

Assessment of zinc and copper in camels (*Camelus dromedarius*) using certain biochemical indicators

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ABSTRACT

This investigation was done at Kordofan state – region of Sudan. The aim of this study firstly is to assess zinc and copper status in the dromedary camel by direct measurements in the blood and indirectly by measuring alkaline phosphatase as an indicator for zinc and ceruloplasmine as an indicator for Copper, then to find out the correlation between them. Direct measurement of zinc in the sera of camels from both localities revealed that the concentration of the element was low and was below the threshold level of deficiency. Alkaline phosphatase values were found to be below the reported values in the literature. The effect of age was clear on alkaline phosphatase activity which was significantly higher in 5 to 10 years old camels, while sex was found to have no effect on alkaline phosphatase activity in this investigation. A negative regression was established between zinc and alkaline phosphatase activity. Direct measurement of copper in the sera of camels from both localities revealed that the concentration of the element was low and was below the threshold level of deficiency. In this study a non significant positive correlation was established between copper and ceruloplasmine activity.

Keywords: Camel, zinc, copper, alkaline phosphatase, ceruloplasmine, dromedary.

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INTRODUCTION

The current study was initiated to study the relationship between zinc and alkaline phosphatase activity and copper and ceruloplasmine activity of the dromedary camels at North and South Kordofan region of the Sudan considering sex and age.

Like most minerals, the satisfactory intake of this trace element depends on the presence of this element in the soil and the capability of the plants to utilize or absorb this mineral. In this study, soil analysis was not performed, however many scientists consider soil analysis to be of limited value for predicting the mineral status of the animal (Paynter, 1996; Judson and Mc Farlane, 1998) because conditions related to low absorption rates by the plants and low pasture concentrations are found in low soil pH, clover

domination by pasture and rainfall.

Ceruloplasmine is a carrier protein for copper; it contains more than 90% of the circulating copper in normal animals, so ceruloplasmine is usually well correlated with copper. In the camels, it appears that ceruloplasmine is also correlated with copper and can be a useful indicator of nutritional copper status as indicated in cattle and sheep (Blakley and Hamilton, 1985), but a copper sub-deficient situation (plasma copper concentration below 50 µg/dl), the ceruloplasmine does not allow one to assess the deficiency status level. Indeed, trace elements in the camel are believed to have biological roles similar to that described in other ruminant. The area selected for this study was north and South Kordofan, sex and age were considered in the study.

Table 1. The level of zinc and alkaline phosphatase in the blood of dromedary camels at North and South Kordofan.

Region	Zinc ($\mu\text{g/ml}$)	Alkaline phosphatase (U/l)
North Kordofan	0.25 ± 0.02	57.6 ± 1.2
South Kordofan	0.25 ± 0.02	58.4 ± 0.4

MATERIALS AND METHODS

A field survey was conducted, during one year (October 2004 to September 2005). The survey covered two states (North Kordofan State and South Kordofan State). Camels (*Camelus dromedarius*) in different sexes and ages were used in this study. All animals graze freely in opened system (Nomadic system). A total of 500 serum samples were collected from both North and South Kordofan.

Blood in plain vacutainer tubes was taken from the Jugular vein by vein punctures, the serum was separated by centrifugation of blood samples at 3000 rpm for 5 min, and then serum samples were stored at -20°C for analysis.

Serum zinc was determined according to the method of Butrimovitz and Purdy (1977). Alkaline phosphatase has been determined according to the method of Anonymous (1972). Serum copper was determined according to the method of Butrimovitz and Purdy (1977). Zinc level was assessed directly by measuring its concentrations in the blood of camel and indirectly by measuring alkaline phosphate activity.

In this study, copper was assessed directly by measuring its concentration in the blood of camel and indirectly by measuring its related indicators-ceruloplasmine. The method of Houchin (1958) was used for the determination of plasma ceruloplasmine activity using Jenway 6505 Uv/Vis spectrophotometer.

RESULTS

Tables 1, 2 and 3 clearly show that the concentration of zinc and the activity of alkaline phosphatase observed in this study were below the reported values in previous studies. Statistical methods revealed that none of the three factors utilized in this study have any impact neither on zinc nor in copper level. Variation in the levels of alkaline phosphatase activity in different age groups, sex and region was found to be statistically insignificant. Negative regression between zinc and alkaline phosphatase was established using linear regression (Figure 1).

