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ASSESSMENT OF SOME TRACE ELEMENTS IN HEALTHY CAMEL, CATTLE AND BUFFALOS

(With 3 Tables)

By

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تقدير بعض العناصر النادرة فى الجمال والأبقار والجاموس السليمة

جابر فرغلى خميس ، إيمان محمد عبد الناصر ، أحمد عبد الفتاح عامر

هدفت هذه الدراسة إلى تقديرتركيز كلا من النحاس، الزنك، الحديد والمنجنيز في الجمال والأبقار والجاموس السليمة اكلينيكيا ومقارنة هذه التركيزات بالدراسات السابقة. تم إجراء الدراسة على عدد ٧٥ من الجمال والأبقار والجاموس مقسمة إلى٢٥ لكل منهم، وجميعها من الذكور وتتراوح أعمارها من ٥-٧ سنوات وقد اثبت الفحص الإكلينيكى لهذه الحيوانات قبل الذبح أنها سليمة إكلينيكيا ولا يبدو عليها أية أعراض إكلينيكية مرضية كما أن الفحص الظاهرى للذبيحة والأحشاء الداخلية أثبتت خلوها من أية تغيرات باثولوجية ظاهرية. تم تجميع عينات الدراسة من مجزر بنى عدى بمحافظة أسيوط، حيث تم تجميع عينات الدم (للحصول على مصل الدم) وكذلك عينات الكبد الخاصة بكل حيوان وقد تم تجميع عينات الغذاء (التبن وبقايا الحقول) من أماكن تغذية هذه الحيوانات. وقد أوضحت نتائج تقديرتركيز كلا من النحاس، الزنك، الحديد والمنجنيز فى عينات مصل الدم أن هناك زيادة معنوية فى كلا من تركيز النحاس والمنجنيز فى الجمال عن الأبقاروالجاموس بينما لا توجد فروق معنوية فى تركيز كلا من الزنك والحديد بين الجمال مقارنة بالأبقار والجاموس. كما أوضحت نتائج تقديرتركيز كلا من النحاس والحديد فى عينات الكبد أن هناك زيادة معنوية فى الجمال عن الأبقار والجاموس بينما لا توجد فروق معنوية فى تركيز كلا من الزنك والمنجنيز فى عينات الكبد بين الجمال عند مقارنتها بالأبقار والجاموس. كما أوضحت نتائج تقديرتركيز كلا من النحاس، الزنك، الحديد والمنجنيز فى عينات الغذاء (التبن وبقايا الحقول) أن هذه التركيزات لا تتعدى الحدود المرجعية الدنيا.

SUMMARY

The present study aimed to establish normal concentration of Copper, Zinc, Iron, and Manganese in some randomly selected individuals representing camels, cattle and buffaloes together with a comparison between the recorded results and those reported in the previous

literature. A total number of 75 clinically healthy male animals represent camels, cattle and buffaloes (25 each). Agesof examined animals ranged between 5-7 years. Animals were slaughtered in Bani Adi slaughter house (Assiut city) where blood and liver samples were collected from each slaughtered animal. Selected animals were proved clinically healthy before slaughter by both clinical and laboratory methods of examinations and post mortem examination revealed no any macro pathological changes of carcasses or internal viscera. Blood serum and hepatic levels of Copper, Zinc, iron, and Manganese were determined and compared with respective values of cattle, buffaloes and camels. Blood serum Copper and manganese levels were significantly higher for camels than for cattle and buffaloes. While Liver copper and iron were significantly ($p< 0.05$) higher for camels than for cattle and buffaloes. The difference in blood serum zinc and iron, liver zinc, manganese between camels, cattle and buffaloes were not statistically significant ($p< 0.05$) Mean levels of copper, zinc, iron, and manganese in hay and crops residue mixture, on the dry matter basis were at the lower margin of the latest NRC recommendations.

