Determination of Some Essential Trace Elements in Cattle liver and sheep liver in Basrah

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ABSTRACT :

Four essential trace elements Cu, Zn, Fe and Mn were determined by F.A.A.S. in the livers of 23cattle and 23sheep samples. The livers were obtained from different abattoirs in Basrsh city in Iraq. The mean concentration of each metals and standard deviation were as follows: Copper 17.81±5.63µg /g wet wt. and 23.15 ±5.62µg /g wet wt., zinc 89.49±7.87µg /g wet wt. and 81.64 ±8.30µg /g wet wt., iron 88.29 ±15.40 µg /g wet wt. and 101.15 ±8.41µg /g wet wt. and manganese 3.92 ±0.71 µg /g wet wt. and 4.05±0.84µg /g wet wt. for cattle and sheep liver samples respectively .The results obtained were compared with the reported values for other countries. The levels of various metals were generally at adequate level except copper was at low level according to the international criteria.

INTRODUCTION :

Trace elements or micronutrients are found only in minute quantities in the body. They are classified into essential , non essential, and toxic group(WHO 1973). At low concentration essential elements play an important role in metabolism and biological process as enzyme activators, stabilizers, functional components of proteins, etc (Kincaid 1999). For example copper(Cu) is a structural elements in the enzymes tyrosinase, cytochrome oxidase , ascorbic acid oxidase, amine oxidases and contained in the enzyme ferroxidase, system which regulates iron transport and facilitates its release from storage . The copper deficiency results in anemia from reduced ferroxidase function. Excess of copper cause liver malfunction and associated with the genetic disorder, (Paula *et al.* 2003 & John 2004) .

Zinc (Zn) is important for hormones reproductive of function FSH (follicle stimulating hormone), enzyme alcohol dehydrogenase, DNA polymerase, lactic dehydrogenase, carbonic anhydrase and the antioxidant copper zinc superoxide dismutase . An excess of zinc cause anemia and reduced liver function (Kincaid 1999). Iron (Fe) is part of hemoglobin and myoglobin which are required for oxygen transport in the human body. Anemia is the primary consequence of iron deficiency and excess of iron cause liver enlargement and may provoke diabetes, cardiac failure and genetic diseases (Stasys *et al.* 2005). Manganese (Mn) is the major component of the mitochondrial antioxidant enzyme manganese superoxide dismutase. The excess in the manganese level lead to poor iron absorption (Langland *et al.* 1984).

Adequate concentrations of essential elements in cattle liver are 35-170, 12-85, 45-300 and >4 (µg /g) wet wt. for Cu, Zn, Fe and Mn respectively (Puls 1988 & Kincaid 1999). Sheep are unique in that they accumulate copper in their liver more readily than other farm animals. As a result, they are very susceptible to Cu toxicity (Esther *et al.*2007).

Homeostasis involves the processes of absorption, storage and extraction, which are vary among trace elements and species of animals (Paula *et al.* 2003). The knowledge of trace elements nutrition is derived from field observation in farm animals, which are exposed much more than human to the influences of the geochemical environment (Walter 1977).

Meat is very important source of essential elements in human nutrition, they are in forms that are much more mobile and accessible to the human than the elements of non – animal origin. (Marchello *et al.* 1985) . Mineral composition of meat is influenced by animal species breed, feed, climate, and type of tissue (Edmundo *et al.*1982 & . Al-busadah 2003). The influence of sex is weak and age effected only during early month's postnatal life (WHO 1973 & Zakaradas *et al.* 1987). Monitoring levels of mineral concentrations in the animal tissues is important for assessing the effect of contamination on animal health and safety of animal-origin products in the human nutrition, (Marta *et al*. 2005)

Trace elements are absorbed from gastrointestinal to the blood and stored in the animal's tissue like liver, kidneys, brain, and hair. Liver contents are good indicator of trace element status of cattle and sheep (Lopez *et al*. 2002).

This study was undertaken in order to determine the levels of Cu, Zn, Fe, and Mn in livers of cattle and sheep in Basrah city and compare our results with those reported in the literature.

SAMPLES COLLECTION :

During November and December (2008). 23 liver samples of sheep and 23 of cattle were obtained from three different abattoirs in Basrah. Samples were taken from cattle and sheep aged (1.5 - 4 years) and (1-2 years) respectively. The samples were collected in polyethylene bags. Fat was removed and stored at (-18C°) until analyzed.

