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EFFECT OF HIGH ZINC DOSE ON HAEMATOLOGICAL, LIPIDS AND PROTEIN PATTERNS IN DROMEDARY CAMEL

S.I. Al-Sultan[1] and S.M. El-Bahr[2]

[1]Department of Public Health and Animal Husbandry, College of Veterinary Medicine and Animal Resources, King Faisal University, P.O. Box: 11647, Al-Ahsa, 31982, Saudi Arabia

[2]Department of Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine and Animal Resources, King Faisal University, P.O. Box: 1757, Al-Ahsa, 31982, Saudi Arabia

ABSTRACT

The present study was aimed to examine the effects of high doses of Zn on selected haematological and biochemical parameters in dromedary camel. A total of 6 camels (400 ± 5 kg BW; 4-7 years old) were used in the current experiment. Camels were assigned to 3 equal groups. Camels of the first group received basal diet and served as a control group. Camels of the second and third groups were fed zinc oxide at a dose 2.5 and 5g/camel/day, respectively for 6 weeks. Two blood samples were drawn from the jugular vein of each animal of all group at the time of clinical examination, one on EDTA and the other in plain tubes for serum harvesting. The whole blood sample was used for estimation of haematological parameters and harvested sera were used for determination of biochemical parameters. The present findings indicated that both examined zinc dose were safe to the camels as reflected on unchanged liver and kidney functions. In addition, all examined haematological and biochemical parameters remained unchanged in camels fed both high zinc doses when compared the control. It was concluded that camels are not like other animals as high zinc doses were non toxic to them at the level of peripheral metabolism.

Key words: Biochemistry, blood, camel nutrition, zinc oxide

Zinc (Zn) is widely distributed throughout the animal body and plays an important role in many metabolic processes. Zn has been investigated for its effect on overall body performance in ruminants but studies on its effect on dromedary camel haematology and biochemistry are still lacking. The present study was aimed to examine the effects of two high doses of Zn on selected haematological and biochemical parameters in dromedary camel.

Materials and Methods

Animals

A total of 6 mature healthy camels (450 ± 5 kg body weight; 4-7 years old) were used and were fed approximately 3 kg of barseem, 3 kg cracked barley and 3 kg concentrates in the morning and 3 kg of barseem plus 3 kg barley and 3 kg concentrates in the evening with free supply of mineral salt licks. Water was provided *ad libitum*. Camels were assigned to 3 groups (2 camels each). Camels of the first group received basal diet and served as a control group. Camels of the second and third groups were fed zinc oxide at a dose 2.5 and 5g/camel/day (5 times than that used by Fahmy *et al,* 2004), respectively for 6 weeks.

Sampling protocol

At the end of the experiment, blood samples were collected from the jugular vein of all groups for estimation of total erythrocytic count (TEC), total leucocytic count (TLC), packed cell volume (PCV) and differential leucocytic count using standard haematological techniques (Feldman *et al,* 2000). Haemoglobin percentage (Hb%) (Drubkin, 1947), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated.

Similarly, blood samples were collected without anticoagulant for serum separation. Serum was separated by centrifugation for 10 min at 1200 g and was immediately frozen at –20°C until the time of analysis. The sera were used for spectrophotometric determination of the activities of Aspartate Transaminase (AST) and Alanine Transaminase (ALT) as directed by Reitman and Frankel (1957). In addition, serum glucose, total protein,

SEND REPRINT REQUEST TO S.I. AL-SULTAN email: alsultan811@gmail.com

albumin and globulin values were determined spectrophotometrically as per the methods of Trinder, 1969; Doumas *et al,* 1981; Reinhold, 1953 and Coles (1974), respectively. Serum blood urea nitrogen, uric acid and creatinine were determined according to the method described by Tabacco *et al* (1979) and Henry (1984), respectively. Furthermore, the sera obtained were used for spectrophotometric analysis of serum triacylglycerol (TAG), total cholesterol by using of enzymatic method of spin react kits according to the methods of Sidney & Bernard (1973) and Zak *et al* (1954), respectively. Very low density lipoprotein cholesterol (VLDL-c) was calculated by division of TAG by 5 (Bauer, 1982). Calcium (Ca), phosphorus (P) and magnesium (Mg) were determined by using commercial kits on chemistry analyser according to the manufacturer instructions.

