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EFFECT OF ENVIRONMENT AND NUTRITION ON MINERALS, HEAVY METALS AND TRACE ELEMENTS ON SINAI BREEDING CAMEL. TRACE ELEMENTS (ZINC AND COPPER) PROFILE

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SUMMARY

The present work was preformed to special part of our country, the land which observed four wars in the last century and many trips, journeys from friends and enemies, Sinai, with special reference to animal especially tread as desert boat, the camel. Our data demonstrated that the Camel Dromedary (Camelus dromedaries) in Sinai area, the zinc level in serum was (33.79 ± 0.17 µg/dl); liver (112.57 ± 0.008 µg/gm DM) , muscle (112.42 ±0.04 µg/gm DM), kidney (103.77 ± 0.01 µg/gm DM), heart (54.66 ± 0.007 µg/gm DM), spleen (54.66 ± 0.007 µg/gm DM), ovary (36.15 ± 0.05 µg/gm DM) and testis (15.27 ± 0.008 µg/gm DM). While serum copper concentrations was 54.66 ± 0.21 µg/dl; kidney (124.65 ± 0.017 µg/gm DM), liver (115.30 ± 0.24 µg/gm DM) , muscle (111.25±0.45 µg/gm DM), spleen (55.94 ± 0.018 µg/gm DM), heart (48.49 ± 0.025 µg/gm DM), ovary (40.80 ± 0.017 µg/gm DM) and testis (28.46 ±0.016);.

The present data revealed that the higher concentrations of both serum zinc and copper levels are present in sera of camels in south Sinai than north Sinai and in the female she-camel than male camel with age related references to over 5 years. The serum zinc level was highest values, in south Sinai especially in female over 5 years (41.87±0.05 µg/dl) but lower in female and male age (2-4 years) and males over 5 years in the same area (34.65 ± 0.22 µg/dl). The serum copper concentrations in south Sinai female over 5 years were 57.12 ± 0.34 µg/dl compared with female (2-4 years) (53.93 ± 0.16 µg/dl). There was influence of the breeding season on the serum zinc and copper levels in either male or female, the serum zinc concentrations increased during

breeding season especially in female in the south Sinai (32.25±0.18 μg/dl). Serum copper level showed high significant increase in its level in female in south Sinai (60.30±1.08 μg/dl) than in north Sinai (56.50 ± 0.11 μg/dl).

Zinc concentrations in kidney of she camel were (187.05 ± 0.013 μg/gm DM), heart (79.18 ± 0.005 μg/gm DM), spleen (58.59 ± 0.02 μg/gm DM) and ovary (36.15 ± 0.05 μg/gm DM). Similarly, copper concentrations were higher in kidney (211.05 ± 0.022 μg/gm DM), followed by heart (89.35 ± 0.016 μg/gm DM), spleen (66.19 ± 0.018 μg/gm DM) and ovary (40.80 ± 0.05 μg/gm DM) than male in the she-camel.

The data indicated that the camel breeds in south Sinai contain higher concentrations of zinc and copper levels than camels in north Sinai and there were significant differences between camels due to age and/or sex and/or breeding season and/or geographical variations.

INTRODUCTIONS

Camel Dromedary (*Camelus dromedaries*) is vital to the productive system in Egypt desert and semi-desert area, where feeding resources are generally scattered and poor. They well adapted to the harsh climatic conditions, not only providing meat milk and hair, hides for local farmers and herdsmen (Wragg, 2004), but also being indispensable means of transport in these arid areas. However there are few data on trace elements in camels in Sinai.

Two main camel localities were present in Sinai, Arish and El-Tor (Arabic) beside different small camel locality. As well as grazing on grass, camels browse on vegetation as high as 0.5 meters above the ground. They eat most plant material, including fresh grasses and shrubs; preferring roughage to pasture that has introduced grasses or has been fertilized. Camels have a high need for salt and they eat salty plants, even devouring thorny, bitter or toxic species that are avoided by other herbivores. At times when forage is green and moist, camels gain all the water they need from their food and do not require drinking water. If water is available in summer, camels will drink regularly and at dawn. In extreme drought they need access to waterholes; a dehydrated camel can drink 200 liters in three minutes. Contrary to legend, the hump is mostly fat, a store of energy rather than water (Wernery and Kaaden, 2002).

During the breeding season, from May to October, males have a herd of 20 or more females, which they defend against advances from other bulls. Pregnancy lasts about 13 months and a cow gives birth to a single young, which is weaned at about 18 months. Camels can live for as long as 50 years and breed actively for 30 years.

The impact of camels on native plants and drinkable water is most pronounced during drought, when areas close to remote waterholes become refuges that are critical to the survival of a range of native animals and plants. Camels can quickly degrade these areas during a drought to the point where they may no longer provide any refuge for native plants and animals, perhaps leading to the local extinction of these species.

