

**THE RELATIONSHIP BETWEEN THE SYNDROMES OF WOOL EATING AND ALOPECIA IN AKKARAMAN AND MORKARAMAN SHEEP FED CORN SILAGE AND BLOOD CHANGES (HAEMOTOLOGICAL, BIOCHEMICAL AND TRACE ELEMENTS)**

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**Abstract**

Imbalances of some blood parameters in sheep can cause alopecia and reduction in productivity and yield. For the diagnosis of these disorders, minerals and protein in body fluids and certain haematological values need to be determined. In the present study, serum samples of normal sheep and Akkaraman and Morkaraman sheep with alopecia, raised in the region of Van, were examined for trace elements, biochemical and haematological changes. Results showed that while Fe, Mn, P, Ca, Na and Cl values obtained from clinically normal and sick animals were not significantly different, Cu and Zn values were significantly ( $P < 0.01$ ) decreased in serum of diseased animals. Furthermore, serum total protein values were significantly decreased in sick animals. In contrast, serum albumin and glucose values of sick were animals the same as normal animals. Haemoglobin levels of diseased animals were also significantly lower ( $P < 0.05$ ). The other haematological values were not significantly different. It is concluded that alopecia and wool eating habit in sheep could be due to the reduction in serum copper and zinc levels as a result of one-way corn silage feeding.

**Key words:** Alopecia, wool eating, sheep, silage, trace elements.

**Introduction**

Bacteria, viruses, parasites, toxic agents, metabolic disorders, and nutritional insufficiencies are important factors in the aetiology of alopecia in sheep. Among them, deficiencies of micro- and macro-elements are the most important. The animals obtain these elements either as mineral salts or as organic compounds. The need of mineral and trace elements (Cu, Co, Mn) in animals change with age, production levels, condition, climate and the levels of these elements in soil. The Alkali imbalances (Na and K), amino acid and vitamin deficiencies in the body induce allotrophagia or eating inanimate items by the animal. These insufficiencies cause lesions throughout the body and specific skin diseases such as alopecia (1-6).

Nelson et al. (4) reported that obvious parakeratosis and hyperkeratosis in animal skin, alopecia and severe wool eating habit were present in two sheep flocks and one goat flock with zinc deficiency. These workers found that sheep, fed on a diet poor in zinc, began to lose wool and the wool was broken easily, starting from seventeenth day of the experiment. They pointed out that erythrocytes, total leukocyte, haematocrit and haemoglobin values were normal but total protein and haemoglobin values were decreased. In the same study, it was estimated that serum zinc values in two sheep were 0.73  $\mu\text{g/ml}$  and 0.64  $\mu\text{g/ml}$ , serum copper values were 1.13  $\mu\text{g/ml}$ , 1.27  $\mu\text{g/ml}$ . In yearling lambs which were in the second experimental group, it was estimated that serum zinc levels was 0.4  $\mu\text{g/ml}$  in the first and 0.32  $\mu\text{g/ml}$  in the second lamb. Serum magnesium values in yearling lambs were 2.4 mg/dl

and 2.34 mg/dl. Furthermore, serum iron levels were 35 mg/dl, 34 mg/dl, and copper levels were 0.84 µg/ml, 1.0 µg/ml in the experimental animals.

In a similar study, Altıntaş et al. (7) found that mean serum zinc values were  $11.84 \pm 1.84$  µmol/L, calcium values  $2.04 \pm 0.24$  µmol/L, magnesium values  $1.00 \pm 0.06$  µmol/L, potassium values  $3.14 \pm 0.29$  µmol/L, sodium values  $136.65 \pm 7.14$  µmol/L in pregnant sheep with alopecia. The researchers stated that these values were similar to those obtained from healthy sheep suggesting that alopecia could be related to parakeratotic lesions in the skin and physiological changes in the pregnancy period. In contrast Ott et al. (8) reported that acute alopecia and a marked reduction in serum albumin levels were seen in the sheep with zinc deficiency.

