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TRACE ELEMENTS LEVEL IN CAMELS (*Camelus dromedarius*) WESTERN SUDAN (KORDOFAN STATE)

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ABSTRACT

Some trace elements status were determined in serum samples include iron, zinc, copper, cobalt and selenium in camels from Kordofan State of both sexes and different age groups over a period of one year. Copper and zinc levels of both elements were low. Cobalt concentration was found to be similar to the values reported for the bactrian camel. Iron and selenium were higher in the blood of camels from North Kordofan, while zinc was higher in the blood of camel from South Kordofan. Serum selenium and copper were higher in the blood of older groups. There was no impact of age upon zinc, cobalt and iron concentrations. The effect of sex was seen only for zinc which is significantly higher in males.

Key words: Dromedary, Sudan, trace elements

Kordofan state is considered as the leading state in camel population in the country, where as 1.05 million heads comprising 36% of the total camel population in the Sudan. The most dominant trees and shrubs in the area are composed of acacia trees and shrubs like *Acacia tortillas* and *Boscia senegalesis*.

Previous research on this area was related to the minerals deficiency (Tartour, 1975 and Abu Damir *et al*, 1988).

This research was aimed to estimate some trace elements status on camels sera e.g. ion, zinc, copper, cobalt and selenium.

Materials and Methods

The survey was carried out at Kordofan state included North and South Kordofan). Five hundred camel samples of both sexes were used in this study in different age group (>5 years, 5 to >10 years and <10 years).

Blood samples were collected from the jugular vein in a plain vacutainer tubes and serum was separated after centrifugation and later frozen at -20°C.

The trace elements (Zn, Cu, and Co) were measured by atomic absorption spectrophotometry according to the method of Butrimovitz and Purdy (1977). Iron was measured by atomic absorption spectrophotometer according to the method of Elmer (1994). Se was measured by using ICP spectrophotometer according to the method of Graham and Stephen (1997).

Results

Copper (Cu), zinc (Zn), cobalt (Co), iron (Fe) and selenium (Se) concentrations in blood of the dromedary camels at North and South Kordofan are shown in table 1. The iron and selenium showed the highest values which were similar or comparable to other values reported in the literature.

Cu and Zn showed lower concentrations and were below the threshold levels.

The Fe and the Se concentrations were within the reported values in the literature, whereas, Cu and Zn were below the deficiency threshold. The values of Co were lower than those reported by Burenbayer (1989). When comparing the serum trace elements levels in the dromedary camel between North and South Kordofan, camels in both locations showed low Cu , Zn and Co (Table 1).

The analysis of variance revealed a significant difference ($p<0.05$) in serum Zn, Se and Fe levels in camels of North and South Kordofan. Fe and Se were higher in the blood of camels at North Kordofan, while Zn was higher in the blood of camels at South Kordofan. No significant difference was shown in the concentration of Cu and Co between the two regions.

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The concentration of Co, Cu, Fe, Zn and Se in the blood of the dromedary camels at different age group are shown in table 2. There was no significant difference in the concentrations of Co between the three age groups used in this study. The concentration of Cu was significantly higher in group three (>10 years) ($p<0.05$) than those in group 1 and 2 (<5 years and 5-10 years), respectively.

The concentration of Fe was higher in animals of group 1 (<5 years) and group 2 (5<10) compared with group 3 animals but the difference was insignificant. The concentration of serum Zn was similar in all groups, while Se concentration was significantly higher in group 2 and 3 ($p<0.05$) compared with group 1.

The concentrations of Co, Cu, Fe, Zn and Se in blood of female and male dromedary camels are shown in table 3 and fig 3. There was no difference in the Co, Cu and Se levels in sera of the male and female dromedary camels. The only significant difference ($p<0.05$) was seen for Zn and Fe concentration, where Fe was higher in the male dromedary and Zn was higher in the blood of female dromedary camels.