METHOD AND MATERIALS :

Five grams of liver samples were wet ashed in a pyrex beaker with 35 ml of mixture of nitric and perchloric acids (6+1) and was placed on a hotplate at 135 C for 2 hours. The colorless liquor formed was evaporated slowly to dryness, cooled and dissolved in 5 ml of 20% nitric acid and diluted with the deionized water (Iwegbue 2008). Samples were analyzed for Cu, Zn, Fe and Mn using flam atomic absorption spectrophotometer (MANAGEMENT CO. LTI. UK. Phenix. 986). Calibration standards were made diluted of high purity commercial BDH metal standards. All metals concentrations are expressed on a wet mass basis.

Data were statistically analyzed by using SPSS (1998). Analysis included independent – samples, T test and correlation coefficient among studied traits

RESULTS :

Table (1) showed mean concentrations (µg /g) wet weight. of essential trace elements(Cu , Zn, Fe, and Mn) in the cattle and sheep livers and standard deviation (SD) .

Table 1. Mean concentrations µg /g wet wt and SD of essential elements in cattle and sheep livers (n=23)

Elements	Cattle (µg /g) ±SD	Sheep (µg /g) ±SD	Sig.
Cu	17.81±5.63	23.15±5.62	NS
Zn	89.49±7.87	81.64±8.30	NS
Fe	88.29±15.4	101.15±8.41	0.01
Mn	3.92±0.71	4.05±0.84	NS

The results indicated a significant differences ($P < 0.01$) between cattle and sheep accordance of the level of Fe , Sheep showed higher level in Fe . However sheep exceeded cattle in Cu but did not reach the significance level. Cattle on the other hand got higher level of Zn . again the different was not significant. Correlation coefficients among trace element are showed in table (2).

There was a significant ($P < 0.01$) negative correlation between Cu and Zn (-0.602) and positive correlation between Cu and Fe (0.424). Zn showed a significant ($P < 0.05$), negative correlation with Fe (-0.370).

Table 2. Correlation coefficient among essential elements in sheep and cattle livers

		Cu	Zn	Fe	Mn
Cu	Pearson Correlation Sig.(2-tailed)	1.000 .	-0.602** 0.000	0.424** 0.003	-0.074 0.625
Zn	Pearson Correlation Sig.(2-tailed)	-0.602** 0.000	1.000 .	-0.370* 0.011	-0.029 0.850
Fe	Pearson Correlation Sig.(2-tailed)	0.424** 0.003	-0.370* 0.011	1.000 .	0.029 0.851
Mn	Pearson Correlation Sig.(2-tailed)	-0.074 0.625	-0.029 0.850	-0.029 0.851	1.000 .

DISCUTION :

In the present study the mean hepatic concentrations of essential trace elements Cu, Zn, Fe and Mn obtained in Basrah were compared with those reported in the literature of some countries, showedin able3.

Liver concentrations of Cu obtained from cattle and sheep 17.81 µg /g wet wt. and 23.15 µg /g wet wt. respectively were lower than the liver concentrations in another studies except in southern Nigeria farm area, but close to the values of cattle's liver concentration in urban area from Kenya, agricultural area from Slovakia and industrial area from Spain. The levels of Zn in this study 89.49 µg /g wet wt. and 81.64 µg /g wet wt. showed higher respectively than Saudi Arabia, Kenya and Spain , but close to the values of liver concentration in Sudan , Slovakia and Mexico. The mean of levels of Fe concentrations in cattle and sheep's livers 88.29 µg /g wet wt and 101.15 µg /g wet wt. respectively are higher than those of Saudia Arabia , Southern Nigeria and lower than levels in all countries that are compared with the present study, but close to the values of liver concentration in Spian . Liver concentrations of Mn 3.92 µg /g wet wt. and 4.05 µg /g wet wt. are higher than of Saudi Arabia, but close to the values of liver concentration in Spain and lower than liver concentration in Nigeria and Mexico.

Table (3) comparison of concentrations of Cu, Zn Fe, and Mn in cattle and sheep liver between this study and other studies

Wet weight =dry weight * 3.5 (Al-Busadah 2003).