It has been reported that when copper levels are less than 0.5 mg/l in lambs, they show copper deficiency symptoms (9). Fahmy et al. (10) determined that serum copper, zinc, manganese and iron levels significantly decreased in sheep which had alopecia and wool eating habit. In another study, Ozan (11) found that mean blood zinc levels were  $14.4 \pm 0.15$  µg/ml, copper level  $63.5 \pm 1.17$  µg/ml. Some workers have also reported that zinc deficiency induced experimentally or naturally, causes alopecia and wool eating (5,12,13).

White et al. (13) reported death following a week of watery saliva flow in natural or experimental zinc deficiency in sheep.

Abdell et al. (14) investigated the causes of allotrophagia in goats and found hypoproteinemia and hypoglycemia, while trace element levels were normal.

Suliman et al. (15) found alopecia around the eyes and on the feet, thickness of skin and slowness in growth in lambs fed with zinc-deficient food with low serum zinc levels. In contrast, Morgan et al. (3) suggested that although blood plasma zinc and copper values in sheep with alopecia were normal, the copper values were lower than those of healthy sheep. Baysu et al. (2) examined inorganic phosphorus, calcium, potassium, sodium and chloride in blood serum of lambs with pica in Sivrihisar and found that inorganic phosphorus values in the diseased lambs were low.

This study was carried out to determine the relationship between alopecia and wool eating in sheep fed with corn silage and report haematological biochemical and trace elements levels.

## Materials and Methods

This study was carried out on 16 Akkaraman and Morkaraman sheep aged between 1 and 3 years old at the research and practice farm of the Yuzuncu Yil University. The diseased sheep were chosen among those showing the most severe symptoms of part or complete alopecia and wool eating habit from other sheep in the flock. Only corn silage and water was given to the animals for 18-20 days.

The control group contained 8 sheep, which were fed with mixed grain and clover in another enclosure of the same pen.

Blood samples were taken with and without anticoagulant from the jugular vein for haematological, biochemical and trace elements analysis. From these blood samples, erythrocyte, total leukocyte, haematocrit and haemoglobin values were measured by a cell counter. Blood samples were kept for 15 minutes at room temperature and then centrifuged to obtain serum for biochemical analysis.

Total protein, albumin, glucose, calcium, iron, phosphorus, AST, ALP and GGT levels were measured with spectrophotometer (Boehringer - Mannheim 5010), sodium and chloride ions with ion-selective (Easylyte Plus, Na, K, Cl Analyser) equipment and the values of trace elements such as zinc, copper and manganese with atomic absorption equipment in the central laboratory of Yuzuncu Yil University.

The significance of variations of the sheep with alopecia and eating of wool of the diseased group and the control group with regard to their certain blood parameters, biochemical, mineral and trace element values were determined by the t-test (16).

## Results

It was found that the sheep flock that included the diseased group were fed only with silage composed of corn for 20 days while the wool was broken easily after 17 days of silage feeding. The sheep began to eat wool balls and two diseased sheep died.

Haematological and biochemical analyses of the diseased animals were performed. Similar analyses of normal animals were also made. The differences were analysed by “t” test, and the results are given the tables 1,2.

RBC, total WBC and PCV values of sheep with alopecia and with the wool eating habit were not significantly different compared to the values obtained from normal animals. On the other hand, haemoglobin values of the diseased animals were significantly ( $p<0.05$ ) different compared to the normal animals (Table 2). Serum iron, manganese, phosphorus, calcium, sodium and chloride values of diseased sheep were not significantly different from the control animals. On the other hand, serum zinc and copper values of the diseased animals were significantly lower ( $p<0.01$ ) than the controls (Table 1). Furthermore, total protein levels of the diseased sheep were significantly ( $p<0.01$ ) different from the control group. In contrast, glucose, albumin and AST values were not significantly different (Table 2). ALP and GGT values increased significantly ( $p<0.05$ ;  $p<0.01$  respectively) in the diseased sheep compared to the normal animals (Table 2).