The essential trace elements are integral components of certain enzymes and of other biological important compounds that have physiological and biochemical roles: for example copper and zinc in superoxide dismutase, copper catalyzes the activity of lysyloxidase, an enzyme that is active in the cross-linking of collagen and elastin, and the bone lesions are probably related to a deficiency of this enzyme. It is well known that camels have some physiological peculiarities in trace elements metabolism (Zongping, 2003) due to their adaptation to arid conditions and poor feeding resources. The hormonal changes were correlated significantly with concentrations of certain elements in the testes (highest Cu contents) and prostate (highest Zn content) (Al-Qarawi et al., 2000).

Zinc present in several tissue fluids and excretions, the zinc content of camels' milk was higner than that of human milk but slightly lower than in cows' milk and infant formula. The concentration of copper in camels' milk was similar to that of cows' milk but lower than in human milk and infant formula (Al-Awadi and Srikumar, 2001). Zinc transporter via free ionized form and in a 40-kDa zinc transporter protein (Kaler and Prasad, 2007). Zinc and copper levels were measured by several methods included anodic stripping voltammetry (ASV) (Chang Chien et al., 2006).

Zinc and copper deficiency were common in camels, all the camels (rare in Mangrove Avicennia marina is poor in some trace elements such as copper, zinc and manganese), Copper deficiency in camels has been reported in East Africa (Faye and Bengoumi, 1994) and in Sudan (Mohamed, 2004 and Baker and Baker, 2005). Copper deficiency in young cattle <1 year of age can also result in clinical and pathological changes similar to rickets.

Several trails were achieved to improve these problems (Faye et al., 1992a and Bengoumi et al., 1998a), beginning with mineral supplementation (Faye et al., 1992b), with little successes using different supplementations in animals feed (Starnes et al., 1984), study side effect of their toxicity affect (Abu Damir et al., 1993) or study zinc and copper and other minerals relationships (Allen and Sansom, 1989) on camels physiology and performance.

Sinai-camel Dromedary (*Camelus dromedarus*) as a local animal has characteristic feature due to its locality. This animal takes little attention in research work and few research articles were illustrated.

The aim of the present work is to study, evaluate and investigate the variations in the content of zinc and copper and status in the serum and tissues of Egyptian Sinai camels (Camelus dromedarius) in this constricted area of Egypt. Secondly, to exhibit the effect of season, age, sex , geographical variations and physiological status on the serum and tissues concentrations of copper and zinc in Sinai camel.

MATERIAL AND METHODS

During a period started from May, 2006 until June 2008 samples were taken according to the following protocols. Among forty five local breeding camel (Camelus dromedaries) , from local breed cited in Sinai region, blood samples (n-45) withdrawn from twenty (20) camels in north area (EL Arish ñ EL Masaid and Pear EL Abd regions) (12, 5 and 3 camels, respectively), eight (8) camels from Middle area (El Hasana and Nighile regions) and seventeen (17) camels from south area (Santa Katherine, Dahab and Sharm El Shik regions)(9, 4 and 4 camels each, respectively). The liver, muscle (gluteal muscle), kidney, spleen, heart and testis from male camel and ovary from she-camel (n=22) were taken from ten, three and nine slaughtered camels from north, middle and south areas, respectively. During preparing the statistical work, the middle regions results were statistically added to the south area results. The animals were healthy, good looking, free from external parasitic infestations and mange. The recorded data including, age, body weight (average), sex and any previous medical medications or illness history were taken. Different problems were associated with sample collections and statistical analysis, first, the camels in this area are "companion animals" because of its long living and mainly used in riding and rarely in feeding purpose. Second, it considered as "wealthy measure" either to Bedouin or its kindred and phratry. Third, the local slaughtered house in this area is very primitive, depend mainly on sheep and goat and local few breed cow and buffalo. Fourth, the greet effort to blood sample withdrawn help to reduce the number beside the long distance between the different areas and geographical complicatedness.

Blood samples and tissues were immediately transferred to local lab to get serum and kept in refrigerating at -20°C till further biochemical analysis.

Serum Sample Preparation:

Blood samples, each of 10 ml obtained from the jugular vein of all the camels, were centrifuged at 2,2000g for 10 min and serum was separated and packed in Eppendorf tubes, and then stored at -20 °C until subsequent analysis.

Tissue Sample Preparation:

The animals were slaughtered and samples of liver, muscle (gluteal muscle), kidney, spleen, heart, testis and ovary were taken from camels for determination of the mineral elements. The tissue samples were dried at 80 ∞C for 48 hours, and then transferred into a muffle furnace at 550 C for 5-8 hours, until ash was obtained, cool, weighted, ground, passed through a 0.5 mm sieve and stored in desiccators over silica gel.

Atomic absorptions measurements of Zinc and copper:

Samples in the solutions were pumped by apneustic neuteulizer into an air acetylene oxidizing flame.

Prepositions of sample: dilutions of serum samples were carried out by using deionized water in a rate of 1:1 for copper and zinc. With the following formulations = reading X 100 X dilution factor = ug/dl.