Statistical methods have revealed that none of the three factors employed in this study have any impact on ceruloplasmine. Tables 4, 5 and 6 show that both copper and ceruloplasmine were below the normal values reported in the literature. Figure 2 clearly shows that a non significant positive correlation exist between copper and ceruloplasmine.

DISCUSSION

Alkaline phosphatase is a zinc containing enzyme found to decrease in activity in animal suspected of zinc deficiency. Measuring alkaline phosphatase activity in

Table 2. The level of zinc and alkaline phosphatase in the blood of male and female dromedary camels.

Sex	Zinc ($\mu\text{g/ml}$)	Alkaline phosphatase (U/l)
Male	0.23 ± 0.01	57.7 ± 0.9
Female	0.26 ± 0.02	58.1 ± 0.9

Table 3. The level of zinc and alkaline phosphatase in the blood of dromedary camels at different age groups.

Age group	Zinc ($\mu\text{g/ml}$)	Alkaline phosphatase (U/l)
<5 years	0.28 ± 0.02	57.2 ± 0.9
5-10 years	0.22 ± 0.02	58.3 ± 1.1
>10 years	0.28 ± 0.01	58.4 ± 1.4

animals was found to be of diagnostic value as an indicator of zinc status in animals. In this study, the reported values for zinc was similar to the finding of Faye et al. (2008), which was lower than the reported values by Mohamed (2004). The level of alkaline phosphatase was below the reported values. Alkaline phosphatase is notable for its rapid loss of activity following zinc deficiency (Kirchgessner and Roth, 1980) and restore to normal activity after 3 days on a zinc adequate diet. In the present study, the low levels of alkaline phosphatase activity may be correlated well with the low zinc concentration in the blood of the dromedary camel from North and South Kordofan. In milder zinc deficiency states activity of alkaline phosphatase may be below normal and increase following zinc supplementation (Prasad et al., 1978).

In the present study, ceruloplasmine was found to be low as copper in the blood of camels from North and South Kordofan. Similar values for ceruloplasmine were reported by Faye et al. (1992) while low values for copper were reported by Abu Damir et al. (2008). Generally, the ceruloplasmine activity and the serum or plasma copper concentration decreases with nutritional copper depletion in ruminants (Mc Murray, 1980; Prohaska, 1990). The present study reports a non-significant positive correlation between copper and ceruloplasmine. Similarly, the study of Faye and Tisserand (1989) reported a lower correlation between copper and ceruloplasmine in camels than other ruminants, however a significant positive correlation between ceruloplasmine and copper in the camel was reported by Faye et al. (1992) (0.68) and Faye and Mulato (1991) (0.72). From

