

Serum Zinc, Copper and Thyroid Hormone Concentrations in Heifers with Retarded Growth

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SUMMARY

In the present study the role of Zn, Cu and thyroid hormone concentrations in the heifers having retardation of the growth problem were aimed to investigate. In this study, 11 Eastern Anatolian Red heifers weighing 35-50 kg body weight (test group) and 6 Eastern Anatolian Red heifers in normal body weight (80-100 kg) (control group) aged between 6-12 months brought to the University of Yuzuncu Yil, Faculty of Veterinary Medicine, Department of Internal Diseases were used as materials. Clinically, infection and parasiter infestation could not be diagnosed. Therefore, trace elements and thyroid hormone status that are known to cause retardation of growth in the growing heifers were investigated. Although Zn, Cu, T3, FT3, T4 and FT4 values were lower in the test group compared to the values obtained from control group, the differences were statistically important only in Zn ($p<0.05$), T4 and FT4 ($p<0.01$) values. Therefore, it was concluded that inadequate and unbalanced feeding, specifically in Zn and Cu content, caused retardation of growth in test group via causing absorption disorders, reduction in the feed efficiency and thyroid hormone concentrations, which are the stimulator of growth hormone.

Key words: Retardation of Growth, Heifer, Zn, Cu, Thyroid Hormone.

Gelişme Geriliği Gösteren Düvelerde Serum Çinko, Bakır ve Tiroid Hormon Konsantrasyonları

ÖZET

Bu çalışmada gelişme geriliği problemleri olan düvelerde Zn, Cu ve tiroid hormon konsantrasyonlarının rolünü araştırmak amaçlandı. Çalışmada Yüzcüncü Yil Üniversitesi Veteriner Fakültesi İç Hastalıkları Kliniğine getirilen 6-12 aylık yaşlarda 35-50 kg canlı ağırlığında 11 adet (Test Grubu) ve normal canlı ağırlığında (80-100 kg) 6 adet (Kontrol Grubu) Doğu Anadolu Kırmızısı düve materyal olarak kullanıldı. Klinik olarak enfeksiyon ve paraziter enfestasyon teşhis edilemedi. Bu nedenle, büyüme çağındaki düvelerde gelişme geriliğine neden olduğu bilinen iz element ve tiroid hormon durumları araştırıldı. Kontrol grubundan elde edilen değerlerle karşılaştırıldığında test grubunda Zn, Cu, T3, FT3, T4 ve FT4 değerlerinin daha düşük olmasına rağmen, sadece Zn ($p<0.05$), T4 ve FT4 ($p<0.01$) değerlerindeki farklılıklar istatistiksel olarak önemli bulundu. Bu nedenle, özellikle Zn ve Cu içeriğinden yetersiz ve dengesiz beslenmenin, test grubunda absorpsiyon bozukluklarına yol açarak growth hormonunun stimülatörü olan tiroid hormon konsantrasyonları ve gıda değerlendirilmesindeki azalmaya bağlı olarak gelişme geriliğine neden olduğu sonucuna varıldı.

Anahtar kelimeler: Gelişme Geriliği, Düve, Zn, Cu, Tiroid Hormonu.

INTRODUCTION

Retardation of growth in animals has been used as under weight and size according to their breed character. The most common reasons for the retardation of growth are inadequate and unbalanced nutrition, insufficient or no colostrum intake after birth, septicemia, chronic infections, parasitism and hormonal unbalance (9, 15).

In general, beside inadequate nutrition, especially mineral and trace element deficiency or unbalances may cause to the retardation of growth. Zinc (Zn), particularly, has been reported to be important in cattle nutrition (4, 15) and in charge in the synthesis of some hormones. Zn deficiency reported to cause reduction in the food consumption and anorexia (3, 13). Anemia, diarrhea, retardation of growth, changes in the hair cover color, fragility in the long bones and even sudden death have been reported in the animals with copper (Cu) deficiency (6, 15, 18).

Thyroid hormones are the very important hormones affecting animals' growth. Thyroid hormones have two

important functions in the organism. The first one is to improve the metabolism rate in almost all tissues. The second function is to stimulate growth in the adult ages. Basal metabolism rate is reported to decrease when the thyroid hormone deficiency occurs (10, 19).

In the present study the role of Zn, Cu and thyroid hormone concentrations in the heifers having retardation of the growth problem were aimed to investigate.