Copper and zinc were determined by atomic absorption Spectrophotometry (Spectrophotometer Model 5000, Perkin- Elmer Corp., Norwalk, CT) (Fernadez and Kahn, 1971 and Wang, 1991). The accuracy of the analytical values was checked by references to certified values of elements in the national Bureau of standards (NBS, Washington, USA) Standard Reference Material, bovine liver SRM 1577.

Statistical analysis

The statistical analysis of the results was preformed using analysis of variance (ANOVA test) (Farver, 1989). The analysis was preformed using SPSS for windows release 8.0.0 (22 December 1997) standard versions (SAS Version 8.2, Proc Mixed, SAS Institute, Cary, NC),

RESULTS

The biochemical results were tabulated in the following 5 tables:

Zinc and copper status in Sinai camel:

Table (1): Zinc and copper concentrations are in serum and tissues of Sinai Egyptian camel (Mean ± SE).

Item	Serum (µg/dl)	Organs(µg/gm DM)						
		Liver	Muscle	Kidney	Spleen	Heart	Testes	Ovary
Zinc (45)	33.79 ±0.17	112.57 ±0.008	112.42 ±0.04	103.77 ±0.01	41.55 ±0.01	54.66 ±0.007	15.27 ±0.008	36.15 ±0.05
Copper (45)	54.66 ±0.21	115.30 ±0.24	111.25 ±0.45	124.65 ±0.017	55.94 ±0.018	48.49 ±0.025	28.46 ±0.016	40.80 ±0.017

Numbers of camels in each group was differing according to material and method proposal (n).
Mean ± standard Error

The zinc level in serum was (33.79±0.17 µg/dl) and in tissues in descending order in liver and muscle (112.57 ± 0.008 and 112.42 ± 0.04 µg/gm DM, respectively), kidney (103.77 ± 0.01 µg/gm DM), heart (54.66 ± 0.007 µg/gm DM), spleen (54.66 ± 0.007 µg/gm DM), ovary (36.15 ± 0.05 µg/gm DM) and testis (15.27 ± 0.008) contains less zinc concentrations compared with previous organs. This profile did not change in respect to copper concentrations except that copper level was in serum (54.66 ± 0.21 (µg/dl) and it was lower in liver (115.30 ± 0.24 µg/gm DM), muscle (111.25 ± 0.45 µg/gm DM) than in with the same descending order as observed previously in kidney (124.65 ± 0.017 µg/gm DM), heart (48.49 ± 0.025 µg/gm DM), spleen (55.94 ± 0.018 µg/gm DM), ovary (40.80 ± 0.017 µg/gm DM) compared with testis (28.46 ±0.016).

Serum Zinc and copper variations in Sinai camel:

Table (2): Serum Zinc and copper concentrations (µg/dl) of male and she-camels in Sinai (according to age, sex and geographical variations) (Mean ± SE):

Age	North Sinai [A] (20)				South Sinai [B] (25)			
	Male [A] (13)		Female [A] (7)		Male [B] (11)		Female [B] (14)	
	2-4 years (6)	Over 5 Years (7)	2-4 years (3)	Over 5 years (4)	2-4 years (5)	Over 5 Years (6)	2-4 years (7)	Over 5 Years (7)
Zinc	32.63 ±0.13 [A]	32.17 ±0.16 [A]	31.93 ±0.09 [A]	32.68 ±0.08 [A]	33.17 ±0.13 [B]	34.65 ±0.22 [C]	31.24 ±0.05 [A]	41.87 ±0.05 [D]
Copper	53.55 ±0.17 [A]	53.64 ±0.17 [A]	56.50 ±0.33 [C]	54.93 ±0.16 [B]	53.95 ±0.17 [A]	53.72 ±0.20 [A]	53.93 ±0.16 [A]	57.12 ±0.34 [D]

Numbers of camels in each group was differing according to material and method proposal (n).
Mean ± standard Error
A, B, C... significant at using ANOVA at probability levels P< 0.05 using F test.

The higher concentrations of both serum zinc and copper levels are present in sera of camels in south Sinai than north Sinai and in female she-camel than male camel with age related references to over 5 years. The zinc level was highest values, in female of south Sinai over 5 years (41.87±0.05 µg/dl) compared with related female and male age (2-4 years) and sex followed by males over 5 years in the same area (34.65 ± 0.22 µg/dl). The serum copper differ from previous hurl that age is not determined factor though in south Sinai female over 5 years (57.12 ± 0.34 µg/dl) compared with female (2-4 years) (53.93 ±0.16 µg/dl) in the same area and female (2-4 years) (north Sinai) (56.50 ± 0.33 µg/dl) and female (over 5 years)(54.93 ± 0.16 µg/dl).

Table (3): Zinc and copper concentrations (μg/dl) is sera during both breeding and non-breeding seasons of male and she-camels in Sinai (Mean ± SE).