Key words: *Camel, Cattle, buffaloes, Copper, Zinc, iron, Manganese*

INTRODUCTION

Trace minerals are those needed in small amounts, with requirements usually. Expressed as p.p.m (parts per million of the diet) and comprise less than 0.01% of the total mass of an organism (Kincaid, 1999).

Trace elements such as copper (Cu), zinc (Zn), iron (Fe), manganese (Mn), Selenium (Se), cobalt and iodine are essential in animal nutrition and are needed in very small amounts for essential metabolic reactions in the body. These trace elements are generally included in enzymes, hormones and vitamins molecules. For example, copper in cytochrome oxidase, alkaline phosphatase cystyloxidase, DNA and RNA polymerase and dehydrogenase. Manganese is recorded in pyruvate carboxylase and selenium in gluthione peroxidase. Iodine is included in thyroid hormones, cobalt in vitamin B12, and iron metalloprotein in haemoglobin and myoglobin. These trace elements are not only necessary for normal growth and development of animals but also important for reproduction (Akhtar *et al.*, 2009).

Herd (1997) indicated that there is concern that trace elements may be limiting production in better- managed herds to a much greater

extent than previously recognized. In animals sub clinical trace element deficiencies may be a larger problem than an acute deficiency, because specific clinical symptoms are not evident to allow the producer to recognize the deficiency (Failla, 2008). Animals with sub clinical status can continue to reproduce or grow, but at reduced rate, with decreased feed efficiency, and a depressed immune system (Nockles, 1994).

Trace elements deficiencies are often associated with alterations in many metabolic processes and cause various diseases. Also this deficiency causes severe economic loss due to increased susceptibility to oxidative stress, growth retardation in young animals, anemia (Bureau *et al.*, 2008), decrease in feed efficiency and fertility (Grenier *et al.*, 2003), enhance the virulence of the infectious agents (Failla, 2008) and decrease immune system function (Rink and Ibs, 2003; Knutson and Wessling-Resnick, 2003).

The smallholding livestock system is dependent mainly on grazing and crop residue as a source of dry matter. Mineral imbalances are quite common in this system and there have been evidences of trace minerals deficiency or excess in different regions (McDowell, 1997).

The most common reason to assess the trace element status of ruminants is because performance is below expectation. Accordingly, the assessment is done to determine the presence or prevalence of nutrient deficiencies (or toxicities) within a population. Assessment also is done to evaluate efficacy of dietary supplementation or to compare available supplements (Kincaid, 1999).

Large numbers of livestock in many parts of the world consume diets that do not meet the dietary requirements (McDowell, 1997 and 2003). Continued ingestion of diets that are deficient, imbalanced or excessively high in a mineral induces changes in the form of concentration of the mineral in the body tissues and fluids, so that it falls below or rises above the tolerable limits. In such circumstances biochemical lesions develop, physiological functions are affected adversely and structural disorders may arise (Suttle and Jones, 2000).

Upper Egypt is predominantly the domain of small and marginal farmers and the landless who keep one or two animals generally as a part of small breeders pattern (Atallah, 2004). Their animals are grazing on seasonal crop residues or freely on the perennial vegetation. The problems that arise are often associated with ill-advised feeding regimes; and cost-effective supplemental minerals. It is difficult to get good information on the composition and quality of the ration and the amounts fed in most cases.

The most common tissue analyzed for mineral content is liver, as it is the primary storage organ for many of the essential minerals (McDowell, 1997). Liver values are more informative and consistent as blood levels may remain normal for longer periods after liver trace elements levels commence to fall indicating an early sign of trace elements deficiency (Radostits *et al.*, 2004).

General clinical signs of trace elements deficiency usually revealed animals anemic and manifest stunted growth, late maturity; longer inter calving periods and reproductive disorders (Khan *et al.*, 2006). The young stock in particular is victims of poor growth rate and high mortality. Mild deficiencies or sub-clinical deficiencies assume great importance because they are difficult to be diagnosed and they are clinically manifested only as unthrifty, unsatisfactory growth, production and fertility (Khan *et al.*, 2007). Large numbers of livestock in many parts of the world consume diets that do not meet the dietary requirements (McDowell *et al.*, 1997 and Khan *et al.*, 2006, 2007).