Discussion

In the present study Cu was found to be below the threshold level in both localities of Kordofan region (North and South Kordofan) (0.28±0.02µg/ml and 0.31±0.02µg/ml, respectively) (Table 3). This result agreed with that reported by Faye *et al* (1991) in the Horn of Africa, particularly in the Rift valley in the Awash area (45 µg/dl). The values reported for Cu in this study for camels from North and South Kordofan were below the values reported for camels in the Horn of Africa. In the Sudan, copper was found to be low in sera and tissues of various Sudanese animals raised under nomadic conditions (Tartour, 1975; Abu Damir *et al,* 1983). Drought and marginal or low Cu may be the predisposing factors for the deficiency. In Kordofan region, problems of infertility in diary cattle related to Cu deficiency were reported by Ahmed *et al* (2002). Similar to the findings of Abdalla *et al* (1988) sex was found to have no impact upon blood Cu level in camels from North and South Kordofan. However, the concentration of copper was found to be significantly higher in older camels as compared to the younger ones. High values for copper were reported in camels more than 5 years

Table 1. Trace elements concentration in sera of dromedary camel at different locations.

Location	Cobalt (µg/ml) (Mean±SE)	Copper (µg/ml) (Mean±SE)	Iron (µg/ml) (Mean±SE)	Zinc (µg/ml) (Mean±SE)	Selenium (ng/ml) (Mean±SE)
North Kordofan	0.11±0.004	0.28±0.02	1.43±0.06	0.22±0.01	1±3.6
	*(0.1-0.11) **n=72	(0.25-0.31) n=144	(1.32-1.54) n=131	(0.20-0.24) n=57	(91.3-195) n=50
South Kordofan	0.10±0.004	0.31±0.02	0.92±0.06	0.24±0.01	117.1±4.2
	(0.09-0.11) n=116	(0.27-0.34) n=144	(0.79-1.03) n=127	(0.23-0.27) n=104	(53.1-175.8) n=50

* Range ** n: Number of animals.

Table 2. Trace elements concentration in sera of dromedary camels at different age groups.

Age	Cobalt (µg/ml) (Mean±SE)	Copper (µg/ml) (Mean±SE)	Iron (µg/ml) (Mean±SE)	Zinc (µg/ml) (Mean±SE)	Selenium (ng/ml) (Mean±SE)
<5 years	0.11±0.005	0.3±0.02	1.2±0.07	0.24±0.01	118±4.8
	*(0.1-0.12) **n=70	(0.23-0.32)n=88	(0.98-1.3) n=83	(0.21-0.25) n=65	(83.0-162.0) n=27
5-10 years	0.1±0.004	0.23±0.02	1.2±0.06	0.22±0.01	128±3.24
	(0.1-0.11) n=89	(0.2-0.30) n=123	(1.04-1.31) n=113	(0.2-0.25) n=80	(53.0-195.0) n=52
>10 years	0.11±0.005	0.36±0.02	1.15±0.08	0.25±0.02	128±5.97
	(0.1-0.12) n=29	(0.31-0.4) n=66	(1.05-1.52) n=62	(0.23-0.28) n=16	(99.0-180.0) n=21

* Range ** n: Number of animals.

Table 3. Trace elements concentration in the sera of male and female dromedary camels.

Sex	Cobalt (µg/ml) (Mean±SE)	Copper (µg/ml) (Mean±SE)	Iron (µg/ml) (Mean±SE)	Zinc (µg/ml) (Mean±SE)	Selenium (ng/ml) (Mean±SE)
Male	0.10±0.004	0.28±0.02	1.30±0.06	0.22±0.01	123±3.6
	*(0.1-0.11) **n=87	(0.20-0.30) n=113	(1.15-1.49) n=107	(0.19-0.25) n=77	(53.1-180.9) n=42
Female	0.10±0.003	0.29±0.02	1.08±0.05	0.25±0.01	128±3.10
	(0.10-0.11)n=101	(0.24-0.31)n=164	(0.96-1.18) n=151	(0.24-0.29) n=84	(83.0-195.9) n=58

old (Marx and Abdi, 1983) in Somalia. It seems that ageing has an impact on blood Cu concentration; probably this could be attributed to differences in food intake, liver storage or faecal excretion between the different age groups utilised in this study.