Seasons	North Sinai ^{A} (11)					South Sinai ^{B} (13)			
	Male ^{A} (7)		Female ^{A} (4)			Male ^{A} (6)		Female ^{A} (7)	
	Non-Breeding Season	Breeding Season	Non-Breeding Season	Breeding Season	Non-	Breeding Season	Breeding Season	Non-Breeding Season	Breeding Season
Zinc	31.71 ±0.08 ^{A}	32.63 ±0.18 ^{B}	31.93 ±0.09 ^{A}	33.42 ±0.11 ^{C}		33.17 ±0.13 ^{C}	36.13 ±0.29 ^{D}	31.24 ±0.05 ^{A}	52.50 ±1.80 ^{E}
Copper	53.55 ±0.08 ^{A}	53.62 ±0.12 ^{A}	53.36 ±0.09 ^{A}	56.50 ±0.11 ^{B}		53.49 ±0.13 ^{A}	53.95 ±0.29 ^{A}	53.93 ±0.05 ^{A}	60.30 ±1.08 ^{C}

Numbers of camels in each group was differing according to material and method proposal (n).
Mean ± standard Error
A, B significant is remark using ANOVA at probability levels $P< 0.05$ using F test.

There were influence of the breeding seasons on the serum zinc and copper level in either male or female. the serum zinc concentrations increased significantly during breeding seasons especially as observed in female in south Sinai (52.50 ± 1.80 μg/dl) compared with female in non breeding seasons (31.24 ± 0.05 μg/dl) and higher than corresponding female in north Sinai either in breeding seasons (33.42 ± 0.09 μg/dl) or in non breeding seasons (31.93 ± 0.09 μg/dl). The same was observed in males where serum zinc concentrations increased during breeding seasons especially in male in the south Sinai (36.13 ± 0.29 μg/dl) compared with males in non breeding seasons (33.17 ± 0.13 μg/dl) and higher than the same with north Sinai male either in breeding seasons (32.63 ± 0.18 μg/dl) or males in non breeding seasons (31.71 ± 0.08 μg/dl). This variation was not observed in serum copper level but high significant increase in its level was observed in female (south region) (60.30± 1.08 μg/dl) compared with she-camel (north Sinai) (56.50 ± 0.11 μg/dl).

Liver and Muscle Zinc and copper variations :

Table (4): Zinc and copper concentration (µg/gm DM) in liver and muscle in male and she-camels in Sinai (Mean ± SE).

Organs	North Sinai [A] (10)				South Sinai [B] (12)			
	Male [A] (6)		Female [A] (4)		Male [A] (7)		Female [A] (5)	
	Liver	Muscle	Liver	Muscle	Liver	Muscle	Liver	Muscle
Zinc	A 107.32 ±0.08	A 105.69 ±0.12	A 108.09 ±0.09	A 105.66 ±0.11	A 107.08 ±0.13	B 119.17 ±0.29	B 127.58 ±0.05	B 119.16 ±1.08
Copper	A 116.14 ±1.80	A 109.94 ±1.20	B 114.31 ±1.50	A 109.94 ±2.60	C 112.65 ±1.70	B 112.58 ±1.30	D 118.10 ±4.60	B 112.57 ±13.00

Numbers of camels in each group was differing according to material and method proposal (n).
Mean ± standard Error
A ,B significant at using ANOVA at probability levels P< 0.05 using student F test.

The liver zinc concentrations increased in south Sinai she-camel (127.58 ± 0.05 µg/gm DM) compared with other while muscle zinc concentrations increase in both south Sinai male and she-camel (119.17 ± 0.29 and 119.16 ± 1.08 µg/gm DM, respectively). Liver copper concentrations increased in south Sinai she-camel (118.10 ± 4.60 µg/gm DM) and north Sinai male (116.14 ± µg /gm) whereas muscle copper decreased south Sinai male and she-camel (112.58 ± and 112.57± 13.00 µg/gm DM, respectively).

Organs Zinc and copper variations:

Table (5): Different organs zinc and copper (µg/gm DM) levels of male and she-camels in Sinai (Mean ± SE).

Organs	Male (13)				Female (9)			
	Kidney	Spleen	Heart	Testes	Kidney	Spleen	Heart	Ovary
Zinc	A 20.50 ±0.013	A 24.52 ±0.010	A 30.15 ±0.009	A 15.27 ±0.008	B 187.05 ±0.013	B 58.59 ±0.02	B 79.18 ±0.005	B 36.15 ±0.05
Copper	A 38.25 ±0.088	A 45.69 ±0.097	A 56.18 0.133	A 28.46 ±0.016	B 211.05 ±0.022	B 66.19 ±0.018	B 89.35 ±0.016	B 40.80 ±0.017

Numbers of camels of each group was differing according to material and method proposal (n).
Mean ± standard Error
A, B significant at using ANOVA at probability levels P< 0.05 using student F test.

Due to many sample collection and statistically difficulty, we restricted the comparison between male and female only, zinc concentrations in female in kidney (187.05 ± 0.013 μg/gm DM), heart (79.18 ± 0.005 μg/gm DM) spleen (58.59 ± 0.02 μg/gm DM) and ovary (36.15 ± 0.05 μg/gm DM). While copper concentrations in female in kidney (211.05 ± 0.022 μg/gm DM), heart (89.35±0.016μg/gm DM) spleen (66.19 ± 0.018 μg/gm DM) and ovary (40.80 ± 0.05 μg/gm DM).