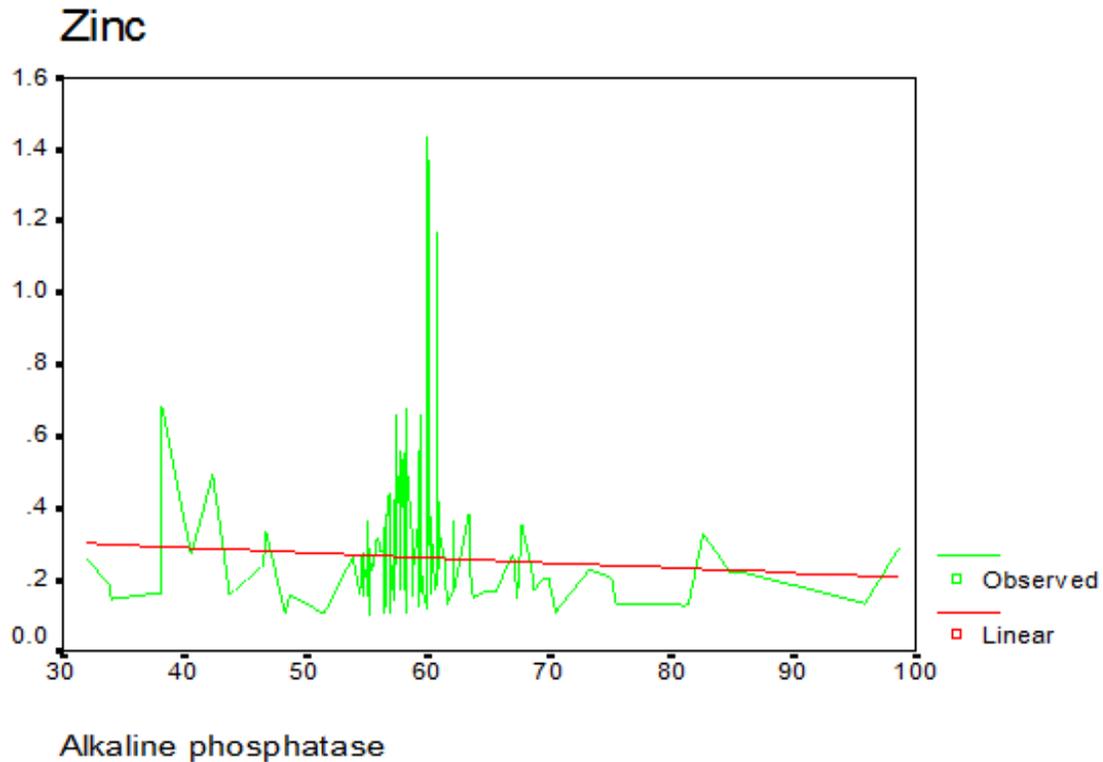


Figure 1. The relationship between zinc and alkaline phosphatase.

Table 4. The level of copper and ceruloplasmine in the blood of the dromedary camels at North and South Kordofan.

Region	Copper ($\mu\text{g/ml}$)	Ceruloplasmine (mg/dl)
North Kordofan	0.21 ± 0.01	3.0 ± 0.2
South Kordofan	0.21 ± 0.01	4.0 ± 0.4

Table 5. The level of copper and ceruloplasmine in the blood of male and female dromedary camels.

Sex	Copper ($\mu\text{g/ml}$)	Ceruloplasmine (mg/dl)
Male	0.20 ± 0.01	3.6 ± 0.3
Female	0.21 ± 0.01	3.3 ± 0.3

Table 6. The level of copper and ceruloplasmine in the blood of the dromedary camels at different age groups.

Age	Copper ($\mu\text{g/ml}$)	Ceruloplasmine (mg/dl)
<5 years	0.20 ± 0.01	3.8 ± 0.5
5-10 years	0.20 ± 0.01	3.4 ± 0.2
>10 years	0.22 ± 0.01	3.1 ± 0.5

diagnostic perspective, ceruloplasmine activity may have

application in many animal species (Pejaudier, 1973).

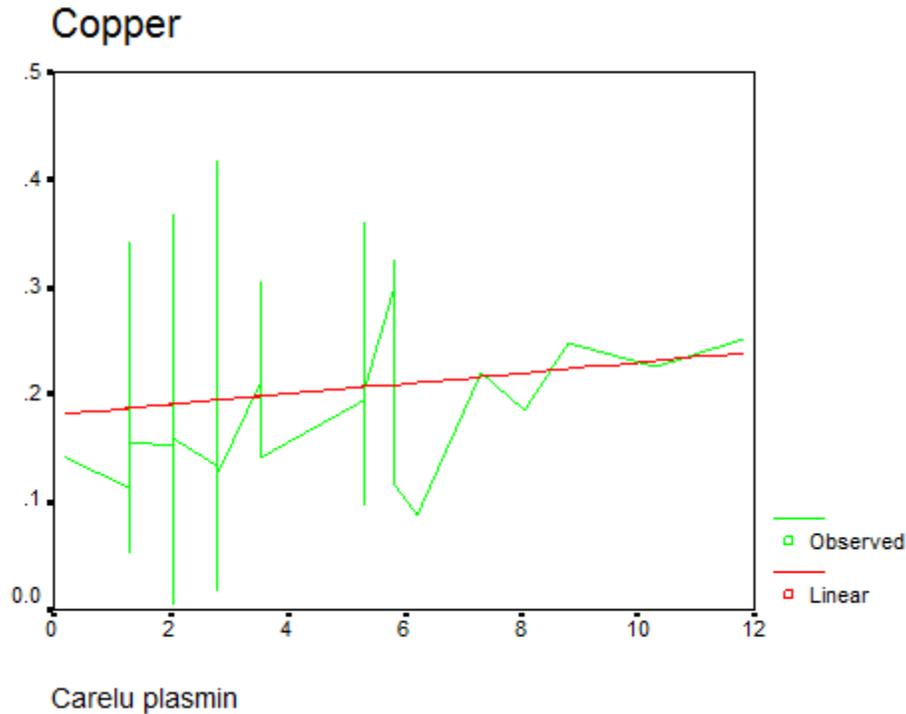


Figure 2. The relationship between Cu and CP.

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