In the present study, analysis of the animal feed, blood serum, and liver was conducted to establish normal concentrations of Cu, Zn, Fe, and Mn in some selected individuals representing camels, bovines and buffaloes and to compare the recorded results with those reported in the previous literature.

MATERIALS and METHODS

Animals:

Seventy five male animals' camels, cattle and buffaloes (25 each) aged from 5-7 years old were selected after careful clinical examination. They were raised at smallholder houses in different villages and slaughtered in Bani Adi slaughter house (Assiut, Egypt) during the period from March to August 2010.

Blood sampling:

Jugular blood samples in clean tubes, free from anticoagulant, were collected from the selected clinically healthy animals. The blood was allowed to clot and centrifuged, then clear blood serum was separated and stored at -20 C° until analysed.

Collection of liver samples:

Liver samples from the selected slaughtered camels, cattle and buffaloes were collected. The samples were transferred into clean sterile containers and immediately frozen at -20 C° until analysed.

Feed samples:

Samples of both hay and crops residue were taken and analysed using an atomic absorption spectrophotometer. Two grams of each sample was wet ashed in a Teflon beaker with cover using (1:3) $HNO_3/HCLO_4$ acid mixture. The residue after evaporation was dissolved in dilute HCL and completed to 50 ml using bi-distilled water.

Biochemical analysis:

Blood serum concentrations of Cu, Zn, Fe, and Mn were measured by atomic absorption spectrophotometer (B3003,Perkin Elmer-AAS). Liver samples (one gram) were digested in a mixture of 2:1: 0.5 nitric acid (HNO, 65%, Perchloric acid ($HCLO_4$, 60%) and sulphuric acid (H_2SO_4, 97%). The samples were further diluted and aspirated into an atomic absorption spectrophotometer.

Statistical analysis:

Recorded data were analyzed statistically using analysis of variance (ANOVA). The statistical differences between means were estimated by Duncons Multiple Range test. The computation was facilitated by statistical package SPSS (2000).

RESULTS

Mean levels of blood serum concentrations of Cu, Fe, and Mn in tested camels, cattle and buffaloes are shown in Table (1). Mean blood serum Cu and Mn in camels were significantly higher ($p< 0.05$) than that in cattle and buffaloes. The difference in mean blood serum Zn and Fe concentrations between camels, cattle and buffaloes were not statistically significant.

Mean levels of liver concentrations for Cu, Zn, Fe, and Mn in tested camels, cattle and buffaloes are shown in Table (2). Mean liver concentration of Cu, and Fe in camels were significantly higher ($p< 0.05$) when compared with their values in cattle and buffaloes, However, the differences in mean liver concentration of Zn and Mn between the camels, cattle and buffaloes were not statistically significant ($p< 0.05$).

Hay and crops residue mixture concentrations of Cu, Zn, Fe, and Mn were within the range recorded by others (Table 3).

Table 1: Mean levels of Cu, Zn, Fe, and Mn in the serum of camels, cattle and buffaloes.

Parameter	unit	Camels	cattle	buffaloes
Cu	µg/dl	133.2±2.5*	93.81±3.3	107.26±5.0
Zn	µg/dl	104.4±2.4	96.67±4.58	101.3±9.3
Fe	µg/dl	119.0±7.4	125.6±3.86	115.6±4.8
Mn	µg/dl	27.47±3.35*	8.03±0.47	12.95±0.72

* = Significant ($p < 0.05$)

Table 2: Mean levels of Cu, Zn, Fe, and Mn in the liver of camels, cattle and buffaloes.