DISCUSSION

Data relating to trace-elements status in camels are scarce, from both a clinical and biochemical point of view. Clinical deficiency or toxicity has rarely been described in this species. However, there is some evidence that camels are sensitive to trace element disorders in the same way as other ruminants. As we known, this is first record of the reference values for the concentrations of trace elements in the sera and tissues of camels (Camelus dromedarius) were reported in Sinai, Egypt.

Serum zinc and copper concentrations:

Essential trace elements (ex. Copper and zinc) are integral components of certain enzymes and for other biological important compounds that have major physiological ad biochemical roles; for examples copper and zinc in superoxide dismutase (Zongping, 2003). It is well known that dromedaries have some physiological peculiarities in trace elements metabolism due to their adaptation to arid conditions and poor feeding resources (Faye and Bengoumi, 1994). Previous studies concerning trace elements in camels have found little evidence of clinical deficiencies in dromedaries (Faye et al., 1992 and Liu et al., 1994a). However, only few authors have been systematically reported references values for trace elements in camels (Fay and Bengoumi, 1994 and Liu et al., 2001).

The present data revealed lower levels of serum zinc (33.79 ± 0.17 μg/dl) and copper level (54.66 ± 0.21 μg/dl) which much lower than that present in human, 70 ñ 150 μg/dl for serum zinc level and 70 ñ 140 serum for serum copper level μg/dl in adult male (Tietz, 1986). Plasma copper and zinc concentrations were significantly lower than that reported in different regions of the world in the camels (61 μg / 100 ml for copper and 38 μg / 100 ml for zinc) (Zia-ur-Rahman et al., 2007) than in the cows (111 and 83, respectively) (Bengoumi et al., 1998a). Normal plasma level is comparable to cattle (70-120 μg /100 mL) . Camels appear to maintain zinc levels at a lower value than other domestic ruminants (< 60 μg /100 mL) (Faye and Bengoumi, 1994). The present data was lower than that reported for the concentrations of zinc in whole blood which was significantly higher in Bactrian camel than in dairy cattle (10.91 + 3.86 mg/l)(Liu et al., 1994b) or sheep (10.06 + 3.4 mg/l) (Liu et al., 1992) in the same area. Our present data were lower to that reported in milk (Haddadin et al., 2007).

These results indicated the lower zinc and copper in serum due to several factors which decrease both zinc and copper supply through forages and herbs to provide these elements and/or decrease protein percentage intake. The plasma concentration of copper increased significantly up to normal levels (less than 70 µg /100 ml) in energy protein supplemented groups, but the quantity supplied (100 mg of copper sulphate/day) was not sufficient to maintain this level after the end of supplementation (Bengoumi et al., 1999). The original zinc deficiency was too severe to observe a significant effect of the mineral supplementation (Faye et al., 1992a). Approximately 90-95% of the Cu 2+ found in blood plasma binds strongly to the a-globulin, ceruloplasmin. The remaining 5-10% binds to serum albumin (HSA) as well as to low-molecular-mass components such as L-histidine (Liu et al., 1995).

Both transport and storage roles have been suggested for Cu-albumin (Sadler et al., 1994). Other factor contribute to lower cupper and zinc contents which aids in absorption and metabolism of these elements, the presence of other elements that cause secondary copper deficiency, as in the gravel desert steppe in the Hexi Corridor in China, as caused by the high molybdenum content in soils and forages (Cu: Mo ratio in forages being only 1.3) (Liu et al., 1994 a and b). When the concentration of copper in blood from the camels was 0.28 +/- 0.17 micrograms/ml in Bactrian camels, there was a hypochromic microcytic anaemia and a low level of ceruloplasmin in the blood, which reflect on camel poor performance and little physiological effect.

Camels appear to maintain zinc levels at a lower value than other domestic ruminants (< 60 micrograms/100 mL). The supplementation had no effect on plasma zinc concentration in the camels in spite of the low observed values in this species (Faye and Bengoumi, 1994; Bengoumi et al., 1998 a and b).

Serum zinc and copper and age and sex difference:

The higher concentrations of both serum zinc and copper levels were present in sera of camels in south Sinai than north Sinai and in female she camel than male camel with age related references to over 5 years. The zinc level was highest values, in south Sinai especially in female over 5 years (41.87±0.05 µg/dl) compared with related female and male age (2-4 years) and sex followed by males over 5 years in the same area (34.65 ± 0.22 µg/dl). The serum copper differs from previous hurl that age is not an determined factor though in south Sinai female over 5 years (57.[illegible] ± 0.34 µg/dl) compared with female (2-4 years) (53.93 ±0.16 µg/dl) in the same area and female

(2-4 years) (north Sinai) (56.50 ± 0.33 μg/dl) and female (over 5 years)(54.93 ± 0.16 μg/dl).