Animal	Cu µg /g ww	Zn µg /g ww	Fe µg /g ww	Mn µg /g ww	Area	References
Cattle **Sheep**	43±5.1 44.1±3.1	39.8±2.2 40.2±2.4	65.4±4.4 71.8±5.5	2.14±0.8 2.45±0.8	Saudia Arabia Research Center	Al-busadah 2003
Cattle **Sheep**	88±9.8 65.5±8.1	85±6.1 139±7.9	180±20 229±15.6	------- --------	Sudan contamination area	Amel *et al.* 2007
Cattle **Sheep**	21±16 59±37	37±11 30±6.1	-------- --------	-------- --------	Kenya urban area	Froslie *et al.* 1983
Cattle **Sheep**	1.99±1.96 ---------	--------- ---------	37.7±20 -----------	11.32±0.8 -------	Southern Nigeria Farm area	Iwegbu 2008
Cattle **Sheep**	34.3 -------	38.5 -----------	96.2 -----------	3.11 ----------	Spain Industrial area	Marta *et al.* 2005
Cattle **Sheep**	31.06 ----------	79.94 --------	125.2 --------	---------- ----------	Slovakia Agricultural area	Beata 2002
Cattle **Sheep**	117.8±86.3 ----------	88.9±22.9 ----------	171±375 ----------	9.4±4.3 ----------	Mexico urban area	Gartenberg *et al.* 1990
Cattle **Sheep**	17.81±5.63 23.15±5.62	89.49±7.87 81.64±8.30	88.29±15.40 101.15±8.41	3.92±0.71 4.05±0.84	Present study urban area	

Table 4 indicated metals concentration (µg /g wet wt.) in liver of cattle were if they deficient, marginal, adequate, high and toxic. Adapted from Kincaid 1999) and (Puls 1988)

Table 4. Criteria for classification of (µg /g wet wt.) cattle's liver

Element	Deficient	Marginal	Adequate	High	Toxic
Cu µg /g	<10	10-35	35-170	170-350	>35
Zn µg /g	<7	7-12	12-85	85-280	>280
Fe µg /g	<40	40-45	45-300	300-700	>700
Mn µg /g	<2	2-4	>4	---------	--------

(Kincaid 1999) and (Puls 1988)

The concentrations of Zn, Fe, and Mn in the liver are at the adequate limit, except Zn in the liver of cattle is at high limit (89.64µg /g w w), while the adequate limit (12-85µg /g w w). The concentration of copper at marginal limit, (17.81µg /g w w) and (23.15µg /g w w) for both species cattle and sheep respectively, while the adequate limit (35-170 µg /g w w) .The levels of metals were generally adequate limit except marginal in copper.

Low level of of copper in liver samples classified as a primary or secondary deficiencies. Primary deficiencies are the result of consumption of feeds that are low in copper, that mean the soil and plant are poor with copper in Basrah, this agrees with the observation of (Hussain 1990). The levels of some trace elements in middle and south Iraq are indicating deficiency; this is possibly due to reduction on domestic feeds in Basrah.

Secondary deficiencies are derived from the consumption of copper antagonists that interfere with the normal metabolism of other minerals, showed in figure 1. (Arthington 2003)

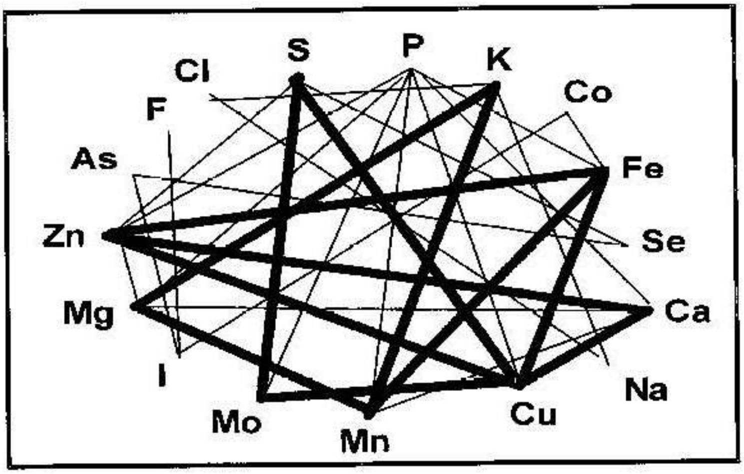

Figure 1. Potential mineral antagonisms in animal nutrition (Arthington 2003)

High level of sulfur, molybdenum, calcium, zinc and iron reduce absorption of copper. Ammonium sulfate is a widely available source of fertilizer nitrogen. Farm animals from the pastures fertilized with ammonium sulfate had lower liver Cu concentration at the end of the grazing season compared to those not fertilize (Arthington 2003). Ammonium sulfate was used as a good fertilizer in basrah, so the feed of animals may have high concentration of sulfur.

The antagonistic of Fe in Cu nutrition is not well understood .One explanation relates to the potential disassociation of ferrous sulfide complexes in the low p^H of the abomasum. Under this explanation, sulfide may be able to react with Cu, forming insoluble Cu- sulfide complexes. (Arthington 2003).

The results obtained in the present study showed Zn had higher concentration while Cu had low concentration. Zinc and copper get displaced from metallothionine, the protein that binds and carries hem (Mioc *et al.* 1998).

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