Parameter	unit	camels	cattle	buffaloes
Cu	mg/kg	260.7±6.81*	135.2±4.6	118.4±6.0
Zn	mg/kg	150.4±6.03	133.9±2.41	138.0±3.71
Fe	mg/kg	285.5±8.3*	228.7±3.20	257.6±7.2
Mn	mg/kg	9.53±0.8	7.82±0.38	9.0±0.21

* = Significant ($p < 0.05$)

Table 3: Mean levels of Cu, Zn, Fe, and Mn in the feed of camels, cattle and buffaloes (on dry matter basis).

Parameter	Unit	Hay	crops residue
Cu	p.p.m	18.6±0.4	34.12±0.51
Zn	p.p.m	35.0±0.4	14.7±0.08
Fe	p.p.m	0.97±0.03	118.0±0.16
Mn	p.p.m	44.0±0.06	101.07±0.2

DISCUSSION

In the present study, the obtained concentrations of some serum trace elements (Cu, Zn, Fe, and Mn) in camels were comparable to that recorded by Selim (1992), and Sayed, (1998).

In general, the blood serum concentrations of Cu, Zn, Fe, and Mn, in cattle and buffaloes were within the lower range recorded for ruminants (Black *et al.*, 1985; Stoszek *et al.*, 1986 and Engle *et al.*,

2001). The obtained blood serum Cu level in camels was significantly higher than that demonstrated in cattle and buffaloes. This is in agreement with the previous reports in which blood serum Cu values are higher in camels than in ruminants (Faye and Grillet, 1984; Faye *et al.*, 1990). This may be attributed to the fact that camels graze more forages and more crops residue than cattle and buffaloes.

Concerning the small variations between the present values and those reported by other workers, can be attributed to the influence of number of examined animals, age, breed, nutrition and the environment difference.

Recorded blood serum Zn and Fe levels showed no differences between camels, cattle and buffaloes. These levels were within the general range reported for other animals (Hafez, 1994; Sayed, 1998).

On the other hand, the determined blood serum Mn concentrations in camels were significantly higher ($p< 0.05$) than its level in cattle and buffaloes. These results agree with that reported by El Tohamy *et al.* (1986).

The recorded values for mean hepatic concentrations of Cu, Zn, Fe, and Mn in camels agree with the previous reports of (Kalifa *et al.*, 1983; Abu Damir *et al.*, 1983; Wensvoort, 1992). Also Liver concentrations of Cu, Zn, Fe, and Mn obtained for cattle and buffaloes were within the general range recorded by (Hatfield *et al.*, 2001; Arthington and Pate 2002). In fact, the trace elements concentrations for animals' in both serum and liver will therefore depend on the mineral contents of feed and forage, the level of dietary sources intake, and the availability of minerals (Kamalu *et al.*, 2006; Khan *et al.*, 2007).

The obtained results indicated that, the hepatic Cu and iron concentrations recorded in camels were significantly higher ($p< 0.05$) than their values in cattle and buffaloes. This may be due to increase accumulation of Cu in the liver of camels, as the liver is the primary copper storage organ (Bailey *et al.*, 2001; Radostits *et al.*, 2004) where hepatic copper represents about 10% of the total amount of copper in the body. Also camels grass more forage –trees than grasses (Rutagwenda *et al.*, 1990) and leaves from those trees are generally richer in copper than pasture plants which are the main diet for the cattle and buffaloes (Faye *et al.*, 1986; Faye *et al.*, 1990). On the other hand, there were no significant differences in hepatic Zn and Mn recorded between camels, cattle and buffaloes.

Mean levels of Cu, Zn, Fe, and Mn in hay and crops residue mixture at the dry matter basis were at the lower margin of the latest NRC (1996) recommendations.

In Fact, theses animals depend mainly on the amount of trace elements found in their food and no attention paid from the small holders to increase the quality of the animals' food by use supplementation with micronutrients where it is necessary. Many environmental and plant factors affect the mineral concentrations of forage plants; which include, species or strain, variety, soil type, the climatic conditions of different seasons during plant growth, stage of maturity of forage plants and other management practices.

Further studies will be needed to evaluate the effects of diet, regional differences, season and physiological status of the animals on serum trace elements of different animals under local farming processes.

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