**Table 1.** Minimum (Xmin) - Maximum(Xmax), mean values and standard errors of serum mineral levels in control and diseased groups

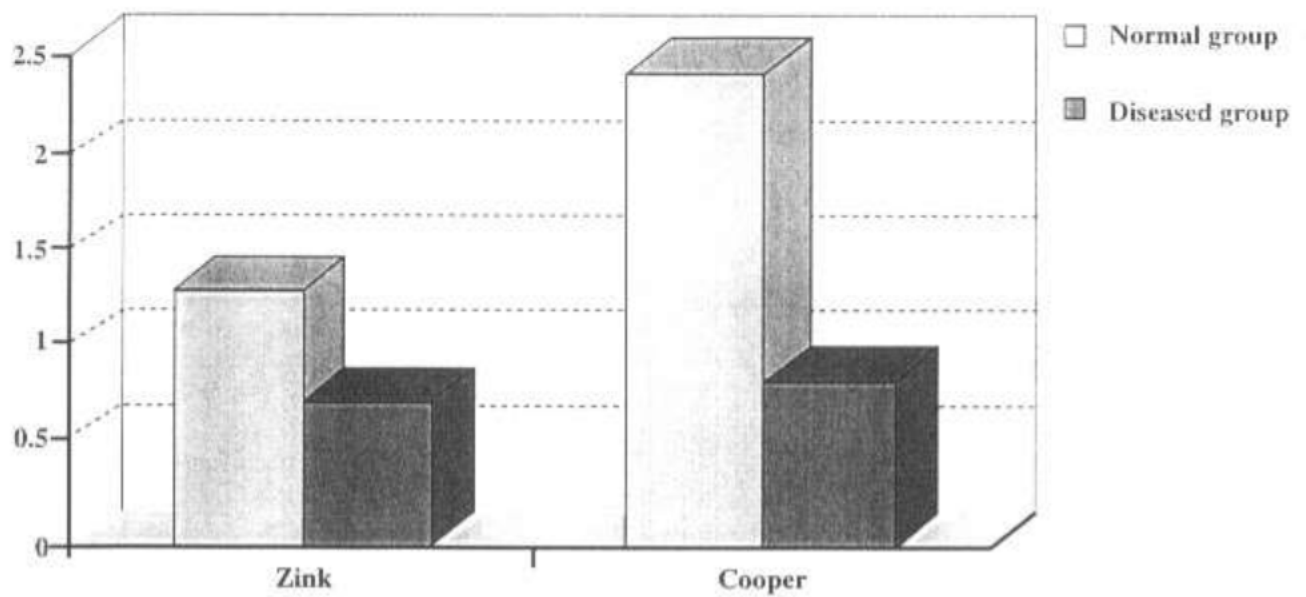
Parameters	Control		Diseased	
	Xmin-Xmax	X±Sx	Xmin-Xmax	X±Sx
Iron (µg/dl)	117-186	147.75±9.42	139-20	166.62±8.03
Copper (µg/ml)	1.6-3.0	2.40±0.16	0.6-1.0	0.82±0.04 **
Zinc (µg/ml)	0.6-1.7	1.31±0.13	0.33-1.09	0.73±0/11 **
Mangan (µg/ml)	0.28-0.85	0.487±0.06	0.05-0.75	0.311±0.08
Phosphorus (mg/dl)	5-8	6.62±0.32	4-10	6.00±0.65
Calcium (mg/dl)	8-10	9.37±0.26	9-11	9.87±0.22
Sodium (mmol/L)	126-159.3	141.12±4.58	135.5-170	147.37±6.26
Chloride (mmol/L)	97.9-110	105.37±1.66	102-109	105.12±1.12