Tropical forages are frequently deficient in Zn, and potential deficiencies in livestock are wide spread (Schillhorn and Loeffler, 1990). This study reports low Zn values in the sera of camels at North and South Kordofan (0.22±0.01µg/ml and 0.24±0.01µg/ml, respectively). According to Faye and Bengoumi (1998) these values are considered deficient and below the deficiency threshold (0.40µg/ml). Other low values for Zn were reported at Djibouti (Faye and Mulato, 1991) and in the United Arab Emirates (Abdalla *et al,* 1988). The study of Faye *et al* (1992) in Djibouti and Bengoumi *et al* (1995) in Morocco and Faye *et al* (1995) in France point to the fact that camels have a lower normal levels of plasma Zn as compared to other ruminants, which suggests that the trace elements requirements seem to be lower in the camel, especially for Zn. The low Zn content in the sera of camels at North and South Kordofan could be attributed to the deficiency of Zn in the soil and pasture. Although both localities of Kordofan are considered deficient in Zn, still South Kordofan disclosed higher Zn levels than North Kordofan and this difference was found to be significant ($p<0.05$). The reason for this variation seems to be due to the difference in the soil type between the two localities and the type of pasture in both localities. Plasma Zn is a reliable reflection of Zn status, but errors of contamination are available which could explain the high values reported by some authors, for example, 284-309 µg/dl reported by Abdelrahim (1983). In the present study sex and age were found to have no impact on Zn concentration in the camel. However, El kasmi (1989) found that young camels have low Zn values. For Faye and Mulato (1991), Zn in plasma is a discriminant parameter of the age of camels. No variation owing to sex has been observed, although a significant decrease in Zn was reported in the female camels at the end of pregnancy (El Tohamy *et al*, 1986), because an active transfer to the foetus late in gestation is likely to be the cause.

Co is an essential trace element for the synthesis of Cyanocobalamine (Vitamin B_{12}). Co level in the plasma of animals is too low to be the subject of clinical investigation. Co in tissues and hair could be more useful in assessing Co status in camels. Tropical forages, particularly forage trees are rich in Co (Faye *et al,* 1986; 1990). However, some low values for cobalt were found in grasses from salty Lowlands in East Africa (Faye *et al,* 1990), which could induce marginal cobalt deficiencies in camel during salt cure. In this study, soil and pasture analysis was not performed to assess its Co content. Under such circumstances the reason why low values of Co were found in the sera of camels from North and South Kordofan remains unclear. Referential data for Co concentration in the camel are lacking. However, Burenbayer (1989) reported values between 3.39-13.6 µg/dl in bactrian camels from Mongolia and China. The values reported in this study were comparable to the values reported for the bactrian camel. Liu *et al* (1994) reported blood Co concentration at 39µg/dl in non-pregnant camel, 56µg/dl in pregnant females and 53µg/dl after parturition. These values were higher than the values reported in this study. In this work, sex and age were found to have no impact on Co of the dromedary camel.

In this study, the serum Fe content of camels at North and South Kordofan were in agreement with the values reported by Tartour and Idris (1970), El Tohamy *et al* (1986), Wahbi *et al* (1979) and Faye *et al* (1986). Although, serum iron of camels in this study is within reported values in the literature, all inter species comparative studies indicated lower Fe blood values in the camels compared to other ruminants (Tartour and Idris, 1970; Faye *et al,* 1986), In this study camels from North Kordofan had serum Fe significantly higher ($p<0.05$) than that from South Kordofan. This is probably due to difference in soil and pasture content of Fe. The younger camels had serum Fe content significantly higher ($p<0.05$) than older ones, also the male camel had significantly higher ($p<0.05$) iron content than the female. Faye *et al* (2005) also mentioned higher mean values for Fe in the male dromedary camel. There is no much work in the literature to explain the needs and intake of Fe by the dromedary camel.

