest and action potentials, Na maintains a stable osmotic pressure of the extracellular fluid, regulate acid-base balance and generate membrane and action potentials *(27),* so that Na and K-salts should be supplied to Sudanese camels during traveling period.

The current work revealed that the serum magnesium (Mg) concentration was increased significantly in Sudanese camels after resting than of fatigued ones, but generally Mg increased significantly in Sudanese camels than that of Egyptian ones. During working (walking), the Mg activates ATP- ase enzyme to breakdown the ATP molecules in mitochondria (in the oxidative phosphorylation coupling) for energy production *(28),* and this may explain the reduced serum Mg in working (fatigued) camels for energy production, so that Mg-Salts should be supplied during the traveling time of Sudanese camels. In addition, Mg play a role in minimizing the lead (pb) and cadmium (cd) intoxication *(29)* and this perhaps explain the reduced serum Pb in rested camels due to their high serum Mg concentration. This conclusion suggesting the need of Mg-salts during traveling period as a protective action for higher serum Pb inhaled from the Pb polluted air.

All Sudanese camel groups showed significant higher serum manganese (Mn) concentration than that of the Egyptian ones. The significant higher Mn concentration was showed also by camels after resting period than that of fatigued camels. Mn is a component of some metalloenzymes and play a role in carbohydrate and lipid metabolisms. Excessive dietary calcium or phosphorus reduce Mn absorption, in contrast, Mn absorption is increased by iron (Fe) deficiency, and the amount of Mn absorbed from GIT appears to be directly proportional with its ingested amount till 10% (the maximum Mn absorption from the total ingested Mn) *(23).* The fact of the reverse relationship between Fe and Mn was detected in sudanese camels of the current study, where Fe is 11.525 ppm, the Mn is low 0.0375 ppm, and when Fe is 1.8825 ppm, the Mn is 7.280 ppm, but this fact could not be detected for Egyptian camels, suggesting a possible low dietary Mn supplied to Egyptian camels according to the basics mentioned by ***Church and Pond (23).***

The current study revealed that the serum iron (Fe) concentrations are higher in Sudanese camels than that of the Egyptian ones, and the significant higher Fe concentration (11.525 ppm)was detected in Sudanese camels drinking from the well's water of higher water iron concentration (0.071 ppm), suggesting that well's water of the quarantine of abu-simble is polluted with Fe, which may resulting in a possible significant chronic Fe- intoxication with prolonged exposure to such polluted water. The signs of Fe-toxicity are diarrhoea, reduced feed conversion and growth , vascular congestion and metabolic acidosis *(30),* such signs could not be detected in Sudanese camels, but the water of this well should be treated for precipitating Fe-salts (unless healthy water could not be supplied during the quarantine period) also, Mn-salts should be supplemented to minimizing serum Fe. The fatigued imported Sudanese camels showed slight (non-significant) increase of ALT and AST enzyme activities than that of Egyptian camels, but one week after rest period the enzymes are significantly elevated in Sudanese camels that drinking well's water, but Sudanese camels which not drinking such water showed only significant increase of ALT

enzyme activity than that of Egyptian camels. The ALT enzyme was elevated with hepatic affections *(31)*, both ALT and AST enzymes are usually elevated in acute hepatic necrosis, extrahepatic obstraction and congestive hepatomegalia *(32)*. The liver dysfunction of the Sudanese camels, one week post arrival, perhaps a sequence of fatigue due to rapid glycogenolysis in the hepatocytes (for energy production during working condition) which may induce cellular hepatocytic damage with sequent elevation of liver enzymes in addition to the elevated , urea, glucose and total protein *(6)*. The Sudanese camels (especially those drinking well's water) in the current study showed also significant increase of serum urea, total protein and creatinine than that of the Egyptian camels, the increased serum urea and creatinine in the fatigued camels after resting period in the present study may pointed to that the renal dysfunction perhaps started before hepatic dysfunction in such conditions as the serum urea and creatinine are elevated with substantial renal impairment *(33)*.

