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WOOL ANALYSIS AS AN INDICATOR FOR DIAGNOSIS OF SOME TRACE ELEMENTS DEFICIENCY IN SHEEP

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ABSTRACT

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The present study aimed to establish the different concentrations of Copper, Zinc, Iron, and Manganese in sheep blood serum, wool and feed stuffs, in comparison with the recorded results obtained from apparently healthy sheep. A total number of 40 ewes 10 of them were apparently healthy and 30 ewes showed different signs as (easly detached wool, anorexia and diarrhoea), their ages ranged between 1-4 years. Blood serum, wool and feed samples of sheep were collected from different villeges around Assiut city. The present study revealed that diseased sheep showed highly significant decrease in the serum and wool Copper, Zinc, Iron, and Manganese levels in comparison with apparently healthy ones. Pearson's correlation coefficient revealed that Cu, Zn, Fe, and Mn were positively correlated in both blood serum and wool samples. Mean levels of copper, zinc, iron, and manganese in hay and crop residue mixture at the dry matter basis, fall at the lower margin of the latest NRC recommendations. These findings indicated that the concentrations of trace elements in the wool of sheep gave a good indication for the diagnosis of of some trace elements deficiency.

Key words: *Sheep, Copper, Zinc, iron, Manganese*

INTRODUCTION

Body stores of minerals may be estimated from hair or wool analysis, because growing hair is metabolically active and is a sequestering tissue. Thus, hair may reflect concentrations of minerals that were in the hair follicle at the time the hair was formed (Combs *et al.*, 1982).

Recently, a number of laboratories have been directed toward the use of hair or wool analysis as a diagnostic tool in determining the trace minerals status in man and animals (McDowell, 2003). Serum or plasma levels of trace elements had used for the determination of the minerals status of the animals and diagnosis of their deficiency diseases (Shalaby, 2003).

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 (Atallah, 2004).

Trace elements are accumulated in wool at concentration that are at least 10 times higher than those present in the blood, serum and urine (Suttle, and Jones, 2000). Wool analysis is easier, inexpensive, safe and reliable (Mohga, and Abdel-Razik; 2000). Copper, zinc, iron and manganese were known to be dietary and metabolic essential elements; they control numerous enzymatic and metabolic functions (Rink, and Ibs, 2003).

In the present study, analysis of the animal blood serum, wool and feed was conducted to determine the levels of zinc, copper, iron and manganese and to compare the wool recorded results with those of serum.

MATERIALS and METHODS

A-Animals:
This study was conducted on 40 ewes (1-4) years old of which 30 suffered from some clinical symptoms including easly detached wool, anorexia, diarrhoea and loss of skin rigidity and elasticity.

The other 10 ewes were apparently healthy according to the clinical and laboratory examinations (analysis of wool and serum) and used as control.

B- Samples and adopted methods:
- Blood samples:
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.

- Wool and Feed samples: 40 wool samples, and 25 feed samples (hay and crops residue) were taken and analysed using an atomic absorption spectrophotometer. About 2 gm of each sample was wet ached in a Teflon beaker with cover using (1:3) HNO3/HCLO4 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) at the central laboratory of the faculty of Veterinary Medicine Assiut University. Wool and feed samples were further diluted and aspirated into an atomic absorption spectrophotometer.

Statistical analysis: Recorded data were analysed 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). Pearson's correlation (r) of data obtained by individual cases in both serum and wool.

RESULTS

The clinically diseased ewes have been reported to suffer from anorexia, unthriftness and diarrhoea. The wool was loose and easily detached.

The mean levels of blood serum concentrations of Cu, Zn, Fe, and Mn in clinically healthy and diseased ewes are shown in table (1).

The mean levels of wool concentrations of Cu, Zn, Fe, and Mn in clinically healthy and diseased ewes are shown in table (2).

The correlation coefficient between the Cu, Zn, Fe and Mg in both serum and wool were positively correlated table (3).

Hay and crops residue mixture concentrations of Cu, Zn, Fe, and Mn were within the range recorded by others (Table 4).

Table 1: Mean levels (± SE) of Cu, Zn, Fe, and Mn in the serum of clinicaly healthy and diseased ewes.

Parameter	Unit	clinicaly healthy	diseased ewes
Cu	µg/dl	98.08±5.94	76.41±3.22**
Zn	µg/dl	86.9±1.36	34.82±1.12***
Fe	µg/dl	121.35 ±1.87	77.53±2.9***
Mn	µg/dl	31.42± 1.65	17.23±1.79***

= very highly Significant (p≤0.01), * very highly Significant (p≤0.001)

Table 2: Mean levels (± SE) of Cu, Zn, Fe, and Mn in the wool of clinicaly healthy and diseased ewes.

