

EFFECT OF FEEDING DIFFERENT LEVELS OF THIOUREA AND LOW PROTEIN DIET ON THYROID IN BROILERS

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Abstract: Present study were undertaken in broilers given 20 & 22 % protein with thiourea @ 0.005 & 0.05% thiourea in diet containing 2600 Kcal ME/Kg in broilers. T3 and T4 levels were found to be elevated significantly in group given thiourea @ 0.005 & 0.05% with increase in T4 level suggesting a state of hypothyroidism, organ weights and thyroid during gross examination. Thyroid revealed variation in colour, shape and size. Lesions of hypothyroidism were confirmed on from the histopathological lesions in groups receiving 0.05% thiourea. It is thus concluded that adverse effect of thiourea is evident when thiourea is given above 0.05% level with 20 or 22% protein in the low energy diet.

Keywords: broilers, Low energy feed, low protein, thiourea, thyroid.

Introduction

Thyroid gland in avian species, are paired organs, which are oval in shape and dark red in colour, with a glistening surface. They are located on either side of the trachea on the ventrolateral aspect of the neck just exterior to the thoracic cavity. They are found as adhering to the common carotid artery just above the junction of the common carotid with the subclavian artery. They are situated medial to the jugular vein¹. The principle hormones secreted by thyroid are T₃ and T₄ i.e. triiodothyronine and thyroxin, respectively. The function of thyroid gland through its hormone thyroxin, is to maintain the rate of metabolism in animals. Deficiency of which causes hypothyroidism. The secretion of thyroid hormone is controlled by TSH from anterior pituitary gland¹. The thyroid hormone stimulates release of growth hormone from anterior pituitary. It is also believed that T₄ is needed for the growth hormone to exert its full effect³. The thiourea, thiouracil and methimazole are the goitrogens which cause enlargement of thyroids due to increase in the cell size (hypertrophy) and or an increase in the number of cells (hyperplasia) associated with reduction in colloid contents of follicles but suppress the formation of thyroxin which occurs through inhibition of thyroid hormone synthesis or inhibition of iodination of thyroglobin⁶. Thiourea have been used in meat producing animals with an effort to increase weight gain efficiency particularly to

improve the finish of animal for market by promoting fat deposition⁴. The birds of hypothyroid group consume less feed as compared to the normal birds. However, the earlier experiment conducted in the department revealed increased body weight and better sustainability of birds in the summer season. Goitrogen administration increases feed efficiency by decreasing feed intake with increased body weight. Considering the above facts present study was planned to evaluate the effect of feeding various levels of thiourea (goitrogen) to broilers. Biochemical parameters, gross and histopathological alterations in the thyroid glands, liver, pancreas, kidney and duodenum, to evaluate T3 and T4 levels.

Materials and methods

A total of one hundred and seventy five day old broiler chicks divided into seven equal groups out of which three groups viz. G1 (commercial diet), G2 (low energy diet 2600Kcal ME/Kg containing 22% protein) and G5 (low energy diet containing 20 % protein) and these were considered as control groups. The positive treatment group G3 (low energy diet + 22% protein + 0.005) and G4 (low energy diet + 22% protein + 0.05% thiourea) respectively and birds from G6 (fed low energy diet + 20% protein + 0.005 thiourea) and G7 (fed low energy diet + 20% protein + 0.05% thiourea) respectively.

At the end of 3rd and 6th week plasma samples were collected from 6 birds in each group for estimation of T3 and T4 level, whereas same birds from each group were slaughtered and thyroid glands, were collected in 10% formal saline for preservation and histopathological examination after recording the gross morphological alterations. Sections of 4 to 5 μ were cut and were stained with routine H & E stain for histopathological examination³. A thyroid hormone such as triiodothyronine (T3) was estimated by using RIA-K 4/4A kit and thyroxin (T4) was estimated by RIA-K 5/5A kit. Estimation was conducted on Gamma Counter, from plasma samples collected at the end of 3rd and 6th week. Statistical analyses were done with Simple CRD for blood biochemical and hormone levels⁷.

Results

A thyroid hormone such as triiodothyronine (T3) was estimated by using RIA-K 4/4A kit and thyroxin (T4) was estimated by RIA-K 5/5A kit. Estimation was conducted on Gamma Counter, from plasma samples collected at the end of 3rd and 6th week. The hormonal levels are presented in (Table – 1).