The current work revealed that the alpha-1 ($\propto_1$) and alpha-2 ($\propto$-2) globulins are increased in Sudanese camels after resting period than that of fatigued and Egyptian camels. In contrast the beta (β) globulins are decreased in all Sudanese groups of camels than that of Egyptian ones. Fatigued camels showed significant decreased in the β-fractions than that of camels after resting period. There are 13- types of $\propto$- globulin fractions of diagnostic values, the elevated levels of some $\propto$- fractions have been reported with some toxic materials. The increased β-fractions may attributed to that some γ-fractions may transferred to the regions of β-fractions in response to autoimmune disease *(34)*.

Based on the present investigation, it could be concluded that the determined concentrations of elements of the well's water of quarantine of abu-simble tourism city are less than that of the hygienic healthy ground water except iron concentration (0.071 ppm) which exceed the hygienic concentration (0.050 ppm), such higher Fe concentration of well's water lead to subsequent increase of serum iron concentration in camels drinking such water, so that it could be recommended that manganese salts should be supplied to the imported camels in the quarantine to reduce serum iron, and this well's water should also be treated for precipitating iron salts (unless hygienic water is supplied). The fatigued Sudanese camels showed decrease in sodium and potassium in their serum, so that their salts should be supplied during importation time. The serum magnesium decreased and the serum lead increased in fatigued camels, and because the magnesium activates ATP-ase enzyme activity in mitochondria for energy production, and also the Mg reduce lead toxicity, so that the Mg-salts should be supplied for Sudanese camels during traveling time. The fatigued camels induced renal dysfunction and subsequent hepatic dysfunction (due to the possible rapid glycogenolysis for energy production with subsequent cellular damage of hepatocytes) and the renal dysfunction started earlier than the hepatic dysfunction, so that high energy feed and hygienic water should be sufficiently supplied to Sudanese camels during their traveling period from Sudan to south Egypt .

REFERENCE

1.Abd El-Rahman, M.A. and Mosaad, G.M.(2005). Effect of feed and water deprivation on nutrient digestibility, behavioural and metabolic patterns of one humped camel (camels dromedaries). Assiut Vet.Med.J., 51(105): 58-79.

2.Assad, F. and El-Sherif, M.M.A. (2002). Effect of drinking saline water and feed shortage on adaptive responses of sheep and camels. Small ruminant research, 45(3): 279-290.

3.Hassan, H.Y. and El-Said, M.S. (2000). Some hematological and biochemical parameters of debilitating camels at Alexandria governorate. Assiut Vet. Med.J.43(80): 219-227.

4.Assad, F., Bayoumi, M.T. and Abou- El Nasr, H.M.(1994). Comparative studies on saline drinking water for camel and sheep.

Egyptian J. of comp path and clinincal path, 7(2):337-351.

5.Zeinab, A.M.A.;El-Belbasi, H.I.; Hamada, M.M.Z. and Yousef, M.M.Z.(2005). Some biochemical studies on blood of racing camels. Vet.Med.J., Giza, 53{2(1)}: 49-422.

6.El-Hassanein, E.E. and Assad, F. (1996). Physical and physiological response of camels to exercise. Vet. Med .J. Giza, 44(1):73-83.

7.Seboussi, R., Faye, B. and Alhadrami, G. (2004). Variation factors of some trace elements (selenium, copper and zinc) and enzyme indicators of muscular fatigue in the serum of camels (camels dromedaries) the united of arab emirates. Revue of Elevage et al., medicine veterinaire des pays tropicaux, 57(1/2) :87-94.

8.Mohamed, H.E. (2004). The zinc and copper content of the plasma of Sudanese camels (camels dromedaries). Vet. Res. Communications, 28(5): 359-363.

9.Abd El-Fattah, M.;Amer, H., Ghoneim, M.A.; Warda, M. and Megahed, Y. (1999). Response of one-humped camel (camels dromedaries) to intravenous glucagen injection and to infusion of glucose and volatile fatty acids, and the kinatics of glocagon disappearance from the blood. J. of Vet. Med. Series-A., 46(8): 473-481.

