



The effects of vitamin A and zinc on thyroid hormones of broilers under heat stress

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ABSTRACT

Antioxidant effects of vitamin A and zinc element is highly regarded under heat stress. Current study was carried out to investigate the effects of different levels of vitamin A and zinc on performance, thyroid hormones of broilers under heat stress. In this study, 420 broilers were evaluated in six treatments and five replications in a completely randomized design. Treatments were 1: 100000 IU of vitamin A plus 100 ppm of zinc per kilogram of diet, 2: 100000 IU of vitamin A plus 150 ppm of zinc per kilogram of diet, 3: 100000 IU of vitamin A plus 200 ppm of zinc per kilogram of diet, 4: 200000 IU of vitamin A plus 100 ppm of zinc per kilogram of diet, 5: 200000 IU of vitamin A plus 150 ppm of zinc per kilogram of diet, 6: 200000 IU of vitamin A plus 200 ppm of zinc per kilogram of diet. To enforce the heat stress, temperature was increasing daily to 35° C eight hours a day. Venous blood was used to measure thyroid hormones. According to results, at 42nd day, T₄ and T₃ were significantly affected by treatments. T₄ amount of group 1 was significantly less than other group and significant differences were between T₃ of group 1, 2 and 6. Considering the results, interaction effect of vitamin A and zinc supplement completely depends on their concentrations in diet and can be considered as an important factor for thyroid performances.

Keywords: Vitamin A, Zinc, Thyroid Hormones, Broilers, Heat Stress

INTRODUCTION

Poultry farming is really important to provide human food. Producing healthy food materials beside appropriate economic return is permanent concern of breeders. During the last 50 years, Poultry farming has depended on drugs and biological products [1].

Diet should be adjusted to meet all nutritional requirements of animal. Reduction or increase in diet components can affect various parts of birds' bodies including liver, liver enzymes and thyroid hormones. On the other hand, changes in secretion amount of thyroid hormones and activity of liver enzymes affect health, quality of reared poultry, losses amount and so on [2].

One of basic problems in poultry production is heat stress. Broilers must have suitable physiological settings under heat stress to survive. Food consumption will be decreased and water use will be increased. Diet balance can reduce metabolic heat and save nutrients [3].

Vitamins are very important in saving health and performance of most of living things. Vitamins deficit obviously causes disorders in immune system of body. Vitamin requirements are generally determined under normal situations. Since birds are under various stresses in saloons, vitamins are more necessary to struggle with stress [4]. Heat stress increases wasting minerals and reduces survival rate of calcium, iron, potassium, sodium and zinc in broilers. When the temperature and humidity are higher than normal, the overall ability of birds is reduced which this leads to physiological changes in animal's body [5]. Vitamin A and its derivatives (retinoides) are basic

materials for human and animals which play important roles in fetal structures such as face, heart, eyes, ears, organs and neural system [6].

Zinc is necessary for metabolic function and activity of about 300 enzymes of body. The most important properties of zinc are its anti-oxidant properties. Zinc deficit causes membrane injuries because of free radicals. Although the mechanism of antioxidant effect of zinc is unknown, existence of this effect of it is obvious [7]. Thyroid gland regulates the amount of body's metabolism. In other words it controls the rate of energy consumption or growth and development. On the whole, Regular secretion of these hormones affects many of body structures or performances from heart beating to skin structure. Natural performance of thyroid gland depends on many factors including perfect function of hypothalamus, pituitary, receiving sufficient iodine and conversion of thyroxine to triiodothyronine [8].

Whenever each factor loses its balance, hyperthyroidism or hypothyroidism will be occurred. The importance of thyroid gland for bird adaptation to heat stress is related to important roles of its hormones in regulating metabolism amount [9]. The goal of this study was investigating the antioxidant effects of vitamin A and zinc on birds under heat stress and appropriate management methods to struggle with its harmful effects.

EXPERIMENTAL SECTION

The study was carried out in summer (2014) to reach the temperature to heat stress condition.

To sterilize the saloon, all movable constructions were moved out and saloon plus fixed apparatuses were washed and sterilized using disinfectant solutions. 35 cages (100*100cm) with 70cm height were made using wire walls.

Broilers had free access to food during the study. Temperature was about 32°C during first week which must be reduced 1°C every three day to reach 21-23°C (Ross 308 manual). But, considering the stress situation, broilers were kept under 30-35°C temperature eight hours a day from the second week. To prevent adaptation, random temperature increments were enforced also in various times of day and night. The study lasted for six weeks. 420 broilers from Ross 308 race were studied as a factorial experiment in completely randomized design with six treatments and five replications. Every cage included 14 broilers. Treatments were:

- 1- 100000 IU of vitamin A plus 100 ppm of zinc per kilogram of diet
- 2- 100000 IU of vitamin A plus 150 ppm of zinc per kilogram of diet
- 3- 100000 IU of vitamin A plus 200 ppm of zinc per kilogram of diet
- 4- 200000 IU of vitamin A plus 100 ppm of zinc per kilogram of diet
- 5- 200000 IU of vitamin A plus 150 ppm of zinc per kilogram of diet
- 6- 200000 IU of vitamin A plus 200 ppm of zinc per kilogram of diet.