The present data declared that age affects on camel sera, in agreement with previous observations with increase of zinc concentration in the plasma with age without clear affect to sampling seasons as observed with Ali et al., (2006) who found that the concentrations of both Cu and Zn in the plasma were higher in the rainy season than in the dry season. The corresponding values for zinc were 51.0 ± 8.9, 53.4 ± 6.4 and 67.1 ± 5.5 μg/100 ml, respectively. Although the current data not agree with that, there was an increase in the concentration of Cu and a decrease in the concentration of Zn in the plasma with age (Mohamed, 2004).

The present data demonstrated that sex has influenced both zinc and copper level. However these are vies versa to result of Ali et al., (2006), who found no effect of sex on the content of these minerals in the plasma. The attending data was coincided with Abu Damir et al., (2008) with low blood copper concentrations as reported in newly born camel calves (100%) and calves 2-4 months old (68%). This is attributed to the low copper and high sulfate in the Rhodes grass which is the only diet offered to the breeding camels.

Serum zinc and copper concentrations in breeding seasons:

There were influence of the breeding seasons on the serum zinc and copper level in either male or female. The serum zinc concentrations increased during breeding season especially as observed in female in the south Sinai (52.50 ± 1.80 μg/dl) compared with female in non breeding seasons (31.24 ± 0.05 μg/dl) and higher than corresponding female in north Sinai either in breeding season (33.42 ± 0.09 μg/dl) or in non breeding season (31.93 ± 0.09 μg/dl). The same concept was observed in males where serum zinc concentrations increased during breeding seasons especially in male in the south Sinai (36.13 ± 0.29 μg/dl) as compared with males in non breeding season (33.17 ± 0.13 μg/dl) and higher than the same with north Sinai male either in breeding season (32.63 ± 0.18 μg/dl) or in non breeding season (31.71 ± 0.08 μg/dl). This variation was not observed in serum copper level except high significant increase in its level was showed in female (south region) (60.30± 1.08 μg/dl) as compared with she-camel (north Sinai) (56.50 ± 0.11 μg/dl). The data were lower than the level previously reported 80 ñ 155 μg/dl for serum cupper level in adult female, in pregnancy with the range of 118-302 μg/dl, 90 - 150 μg/dl in RBC and 15- 30 μg/day in urine (Tietz, 1986).

The dynamic zinc and copper level was previously observed by Abu Damir et al., (2008) where low blood copper concentrations were reported in newly born camel calves (100%) and calves 2-4 months old (68%), breeding camels at early (55.6%) and at mid lactation (48%) and at late pregnancy (69%). Partially our results may be explained on the bases of the progesterone level. Increasing progesterone level is followed by the copper level reaches peak values at mid-pregnancy. The zinc level decreases with increasing pregnancy (Eltohamy et al., 1986). Increases non-pregnant, early, mid-, and late pregnant as well as puerperal camels, the plasma copper concentrations in pregnant, low-lactating and high-lactating camels were 81.3 ± 4.7, 59.7 ± 6.1 and 61.3 ± 5.5 microg/100 ml, respectively. The corresponding values for zinc were 51.0 ± 8.9, 53.4 ± 6.4 and 67.1 ± 5.5 microg/100 ml, respectively (Mohamed, 2004 and Ali et al., 2006).

The zinc level decreases with increasing pregnancy. It is therefore suggested that sway disease of Bactrian camels (Liu et al., 1994a) is caused by secondary copper deficiency, mainly due to the high molybdenum content in soils and forage. The copper deficiency in the camels was aggravated during reproduction. Oral administration of copper sulphate can prevent and cure the disease.

Liver and Muscle zinc and copper concentrations:

The zinc concentrations in the liver and muscle of Sinai camel were (112.57 ± 0.08 and 112.42 ± 0.04 µg/gm DM, respectively), but copper concentrations were lower in muscle (111.25 ± 0.45 µg/gm DM) than in liver (15.30 ± 0.24 µg/gm DM). This was in parallel with that camels copper and zinc concentrations which were lower than in cows even with trials of copper, zinc and mineral supplementations (Bengoumi et al., 1998b), who suggested that trace element requirements are lower in camels than in cows and that camels regulate their zinc and copper concentration at a very low level. This concert with Liu et al., (1994b) where the concentrations of copper in the forages and liver, kidney and rib in a camels were below normal values but disquiet with them that mean values of copper in the liver was exceeded the upper limits of normal ranges in other ruminants, this may due different progeny of camels (Bactrian camels). The present results indicated also that both copper and zinc were lower and deficient in this area which reflect on animal feeding with appearance and suffering form rickets and osteomalacia (Zongping, 2003 and 2005) that observed especially in the north Sinai where this levels were below that concentrations of that camels present in south one. Where the liver zinc concentrations increased in south Sinai she-camel (127.58 ± 0.05 µg/gm DM) compared with other while muscle zinc concentrations increase in both south Sinai male and she-camel (119.17 ± 0. and 119.16 ± 1.08 µg/gm DM, respectively) and liver copper concentrations increased in south Sinai she-camel (118.10 ± 4.60 µg/gm DM) and north Sinai male (116.14 ± 1.80 μg /gm) where as muscle copper increased in south Sinai male and she-camel (112.58 ± 1.30 and 112.57± 13.00 μg/gm DM, respectively). Although the present results observed sex influence on both zinc and copper concentrations, others where not observed this influences (Abu Damir et al., 1993).