10.Yagoub, I.A. (1988). Studies on the blood constituents of Sudanese camels (camels dromedaries). Acta veterinaria Beograd, 38(1/2):99-108.

11.El-Anwar, A.H.; Mabrouk, E.A. and Ibrahim, S.S. (1993). Effect of muscular exercise on some serum biochemical constituents in camels.Vet. Med.J.Giza, 41(1):83-85.

12.Ahmed, W.M.; Nada,A.R.; Shalaby, S.I.A.; Ezzo, O.H. and Hassan , S.G. (1994). Impact of work status on metabolic profile in cycling cows, mares, she-camels and buffalo cows. International journal of animal science, 9(2): 305-308.

13.Schrenk, W.G.(1975). Analytical atomic spectroscopy, plenum press, New York and London.

14.Schalm, O.W.(1975). Veterinary haematology, London, Bailliere Tindall and Cassel LTD , and Ed-London.

15.Birrier, B.W.(1969). Electrophoretic analysis of blood serum and plasma proteins of normal horses. Amer .j.vet. res.(30): 2237-2240.

16.Reitman, S. and Frankel, S. (1967). Kits for determination of S GOT and SGPT .J.Clin. Path. (28):56.

17.Doumas, B.T.; Watson, W.A. and Bigs, H.G. (1971). Kits for determination of serum total protein. Clin. Chem.. Acta., 31(1): 87.

18.Fawcett, J.K. and Scott, J.E. (1960). Kits for determination of serum urea consentration J. Clin. Path. (13): 156.

19.Henry, R.J. (1974). Clinical chemistry, principles and technics, 2 nd.Ed. Harper and row, PP: 525.

20.Snedecor, G.W. and Cochran, W.G. (1969). Statistical methods. 6 th. Ed. Iowa state university press, Ames IOWA.

21.Holl, K. (1972). Water (examination, assessment, conditioning, chemistry, bacteriology, biology). Walter De Gruyter, Berlin, New York.

22.Meranger, J.C.; Subaman, K.S. and Chalifoux, C. (1981). Survey for cadmium, cobalt, chromium, copper, nickel, lead, zinc, calcium, and magnesium is Canadian drinking water supplies. J. Assoc. Off Anal. Chemi, 64(1) : 44-53.

23.Church, D.C. and Pond, W.G. (1988). Basic animal natrition and feeding, 3 rd ed. Wiley, j.& sons, New York, Chichester, Brisbene, Toronto and Singapore.

24.Stryer, L., (1981). Biochemistry, 2nd ed., Freeman, W.H and company, San Francisco.

25.McIntyre, A.D. and Mills, C.F (1975). Ecological toxicology research (Effects Of Heavy Metal And Organohalogen Compounds) proceeding of NATO-science committee conference, PP: 215, plenum press, New York and London.

26.Buck, W.B. (1970). Lead and organic pesticide poisoning in cattle. J. Am. Vet med. Assoc Vol. 156 (10): 1468-1472.

27.Georgieva, S.A. (1989). Essentials of physiology. English translation. Mir publishers, Moscori, PP., 195.

28.Shechan, D.C. and Hrapchak, B.B. (1980). Theory and practice of histotechnlogy, 2nd ed., the C.V. Mosbly Co.

29.Stec.J. (2000). Inhibition of DNA- Repair by cadmium and lead in sheep lymphocytes, protective interaction of magnesium. Bulletin of the veterinary institute in Puawy, 44(2): 221-226.

30.Falandysx, J.; Lorence, B.H. and Centkowska, D. (1989). Metals in muscles, livers and kidneys of slaughter animal from northorn polond in 1985. Roczniki Panstwowego Zakadu igieny, 40(4-6): 279-283.

31.Kachman, J.F. and Moss, D.V. (1976). Enzymes in fundamentals of clinical chemistry, edited by N. Tietz, PP: 565-698, Saunders, W.B. Philadelphia.

32.Zimmerman, H.J. (1984). Function and integrity of the liver. In clinical diagnosis and monagement by laboratory methods, edited by Henry, J.H. PP: 217-250, Saunders, W.B. Philadelphia.