Statistical analysis

Data were analysed by repeated measurements analysis of variance (ANOVA) and the statistical significance between means was compared using Student's t-test; $p<0.05$ was considered significant. All tests will perform using computer package of the statistical analysis system (SAS, 1995).

Results

The obtained results demonstrated that, TEC, TLC, Hb, PCV, MCV, MCH and MCHC were not changed significantly ($P < 0.05$) in all groups throughout the experimental period when compared with the control (Table 1). Interestingly, the differential leucocytic counts revealed that, the percentage of lymphocytes was significantly increased ($P < 0.05$) in camels fed zinc oxide throughout the whole experimental period with dose dependant manner when all compared with the control (Fig 1).

Spectrophotometric analysis of serum samples indicated that, during the whole experimental period all biochemical parameters related to glucose and protein metabolism (Total protein, albumin, globulin and their ratio) remain unchanged in camels fed zinc oxide (2 doses) when all compared with the control group (Table 2). Uses of zinc oxide with different levels did not disturb liver and kidney functions as reflected on unchanged measured liver enzyme (ALT and AST) activities, blood urea nitrogen, uric acid and creatinine (kidney function, Table 2). The present findings also demonstrated that TAG, VLDL-c and total cholesterol were not changed significantly ($P < 0.05$) in all treated groups throughout the experimental period (Table 2). Moreover, the electrolytes balance was not altered in all treated groups as reflected in unchanged ($P < 0.05$) values of Ca, P and Mg (Table 2).

Discussion

Evaluation of the physiological state of camel has become an integral part of the routine examination of camel health. However, published information on these aspect in camels reflect a wide range of values which was attributed to difference in breed, age, sex, sampling and analytical methods (Mohamed and Hussein, 1999). The metabolic profile of camel is reflected by season, mineral supplementation and health status (Faye *et al,* 1995). Due to variation in haematological and biochemical parameters resulting from variation in these factors each laboratory is recommended to establish normal values for camels in their region (Mohamed and Hussein, 1999). Apparently any

Table 1. Effect of dietary supplementation of zinc on haematological parameters of dromedary camels.

Parameters	Group 1	Group 2	Group 3
TEC 10^6/ µl	16.0 ± 1.30	18.0 ± 1.06	14.0 ± 2.11
TLC 10^3/ µl	10.0 ± 0.40	10.0 ± 0.60	11.0 ± 0.90
PCV (%)	42.3 ± 0.11	42.8 ± 0.12	43.3 ± 0.60
Hb (%)	15.8 ± 0.30	15.1 ± 0.20	15.2 ± 0.10
MCV (μ^3)	26.4 ± 2.60	23.7 ± 2.03	30.9 ± 2.11
MCH (pg)	9.9 ± 0.10	8.4 ± 0.60	10.9 ± 0.60
MCHC (%)	37.4 ± 1.22	35.2 ± 0.91	35.1 ± 0.10

TEC (Total erythrocyte count), PCV (packed cell volume), Hb% (Haemoglobin percentage), MCV (Mean corpuscular volume), MCH (Mean corpuscular haemoglobin), MCHC (Mean corpuscular haemoglobin concentration).

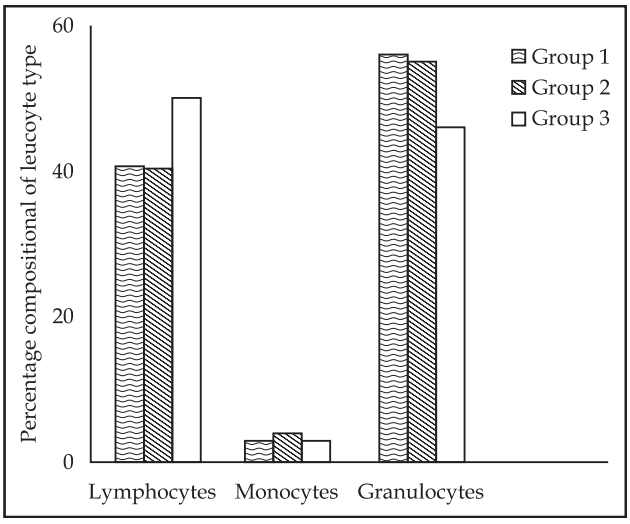

Fig 1. Effect of dietary supplementation of zinc oxide on differential leucocyte counts of dromedary camels. *P<0.05.

Table 2. Effect of dietary supplementation of zinc on biochemical parameters of dromedary camels.