Zinc and copper concentrations in other organs:

The present results demonstrated that kidney contains higher concentrations of zinc (103.77 ± 0.01 μg/gm DM) followed by heart (54.66 ± 0.007 μg/gm DM), spleen (54.66 ± 0.007 μg/gm DM), ovary (36.15 ± 0.05 μg/gm DM) while testis (15.27 ± 0.08) contains less zinc concentrations compared with previous organs. This picture not changed much with copper concentrations with the same order as observed previously in kidney (124.65 ± 0.017 μg/gm DM), heart (48.49 ± 0.025 μg/gm DM), spleen (55.94 ± 0.018 μg/gm DM), ovary (40.80 ± 0.017 μg/gm DM) compared with testis (28.46 ±0.016). The concentrations of zinc in the tissues were within the reference ranges for other ruminants, but the mean copper concentrations in the liver were significantly higher than those in other ruminants (Zongping, 2003). The mean copper concentrations in the liver were significantly higher than in other ruminants. Previous studies concerning copper and zinc have shown that the concentrations and distribution of these elements were different than other breeds (Liu et al., 2001). These results insured that the hematological and serum biochemical values and mineral contents in the tissues of domestic animals may vary according to geographic (altitude, latitude, climate) and dietary factors. Too little information's is available to permit this conclusion.

Due to sample collection and statistically difficulty, we compared between male and female only, the zinc concentrations in female kidney were (187.05 ± 0.013 μg/gm DM), heart (79.18 ± 0.005 μg/gm DM) spleen (58.59 ± 0.02 μg/gm DM) and ovary (36.15 ± 0.05 μg/gm DM), the same observed in copper concentrations in female kidney (211.05 ± 0.022 μg/gm DM), heart (89.35±0.016μg/gm DM) spleen (66.19 ± 0.018 μg/gm DM) and ovary (40.80 ± 0.05 μg/gm DM). This explanation were accompanied with these changes with hormonal changes; The season, mineral supplementation and the health status had a significant effect on the metabolic profile of the she-camels. Various authors have reported that copper levels > 6.0 and 5.0 mg/kg DM in soil and forage are safe for ruminants (Blanco-Penedo et al., 2006). Camels who are always on hay and who never have access to green pasture will benefit from a complete vitamin-mineral supplement. Fat-soluble vitamins, especially E and A, are abundant in green grass but degrade quickly in dried hay (Manefield and Tinson, 2008). Camels can tolerate copper excess or deficiency better than sheep or goats (Georgievaskii et al., 1982 and Bengoumi et al., 1999).

From the present results, the Sinai camels little suffering from zinc and copper deficiency except with the unexplained low circulating zinc and copper which may due to presence of other minerals that interfere with zinc and/or copper circulations which disguise the previous research concerning trance elements in camels in either dromedaries (Faye et al, 1992) or Bactrian camels (Liu et al, 1994). The present data differ from systematically reported reference values for trace elements in camels (Faye and Bengoumi, 1994 and Liu et al, 2001). Dromedaries have a specialized regulation to trace elements regulations where they appear to maintain lower concentrations of zinc than other domestic ruminants (Faye and Bengoumi, 1994, Faye et al., 1995 and Bengoumi et al., 1998b) and also maintain copper at lower level than cattle (Zongping, 2003).

CONCLUSIONS:

The Sinai area is very special part of our beloved Egypt, the south Sinai region is more wealthy, distinguishing and distinctive purport of agriculture, plants and growing herbs and climate which influenced on reared grazing camels and it is content of both serum and zinc and copper levels and concentrations which in final result will affect on the camel physiology and body performance. The present paper must further take attentions to this part of Egypt as the future land to our populations and need further development programs to solve our local problems.

Although serum zinc and copper levels were below the reference values the tissue concentrations did not significantly change where liver, muscle and kidney contains higher concentrations of both zinc and copper than other organs and tissues. There were significant differences between camels due to either age or sex and geographical variations.

The present information's needs large scales and further investigations and required to confirm this proposal.

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تأثير البيئة والتغذية على مستويات العناصر المعدنيه والثقيله والنادره فى الجمل السينائى . العناصر النا دره (الزنك والنحاس)

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هذا العمل كان تم إجراءه فى جزءا عزيز من الأراضي فى بلادنا ، التي عانت من ويلات اربع حروب في القرن الماضي ،وشربت أراضيها من دماء الشهداء الوطن وعبرت بها العديد من الرحلات ، سيناء ، تناول البحث قارب الصحراء ، الجمل.