\*  $p<0.05$       \*\*  $p<0.01$

Parameters	Control		Diseased	
	Xmin-Xmax	X±Sx	Xmin-Xmax	X±Sx
T. Protein (g/dl)	7.7-9.3	8.75±0.16	5-6	5.85±0.14 **
Albumin (g/dl)	3-4	3.50±0.18	3-4	3.62±1.18
Glucose (mg/dl)	58-86	72.50±3.25	55-205	96.76±19.68
AST (U/L)	69-79	72.62±1.79	72-155	107.25±11.25
ALP (U/L)	85-187	138.12±14.17	104-477	266.12±46.13 *
GGT (U/L)	17.6-31.2	23.00±1.89	33-80	50.00±5.86 **
Erythrocyte (* 106)	9.33-11.36	10.24±0.26	7.48-10.88	9.50±0.37

mm <sup>3</sup> )				
Total Leukocyte (* 10 <sup>6</sup> mm <sup>3</sup> )	8.0-9.0	8.37±0.10	6.3-8.7	7.47±1.33
Haematocrit (%)	30-37	33.50±0.92	23-38	34.25±1.87
Haemoglobin (g/dl)	9.8-13	11.06±0.38	6.14-12.0	9.07±0.73*

**Figure 1.** Average Zinc and copper values of the normal and diseased groups



**Pictures 1 and 2.** Wool eating sheep

## Discussion

It is well known that faulty feeding and management of sheep cause alopecia and the wool-eating habit (5,6,7,8,11,13,17). However, no detailed research related to the influence of corn silage on the

syndrome has been documented. In this study, the syndrome was observed in sheep fed with corn silage for approximately 20 days whereas the same signs were not seen in sheep pen fed on different food. It was concluded that feeding with only corn silage is a positive factor in this syndrome.

Haematological, biochemical and trace element levels in blood and serum samples of Akkaraman and Morkaraman sheep were analysed, the differences between the diseased and the control groups were calculated, and their statistical significance were determined (Table 1,2). According to these results, the differences between iron, manganese, phosphorus, calcium, sodium and chloride values in blood serums of the sheep with alopecia and wool eating and the control group were insignificant while the difference between the groups with regard to zinc (the control, 1.315 µg/ml, the diseased 0.738 µg/ml) and copper values (the control, 2.405 µg/ml, the diseased 0.822 µg/ml) were statistically significant ( $p<0.01$ ,  $p<0.01$ ) (Table 1).

Significant decreases in zinc and copper values (0.822 µg/ml, 0.738 µg/ml respectively) in sheep with alopecia and wool eating are similar to those reported by other workers (3,4,5,7,8,15), but these data disagree with the results of Ozan (11) who found an increase in copper levels in Merinos sheep with alopecia.

Nelson et al. (4) stated that sheep fed experimentally with rations poor in zinc quickly cause alopecia or brittle wool after seventeen days of the experiment. Furthermore, Suliman et al. (15) found severe alopecia and wool eating syndrome in sheep with zinc deficiency. On the other hand, Morgan et al. (3) stated that blood plasma zinc and copper values in sheep with alopecia were normal but copper values were lower.

Based on this study it is believed that alopecia and wool eating syndrome in sheep are the result of reduced copper and zinc values. Similarly, some researchers (1,2,6,11) suggest that sheep fed for a long time with certain rations, that are poor in zinc, copper and trace elements, develop deficiency syndromes.

When total protein values of the diseased group (5.85 g/dl) were compared to the control group (8.78 g/dl), significant differences were evident ( $p<0.01$ ). Nelson et al. (4) found that total protein and globulin values in sheep with alopecia and wool eating habit were low and Ott et al. (8) stated that parakerotic lesions in the skin of sheep having zinc deficiency were present. Significant decreases in the blood albumin level in these sheep were also reported. In the present study, it was determined that total protein levels of blood serums were low in sheep with alopecia and wool eating, while albumin level was normal. The divergent results obtained in the present study and those reported by others are due to different etiological agents (4,14).

In the present study, no significant differences were found between diseased group and control group for serum glucose and AST levels. However there were a significant differences for ALP ( $p<0.05$ ) and GGT ( $p<0.01$ ).

No published data was found with regard to blood serum glucose, AST, ALP and GGT levels in sheep fed with corn silage. The glucose levels of the sheep were normal because energy value of silage grain was high.

In the present study, it was found that when erythrocyte, total leukocyte and haematocrit values of the control group were compared to those of the diseased group, no statistical difference could be seen. However, there was a significant decrease in haemoglobin values of the diseased compared to those of the control group ( $p<0.05$ ).

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