Parameters	Group 1	Group 2	Group 3
Glucose	62.55 ± 0.00	104 ± 0.00	66.00 ± 0.00
Total Protein (g/l)	7.25 ± 0.20	6.95 ± 0.19	7.20 ± 0.15
Albumin (g/l)	5.00 ± 0.05	4.95 ± 0.05	5.45 ± 0.46
Globulin (g/l)	2.25 ± 0.20	2.00 ± 0.20	1.75 ± 0.30
A/G ratio	2.22 ± 0.39	2.74 ± 0.20	3.11 ± 0.45
Total cholesterol (mg/dl)	22.8 ± 0.03	19.55 ± 1.05	21.80 ± 0.06
TAG (mg/dl)	104.85 ± 4.01	100.55 ± 3.06	94.40 ± 2.19
VLD-c (mg/dl)	21.00 ± 0.05	20.11 ± 0.16	18.88 ± 1.78
ALT (U/l)	42.25 ± 0.76	38.70 ± 1.69	42.75 ± 1.88
AST (U/l)	19.55 ± 1.13	21.90 ± 1.07	22.35 ± 1.09
BUN (mg/dl)	17.80 ± 1.55	16.7 ± 1.92	14.85 ± 1.98
Creatinine (mg/dl)	0.80 ± 0.29	1.95 ± 0.91	1.05 ± 0.77
Calcium (mg/dl)	10.4 ± 0.08	11.05 ± 0.09	11.90 ± 0.06
Phosphorus (mg/dl)	2.85 ± 0.50	3.45 ± 0.90	2.70 ± 0.99
Magnesium (mg/dl)	1.00 ± 0.00	1.05 ± 0.05	0.70 ± 0.37

Albumin/globulin ratio (A/G ratio), AST (Aspartate Transaminase), ALT (Alanine Transaminase), TAG (triacylglycerol), VLDL-c (Very low density lipoprotein cholesterol).

adverse effects were not found on the state of the camel health in this study. In addition, differences were not observed in blood and serum parameters of camels among all groups. Although, zinc may change some blood haematological and blood biochemical indices of the camels as reported before (Yousef *et al,* 2002), this was not the case in the current study as TEC, TLC, Hb, MCV, MCH and MCHC remained unchanged significantly in all treatments. Similarly serum total protein, glucose, albumin, globulin, total cholesterol, TAG, VLDL-c, ALT, AST, urea nitrogen, uric acid, creatinine, Ca, P and Mg were not changed significantly in camel fed zinc oxide when compared with the control group.

There are some published reports on haematological and biochemical parameters in Sudanese (Damir *et al,* 2008; Muna Ahmed *et al,* 2003 and Mohamed 2004), Saudi Arabian (Al-Busadah, 2007; Al-Shami, 2009; Osman and Al-Busadah, 2003), Kuwaiti (Mohamed and Hussein, 1999), Iranian (Badiei *et al,* 2006 and Mohri *et al,* 2008), Pakistani (Zia-ur-Rahman *et al,* 2007), Kenyan (Kuria *et al,* 2006) and even European (Faye *et al,* 1995) camels. The present results concerned the haematological and biochemical parameters of control group near to the previously mentioned reports. Furthermore, the haemoglobin content of the control and other groups was within the range reported for camels of gulf region (Wernery *et al,* 1999). Al-Busadah (2007) reported a range of 9.2-14g/l for Majaheem, Maghateer and Awarik Saudi camels. Ayoub and Saleh (1998) and Saeed and Hussein (2008) reported a value of 14.5mg% and 13g/dl in United Arab Emirates (UAE) camels, respectively. Mohamed and Hussein (1999) reported a range of 11-16g/dl in Kuwaiti racing camels. The present values were also comparable to that of 11.2-11.8 g/dl reported for Sudanese camels (Omer *et al,* 2008). PCV values in the present study were within the range reported for camels in Gulf region. Wernery *et al* (1999) reported a range of 26-38% PCV in 2-12 years old racing camel in UAE. Al-Busadah (2007) reported a range of 24-30g/dl for Majaheem, maghateer and Awarik Saudi camels. Ayoub and Saleh (1998) reported a value of 31% PCV in UAE camels. Mohamed and Hussein (1999) reported arrange of 16 L L-1 in Kuwaiti camels. The present PCV values were also comparable to that of 26% reported for Sudanese camels (Omer *et al,* 2008).