33.Hayes, A.W. (1989). Principles and methods Fo toxicology, 2nd ed., PP: 485-519, Raven Press, New York.

34.Kaneko, J.J.(1989). Clinical biochemistry of domestic animals. Chapter (6) 4th. Cd. Academic press. Inc.

الملخص العربى

بعض الدراسات البيوكيميائية والهيماتولوجية على الجمال السودانية المستوردة بالمحجر مع الاشارة إلى الجمال الفلاحى

فوزي إبراهيم شحاتة*، مهدي عبد الفتاح علي فرج*، ليلى جورجي رزق، علاء الدين هلال علي**.**
* معهد بحوث صحة الحيوان (فرع شبين الكوم – قسم الكيمياء).
** معهد بحوث صحة الحيوان (الدقي – الجيزة – قسم أمراض الجاموس)

تم الاختيار العشوائي لثلاثون من الجمال السودانية المستوردة (عمر ٧-١٠ أعوام) والسليمة ظاهريا والخالية من الطفليات الداخلية والخارجية وطفيليات الدم من محجر مدينة أبو سمبل السياحية، وقسمت الجمال إلي ثلاث مجموعات متساوية، المجموعة الأولى هي جمال مجهدة في أول يوم من وصولها إلى المحجر،حيث تم أخذ العينات في ذلك اليوم ، والمجموعة الثانية سمح لها بالراحة مع شرب ماء بئر المحجر لمدة أسبوع بينما المجموعة الثالثة سمح لها بالراحة دون شرب أي ماء وذلك لمقارنتهم بمجموعة رابعة من الجمال المصرية (هجين الفلاحي) السليمة الخالية من الطفيليات أيضا، وتم أخذ عينات دم من جمال المجموعات الأربعة لعمل دراسات هيماتولوجية وبيوكيميائية ومناعية وكذلك تعيين العناصر المعدنية المختلفة للمصل وماء بئر المحجر. وبناء علي النتائج المتاحة فقد أمكن استنتاج أن تركيز العناصر المقدرة في ماء بئر المحجر أقل من تركيزات العناصر في المياه الجوفية الصحية ماعدا عنصر الحديد فقد وجد تركيزه٠,٠٧١ جزء من المليون(ppm) مقابل ٠,٠٥ ppm في المياه الصحية وبالتالي حدث زيادة متوقعة في تركيز عنصر الحديد في مصل الجمال التي شربت من ماء بئر المحجر، ولهذا يجب إعطاء أملاح المنجنيز للجمال المستوردة لتقيل زيادة الحديد في مصل الجمال (حيث العلاقة عكسية بين العنصرين في الدم). ولقد أوضحت نتائج الدراسة في الجمال المستوردة المجهدة نقص في مستوى الصوديوم والبوتاسيوم في المصل ولذا يجب إعطاء أملاح الصوديوم والبوتاسيوم في غذاء الجمال أثناء فترة رحلة النقل، وأوضحت الدراسة وجود نقص في عنصر المغنسيوم وزيادة في عنصر الرصاص بمصل الجمال المجهدة، ولأن المغنسيوم يزيد من نشاط إنزيم ATP-ase لإنتاج الطاقة ويقلل من التسمم بالرصاص في نفس الوقت، فإنه ينصح بإعطاء أملاح الماغنسيوم للجمال أثناء رحلة النقل، وأوضحت أيضا الدراسة أن الجمال المجهدة يحدث لها خلل في وظائف الكلى أولا، يتبعه خلل في وظائف الكبد (نتيجة للتحليل السريع المحتمل للنشا الحيواني بالكبد إلي جلوكوز لإنتاج الطاقة أثناء فترة النقل والإجهاد وبالتالي تغيرات انحلالية لخلايا الكبد)، ولهذا يجب إعطاء الجمال علائق عالية الطاقة ومياه شرب صحية وكافية أثناء رحلة النقل. كما أوضحت النتائج أن الجلوبيولنبات المناعية لم تتأثر معنويا بجهد السفر في الجمال السودانية ربما لزيادة عنصر الزنك المنبه للمناعة.