Se is an essential trace element for the prevention of a number of deficiency syndromes in a variety of species (Underwood, 1981). The occurrence of Se in soil varies considerably worldwide. No data is available concerning the Se content of different soils in the Sudan with scarcity and absence of referential data for Se concentration in the blood of camel. In the current study, Se was measured in the blood of camels from North and South Kordofan (133±3.6 ng/ml and 117.1±4.2 ng/ml, respectively). These values are comparable to the finding of Hamliri *et al* (1990) who reported a range of 109.0-117.7 ng/ml Se in the blood of the dromedary camel. Similar values (9.7 µg/dl-11.4 µg/dl) involving bactrian

camels were reported in China (Liu *et al*, 1994). Bengoumi *et al* (1998) reported 33ng/ml Se in the plasma of camels, a value considered significantly low when compared to cattle. Barri and Al Sultan (2007) reported Se values above 100 ng/ml (131±0.2 ng/ml) in 30% of the Megaheem dromedary camels of Saudi Arabia. 30% also had Se values higher than 50 ng/ml (76±0.3 ng/ml), whereas, 34% had Se values lower than 50 ng/ml (30.2±0.3 ng/ml) and 6% had Se values below 10 ng/ml (5.3±0.9 ng/ml), this value is comparable to the values reported by Al Qarawi *et al* (2001) in camel suffering from Se deficiency in Al Qassim region of Saudia Arabia. Although, Se was found to be significantly higher ($p<0.05$) in the sera of older camels being investigated in this study, sex was found to have no effect on blood Se of the camel. Older camels may have greater food intake, less faecal excretion and greater requirement for Se that justifies the higher values observed in this study as compared to the younger camels. Hamliri *et al* (1990) found that sex and age had no effect on blood Se.

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Antibacterial activity of the lactoperoxidase system in camel milk against Gram-positive and Gram-negative bacteria

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Lactoperoxidase (LPO) is an oxidative enzyme that is found in milk of mammals including camel. Lactoperoxidase for bacteriostatic activity to thiocyanate and hydrogen peroxide needs. Lactoperoxidase enzyme was extracted and purified with centrifuge, ion exchange C-50 chromatography and sephdex G-100 gel filtration from raw milk. The activity of enzyme was measured by using Tetra methylbenzidine and assay of enzyme was carried out by Bradford method. To evaluate the purity of the enzyme Polyacrylamide gel electrophoresis was used. Staphylococcus aurous (Gram-positive bacteria) andPseudomonasaeruginosa (Gram-negative bacteria) obtained from Razi vaccine and serum research institute. We were found number of bacteria by colony count and used 10^{-6} dilution per ml for accomplishment of tests. We made 4 test groups (for each bacteria) and one control group that there were four replications with equal conditions. Test groups include 2 reagent groups (H_2O_2, tiocyanate) and one groupcontainingH_2O_2 and tiocyanate together and one complete system {H_2O_2 (0.03Mm), tiocyanate (1Mm), LPO (0.02µg/ml)}. The number of bacteria calculated at 0, 60 and 360 mints with colony-count method on Blood agar. Based on the test ratios (Chi-square), significantly (P = 0.0001) between the effects of complete system (with a 70 percent reduction in minute 360 for Staphylococcus aurous and (with a 63 percent reduction in minute 360 for Pseudomonas aeruginosa) with participants of other materials in response was seen to antibacterial activity. As a result, Lactoperoxidas enzyme was extracted from Camel Milk has a significant anti-bacterial activity on Gram-positive and gram-negative bacteria.

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