The values obtained in this study for WBC count is comparable to values reported in other studies (Lakhotia *et al,* 1964; Soliman and Shaker, 1967 and Al-Ani *et al,* 1992). However, the most frequent white cells are not neutrophils but lymphocytes and granulocytes as were near to each other. In this study the percentages of lymphocytes were 40.7± 0.51, 40.3 ± 0.82 and 50± 0.11 and granulocytes were 56.7 ± 0.11, 55.3 ± 0.22 and 46 ± 0.31 in groups 1, 2 and 3 respectively. Al-Busadah (2007) reported that the percentages of lymphocytes were 50.13 ± 1.7 and neutrophils were 37.45 ± 0.71. Corresponding values of lymphocyte and neutrophil counts were 29 and 58% in lranian camels (Ghodsian *et al,* 1978), 45.9 and 48.11% in Turkmen camels (Rezakhani *et al,* 1997) 50 and 36.6%, in Pakistani camels (Majeed *et al,* 1980) and 56 and 38%, respectively in Kenyan camels (Nyang'ao *et al,* 1997). Therefore, the haematology of all treated camels under the present study was within the normal range and indicated that these animals were healthy. In addition, this unchanged haematological values in camel fed zinc compared with the control indicated the safety of zinc doses for haemopoisis (Anaemia did not arise). The results obtained in the present study (changes in relative abundances of different leucocytes) suggested that camels were mounting some kind of immune stimulant and this certainly require further investigation. The observed lymphocytosis indicated the immune modulating effect of zinc (Prasad, 1995). Thymulin, a thymic

hormone involved in T-lymphocyte maturation, is known to be zinc dependent and is adversely affected by Zn deficiency. Zn deficiency is known to decrease interlukin-2 production by helper T-lymphocytes and abnormalities in T-lymphocyte subpopulations have been observed in Zn deficient humans. Other effects of Zn deficiency include skin change, poor appetite, and mental lethargy, delayed wound healing and neurosensory disorders (Prasad, 1995).

Similar values of serum proteins in this study were obtained by other workers (Soliman and Shaker, 1967; Ghodsian *et al,* 1978; Abdo *et al,* 1987; Mehrotra and Gupta, 1989; Al-Ani *et al,* 1992; Nyang'ao *et al,* 1997 and Al-Busadah, 2007). However the mean serum albumin concentration and A/G ratio were significantly higher than those in other ruminants (Sarwar *et al,* 1992) being more than one. This probably makes it possible to maintain the high colloid osmotic pressure needed for storing water in blood or regulating water balance. Furthermore, it has been shown that the A/G ratio deceased by about 25% when camel was taken from semi – desert pasture to artificial feeding (Ghosal *et al,* 1975). The blood urea nitrogen (BUN), creatinine, cholesterol and enzymes were similar to the reference values for cattle (Zongping, 2003) and the dromedary camels (Abdelgadir *et al,* 1984; Wahbi *et al,* 1984; Eldiridiri *et al,* 1987; Bengoumi *et al,* 1999 and Al-Busadah, 2007). The high level BUN in camels in comparison to other livestock are of interest in view of camel's ability to utilise urinary nitrogen at times of poor grazing or water deprivation (Al-Busadah, 2007). The unchanged level of blood urea nitrogen, uric acid and creatinine in camels fed with zinc oxide, both doses, indicated that kidney function also was not disturbed. Similar value of AST has been established by several workers (Boid *et al,* 1980 and Eldirdiri *et al,* 1987). AST and ALT are imported and critical enzymes in the biological processes. These enzymes are involved in the breakdown of amino acids into Keto acid which are routed for complete metabolism through the Kreb's cycle and electron transport chain. Consequently, they are considered as a specific indicator for hepatic dysfunction and damage (Osuna *et al,* 1977 and Shakoori *et al,* 1994). The increment of the activities of AST and ALT in plasma is mainly due to the leakage of a these enzymes from the liver cytosol into the blood stream (Navarro *et al,* 1993), which indicated liver damage and disruption of normal liver function (Shakoori *et al,* 1994). The unchanged level of albumin along with unchanged ALT and AST indicated that zinc oxide of both doses were safe to camels as liver function was not disturbed. The mean values of serum calcium in this study are in agreement with those reported by soliman and Shaker (1967), Al-Ani *et al* (1992), Rezakhani *et al* (1997) and Al-Busadah (2007).

The present findings can concluded that camels are not like other animals as high zinc doses were non toxic to them at the level of peripheral metabolism.

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