MATERIALS and METHODS

In the present study, 11 DAK (eastern anatholian red) heifers (test group) weighing 35-50 kg body weight and 6 DAK heifers (control group) in normal body weight (80-100 kg body weight) (16) aged between 6-12 months brought to the University of Yuzuncu Yil, Faculty of Veterinary Medicine, Department of Internal Diseases were used as materials. The animals in the control and test groups were from two different herds. The animals in these two herds were collected from different locations when they were 2-4 months of age and put to fattening

according to anamnesis. Information about their colostrum intake and diseases they had prior to collection was not present. The animals were kept in door and fed with mainly straw, bran, hay and barley in these two herds.

Serum samples taken from both control and test groups were stored at -20°C until analysis. Zn and Cu concentrations were determined by atomic absorption spectrophotometer (Unicab/USA). Thyroid hormone levels were determined by Immulite (USA) kits and equipment using chemiluminescent enzyme-labelled immunometric assay. The results were analyzed by Harvey's packet programme (11).

RESULTS

In the clinical examination, animals in the test group were cachectic, had dull and mixed hair cover and had short legs but in balance compared to their weights. Other clinical examinations such as heart rate, respiration rate and digestive system functions such as rumen contractions, pH and the number and activity of infusoria were normal. Parasitic infestation was not observed in fecal examination. Zn, Cu, T3, FT3, T4 and FT4 values are much lower in the test group compared to the values obtained from control group (Table 1). Furthermore, the results obtained from control group were also very low compared to the literature values (14).

Table 1. Serum Zn, Cu and thyroid hormone values of control and test heifers having growth retardation problem.

Groups	Control	Test
Zn (mg/L)	0.400 ± 0.073	$0.269 \pm 0.054^*$
Cu (mg/L)	0.351 ± 0.053	0.229 ± 0.039
T3 (ng/dl)	116.2 ± 13.53	93.6 ± 9.99
FT3 pg/ml)	2.47 ± 0.30	1.78 ± 0.22
T4 ($\mu\text{g/dl}$)	4.74 ± 0.56	$2.19 \pm 0.41^{**}$
FT4 (ng/dl)	1.00 ± 0.11	$0.52 \pm 0.08^{**}$

*: $p < 0.05$ and **: $p < 0.01$ compared to control values.

DISCUSSION

Trace elements take important place in the animal nutrition. Especially Zn deficiency has been reported to cause anorexia and retardation of growth in lambs and calves (9). Zn deficiency has also been reported to cause reduction in the resistance to infectious diseases, because it has important role in the development of cellular immunity (5, 8). Furthermore, determination of Zn levels in the animals kept in intensive systems is suggested to be useful in the control of epidemic diseases (5). Food deficient in Cu content has also been reported to cause retardation of growth in young animals (1, 6, 9, 15). In the present study, animals in the test group had very low serum Zn and Cu concentrations and believed to have been in inadequate and unbalanced feeding conditions. Therefore, low level of Zn and Cu could be the reason for the retardation of growth.

Several factors play role in the retardation of growth in the growing animals. Some of them are inadequate and unbalanced food, vitamin, mineral, trace elements and hormonal disturbances especially thyroid hormones. T3 and T4 are released from thyroid gland activated by TSH (19). Normal serum T3 and T4 values in cattle have been reported to be $6.22 (\mu\text{g/dl})$ and $92.5 (\text{ng/dl})$, respectively (14). All of the T4 is released from thyroid gland. T3 is released from thyroid gland and also it is synthesized from deiodination of T4 in the peripheral blood (19).

Determination of FT4 reported to be more specific in determining thyroid gland functions compared to the other parameters. However, when there is deficiency in T4 transformation to T3 animals having normal T4 values may also have the signs of hypothyroidism (2). Thyroid hormones have two important functions in the organism. The first is to increase total metabolism rate and the other is to stimulate growth (through the increase of growth hormone release) in children. Tiroxin increases the absorption of glucose from digestive system and the usage of carbohydrates in the tissues (19).

Animals having inadequate food reported to have low levels of serum T3 and T4 values. Especially Cu deficiency may cause atrophy in the intestinal villus (15). Furthermore, Zn deficiency causes anorexia (17). Therefore, significantly low level of T4 observed in the present study could be the results of inadequate and unbalanced feeding. Deiodination of deficient T4 to T3 also affected T3 values although T3 was not significant in the present study. As a matter of fact, Ellenberger et al. (7) reported that T3 values are not affected much in the cases of growth problem. However, some workers suggested that T3 values are good indicators in determining changes in the growth (12).

It can be concluded that inadequate and unbalanced feeding, specifically in Zn and Cu content, causes absorption disorders in the digestive system, reduction in the feed efficiency and reduction in the thyroid hormones, which are the stimulator of growth hormone, retardation of growth and important economical losses. Finally, growth hormone and other reasons reported to cause retardation of growth are needed to be investigated together to determine etiological diagnosis properly and future studies should be in this direction.

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