At day 42, two broilers were selected from each unit and 4-5 ml of blood was taken from Wing vein, and thyroid hormones (T₃, T₄, and TSH) were measured in laboratory.

RESULTS AND DISCUSSION

TSH Concentration

Statistical analysis showed no significant differences between TSH of groups at 42nd day (Figure 1).

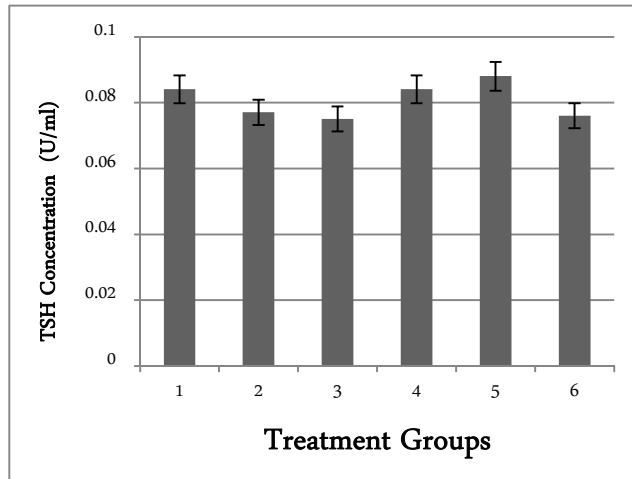


Figure1. Mean comparison of TSH concentration at 42nd day

T₄ Concentration

At 42nd day, T₄ was significantly affected by treatments. T₄ amount of group 1 were significantly less than other group (Figure 2).

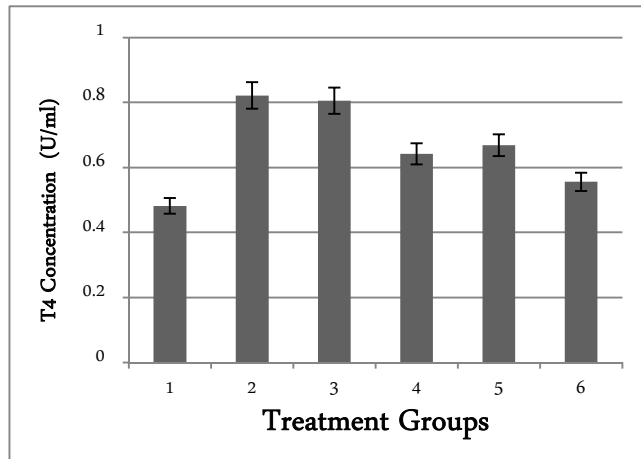


Figure2. Mean comparison of T₄ concentration at 42nd day

T₃ Concentration

Statistical analysis showed significant differences between T₃ of group 1, 2 and 6 at 42nd day (Figure 3).

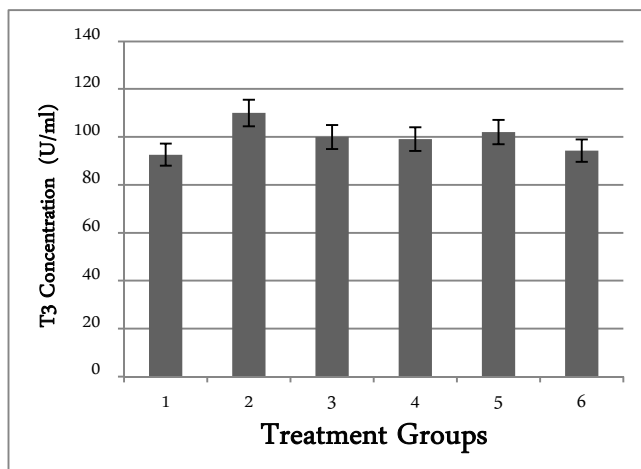


Figure3. Mean comparison of T₃ concentration at 42nd day

The effects of treatment groups on thyroid hormones of serum at 42nd day showed that zinc and vitamin A did not affect the hormones significantly. But T₃ was increased significantly by interaction of 150-10000 group in proportion to 100-10000 and 200-20000 groups. Also, the highest T₄ was obtained by 150-10000 and the lowest amount was related to 100-10000 groups. Considering the role of thyroid gland on the rate of energy consumption and regulating growth mechanism, it seems that vitamin A and zinc supplement in various concentrations can affect the metabolism, so that, in spite of previous studies which announced reduced thyroid hormones secretion by temperature increment, T₃ was increased in treatment 2 and T₄ was increased by 2 and 3 which can be due to its interaction with zinc supplement.

CONCLUSION

Considering the role of zinc in producing thyroid hormones and therefore on metabolism, various treatments had different effects so that at 42nd day can be sign of reduce activity of thyroid hormones action.

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