أظهرت لدينا بيانات أن الجمل (Camel Dromedary (*Camelus dromedaries*) في منطقة شبه جزيرة سيناء ، كان مستوى الزنك في مصل الدم هو (٣٣,٧٩ ± ٠,١٧ ميكروغرام/١٠٠ مللى) ؛ الكلى (١٠٣,٧٧ ± ٠,٠١ ميكروغرام/جم وزن جاف) ، والقلب (٥٤,٦٦ ± ٠,٠٠٧ ميكروغرام/جم وزن جاف) ، والطحال (٥٤,٦٦ ± ٠,٠٠٧ ميكروغرام/جم وزن جاف)،المبيض (٣٦,١٥ ± ٠,٠٥ ميكروغرام/جم وزن جاف)،والخصية (١٥,٢٧ ± ٠,٠٠٨ ميكروغرام/جم وزن جاف)، الكبد (١٢,٥٧ ± ٠,٠٠٨ ميكروغرام/جم وزن جاف)، والعضلات(١٢,٤٢ ± ٠,٠٤ ميكروغرام/جم وزن جاف). في حين كان تركيز النحاس في المصل ٥٤,٦٦ ± ٠,٢١ ميكروغرام/١٠٠ مللى ؛الكلى (١٢٤,٦٥ ± ٠,٠١٧ ميكروغرام/جم وزن جاف)،والطحال (٥٥,٩٤ ± ٠,٠١٨ ميكروغرام/جم وزن جاف) ، وقلب (٤٨,٤٩ ± ٠,٠٢٥ ميكروغرام/جم وزن جاف) ، المبيض (٤٠,٨٠ ± ٠,٠١٧ ميكروغرام/جم وزن جاف)؛ الخصية (مسجلة ٢٨,٤٦ ± ٠,٠١٦)،الكبد(١٥,٣٠ ± ٠,٢٤ ميكروغرام/جم وزن حاف)والعضلات (١١,٢٥ ± ٠,٤٥ ميكروغرام/جم وزن جاف).

هذا وكشفت البيانات ارتفاع تركيزات مصل كل من الزنك والنحاس والمستويات الموجودة في الأمصال من الجمال في جنوب سيناء اكثر من تلك التى فى شمال سيناء وأنها بين الإناث أكثر من الذكور الجمال وخصوصا الجمال مع تقدم العمر أكثر من ٥ سنوات ذات الصلة. إشارات النتائج إلى ان المصل الزنك أعلى مستوى القيم ، في جنوب سيناء مع الإناث أكثر من ٥ سنوات (٤١,٨٧ ± ٠,٠٥ ميكروغرام/١٠٠ مللى) ، مقارنة مع ما يتصل بذلك من الإناث والذكور في سن (٢-٤ سنوات) ، يليه الذكور أكثر من ٥ سنوات في نفس المنطقة (٣٤,٦٥ ± ٠,٢٢ ميكروغرام/١٠٠ مللى). فإن تركيزات مصل النحاس في جنوب سيناء الإناث أكثر من ٥ سنوات (٥٧,١٢ ± ٠,٣٤ ميكروغرام/١٠٠ مللى) بالمقارنة مع الإناث (٢-٤ سنوات) (٥٣,٩٣ ± ٠,١٦ ميكروغرام/١٠٠ مللى).

كان هناك تأثير للموسم تكاثر على مصل الزنك والنحاس في المستويات سواء الذكور أو الإناث ، وزيادة تركيزات مصل الزنك خلال موسم تكاثر خاصة كما لوحظ في الإناث في جنوب سيناء في الإناث في جنوب سيناء (٥٠,٣٠ ± ٠,١٠٨ ميكروغرام/١٠٠ مللى) مما كانت عليه في شمال سيناء (٥٦,٥٠ ± ٠,١١ ميكروغرام/١٠٠ مللى).

وكانت تركيزات الزنك الجمال في الكلى (١٨٧,٠٥ ± ٠,٠١٣ ميكروغرام/جم وزن جاف) ، وقلب (٧٩,١٨ ± ٠,٠٠٥ ميكروغرام/جم وزن جاف) ، والطحال (٥٨,٥٩ ± ٠,٠٢ ميكروغرام/جم وزن جاف)، والمبيض (٣٦,١٥ ± ٠,٠٥ ميكروغرام/جم وزن جاف) ، لوحظ في نفس المجال ان النحاس فيها تركيزات أعلى في الكلى (٢١١,٠٥ ± ٠,٠٢٢ ميكروغرام/جم وزن جاف) ، يليه القلب (٨٩,٣٥ ± ٠,٠١٦ ميكروغرام/جم وزن جاف) ، والطحال (٦٦,١٩ ± ٠,٠١٨ ميكروغرام/جم وزن جاف) ، والمبيض (٤٠,٨٠ ± ٠,٠٠٥ ميكروغرام/جم وزن جاف) على التوالي فى الاناث اكثر من الذكور.

وأشارت البيانات إلى أن سلالات الإبل في جنوب سيناء يحتوي على تركيزات أعلى من الزنك والنحاس من مستويات الجمال في شمال سيناء مع وجود اختلافات كبيرة بين الجمال بسبب العمر و / أو الجنس و / أو موسم تكاثر و / أو التغيرات الجغرافية.