Parameter	Unit	clinicaly healthy	diseased ewes
Cu	Ppm	86.42±3.1	69.87±3.46*
Zn	Ppm	92.1±4.13	68.21±3.9**
Fe	Ppm	132.92±3.9	85.8±2.86***
Mn	Ppm	29.88±1.79	13.81±0.71***

*= Significant (p <0.05) **= very highly Significant (p≤0.01)
*** very highly Significant (p≤ 0.001)

Table 3: Correlation coefficient (r) among Cu, Zn, Fe, and Mn in serum and wool

		Cu	Zn	Fe	Mn
Cu	**r**	1.000	0.42*	0.36*	0.31*
Zn	**r**	0.32*	1.000	o.42*	0.33*
Fe	**r**	0.33*	0.33*	1.000	0.31*
Mn	**r**	0.36*	0.31*	o.31*	1.000

* = Significant (p< 0.05)

Table 4: Mean levels (± SE) of Cu, Zn, Fe, and Mn in the feed of clinically healthy and diseased ewes (on dry matter basis).

Parameter	Unit	Hay	crops residue
Cu	**Ppm**	18.3±0.2	31.12±0.41
Zn	**Ppm**	33.0±0.3	13.9±0.07
Fe	**Ppm**	0.89±0.03	116.0±0.15
Mn	**Ppm**	42.0±0.05	104.05±0.3

DISCUSSION

The examined ewes in this study gave an indication of trace elements deficiency in the diseased sheep and were coincided with those previously described by Faris, 2002, Abd El-Raof and Ghanem, 2006 and Shalaby, 2010.

The values obtained in this study were remarkably lower than those of previous studies (shalaby, 2003 and Shalaby, 2010).

The obtained results indicated that copper level in both serum and wool of diseased sheep (anorexia and diarrhoea) was highly significant ($P<0.01$) decreased as compared with the control group. This result may be attributed to inadequate copper in the diet or due to other factors which reduce the availability of dietary copper in the rumen (El-Sayed and Hassan, 1993 and Hatfield *et al.,* 2001).

Zinc level in both serum and wool of diseased sheep (anorexia and diarrhoea) was highly significant ($P<0.01$) decreased as compared with the control group. This result may be attributed to nutritional deficiency of zinc which confirmed by analysis of ration. This observation was in agreement with those mentioned by Faris (2002) and Shalaby (2010). There was a general relation between zinc content of hair and its level in the diet (Radostits *et al.,* 2004).

The reduction of serum and wool iron level in the diseased sheep (anorexia and diarrhoea) in the present study may be attributed to the deficiency of iron in the diet or due to copper deficiency, which decreases the absorption of iron and releases the iron from the body stores in addition to utilization of iron in haemoglobin synthesis. These results were in agreement with Faris, (2002) and shalaby (2003).

The reduction of serum and wool manganese level in the diseased sheep in the present study may be attributed to a dietary deficiency of manganese. Radostits *et al.* (2004), recorded that manganese level in hair was reflected the manganese dietary supply better than any other part of the body.

Pearson's correlation coefficient revealed that Cu, Zn, Fe, and Mn were positively correlated in both blood serum and wool samples.

Deficiency of copper, zinc, iron, and manganese occurs concurrently suggesting that nutritional deficiency problem is mostly caused by deficiency of more than one element.

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 (2005) recommendations.

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 (Kincaid, 1999; Khan *et al.,* 2007 and Faille, 2008).

These findings indicated that the concentrations of copper, zinc, iron, and manganese in the wool of clinically diseased sheep gave a good indication for the diagnosis of trace elements deficiency. Wool samples can be used to detect the trace minerals deficiencies before the appearance of the clinical symptoms.

In Fact, these 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 (Khan *et al.,* 2006 and Khan *et al.,* 2007).

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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تحليل الصوف كمؤشر لتشخيص نقص بعض العناصر النادرة فى الاغنام

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هدفت هذه الدراسة إلى تقديرتركيز كلا من النحاس، الزنك، الحديد والمنجنيز في مصل الدم وصوف وغذاء الاغنام السليمة والمريضة اكلينيكيا ومقارنة هذه التركيزات بالدراسات السابقة. تم إجراء الدراسة على عدد 40 من الاغنام وتتراوح أعمارها من 1-4 سنوات مقسمة إلى 10 سليمة اكلينيكيا ولا يبدو عليها اية اعراض اكلينيية مرضية وعدد 30 نعجة يظهر عليها اعراض مختلفة منها سهولة نزع الصوف وفقدان الشهية والاسهال. تم تجميع عينات الدراسة من بعض القرى بمحافظة أسيوط ، حيث تم تجميع عينات الدم (للحصول على مصل الدم النقى) وكذلك تم تجميع عينات الصوف وعينات الغذاء (التبن وبقايا الحقول) من أماكن تغذية هذه الحيوانات. وقد أوضحت النتائج وجود نقص معنوى فى تركيز كلا من النحاس،الزنك، الحديد والمنجنيز فى عينات مصل الدم والصوف فى الاغنام المريضة. وقد اوضح معامل ارتباط بيرسون أن تركيز لكل من النحاس ، الزنك، الحديد والمنجنيز بينهم ارتباط موجب بدرجة معنوية فى لكل من مصل الدم والصوف. كما أوضحت نتائج تقدير تركيز لكل من النحاس، الزنك، الحديد والمنجنيز فى عينات الغذاء (التبن وبقايا المحاصيل الحقلية) أن هذه التركيزات لا تتعدى الحدود المرجعية الدنيا. وقد أوضحت هذه الدراسة ان تحليل الصوف يمكن استخدامه كمؤشر لتشخيص نقص بعض العناصر النادرة فى الاغنام.