Table 1: Thyroid hormone level (ng/ml) in various treatment groups

Groups	Triiodothyronine(T3)		Thyroxin (T4)	
	3rd week	6th week	3rd week	6th week
G1	1.26 ^c ± 0.11	0.66 ^{bc} ± 0.15	8.4 ^a ± 1.36	8.75 ^a ± 2.2
G2	0.43 ^a ± 0.18	1.03 ^d ± 0.061	9.5 ^{ab} ± 0.35	11.27 ^{ab} ± 1.67
G3	1.03 ^{bc} ± 0.24	0.82 ^{cd} ± 0.07	15.4 ^c ± 1.13	12.85 ^b ± 3.23
G4	1.18 ^c ± 0.7	0.54 ^{ab} ± 0.12	12.27 ^{bc} ± 1.01	13.37 ^b ± 2.13
G5	1.18 ^c ± 0.22	0.65 ^{bc} ± 0.067	10.5 ^{ab} ± 1.49	13 ^b ± 1.55
G6	0.89 ^b ± 0.10	0.5 ^{ab} ± 0.07	12.5 ^{bc} ± 2.13	13.42 ^b ± 3.67
G7	1.12 ^{bc} ± 0.22	0.37 ^a ± 0.15	12.62 ^{bc} ± 2.38	14 ^b ± 2.44
Pooled mean	1.01 ± 0.16	0.65 ± 0.10	11.60 ± 1.41	12.38 ± 2.42

Mean values with common alphabet as superscript do not differ significantly CD for T3 = 0.26 (Significant at 1% and 5% level), CD T4 = 3.63(Significant at 1% and 5% level).

Triiodothyronine T3 (ng/ml): From all experimental groups, the samples were collected at the end of 3rd week. The significant higher level (1.26 ± 0.11) of plasma T3 was recorded in G1 group birds which received commercial feed, whereas the significantly lower level of T3 (0.43 ± 18) was recorded from G2 group birds. Amongst all experimental groups, at the end of 6th week, the significantly higher level (1.03 ± 0.061) of plasma T3 was recorded in G2 group birds. Whereas, the significantly lower level of T3 (0.37 ± 15) was recorded from G7 group birds. As the dose of thiourea increased in the treatment diet either in 22 or 20% protein, plasma T3 level was progressively decreased as compared with respective control group birds.

Thyroxin T4 (ng/ml): Samples collected at the end of 3rd week revealed significantly increased level (15.4 ± 1.13) of thyroxin (T4) in G3 group. However, significantly decreased level (8.413 ± 1.3) was recorded from G1 group birds. At the end of 6th week, significantly increased level (14.0 ± 2.44) of thyroxin (T4) was recorded in G7 group birds. However, significantly decreased level (8.75 ± 2.22) of thyroxin (T4) was recorded from G1 group birds. Only in G1 (commercial feed group) birds showed significant decrease in T4 level. However, from treatment diet containing 22 or 20% protein with or without thiourea T4 level

showed non significant difference except the numerical increase in T4 level than the respective control group birds.

On the basis of gross observations about colour, birds receiving commercial diet and 20 or 22 % protein diet showed pale to pink colour in most of glands. However birds receiving thiourea @ 0.005% with 20 or 22 % shows pink discoloration possibly due to adverse effect of thiourea, however, birds receiving 0.05% showed red to dark red discoloration suggesting dose dependent more severe adverse effect on thyroid discoloration.

On the basis of observation of color of thyroid gland @ 0.005% thiourea showed mild change of pink discoloration as compare to birds receiving 0.05% thiourea showing red discoloration suggesting adverse effect of thiourea @ 0.05% level in low energy diet.

In respect of shape of gland the majority of thyroid glands showed oval shape in birds receiving commercial or diet containing 20 or 22 % protein with 0.005% thiourea. However elongated shape of thyroid gland was more prominent in birds receiving 0.05% thiourea with 20 or 22% protein diet groups suggesting primary alteration in elongation of gland as adverse effect of thiourea.

Maximum number of thyroid gland showed medium size in birds receiving commercial diet, low energy diet irrespective of protein without thiourea. However enlargement of thyroid size of thyroid gland showed more prominent in birds receiving with 20 or 22% protein diet containing thiourea suggesting that adverse effect of thiourea.

On the basis of observations of colour, shape and size of thyroid gland in different groups it could be concluded that thiourea @ 0.005 in 20 or 22% protein in low energy diet showed red to dark discoloration, elongated size and enlargement of glands @ 0.05% thiourea with 20 or 22 % protein in low energy diet suggesting state of adverse effect. However 0.005% level morphology appeared similar to that of commercial or diet without thiourea irrespective of protein levels.

Histopathological observations were evaluated on the basis of epithelial lining, acinar epithelium, colloid in the acini, size of the follicles and presence of RBCs either in inter follicular stroma, colloid and in at both the areas.

In respect of epithelium the flat epithelium with uniform colloid was prominent in birds given commercial diet, birds given proteins at 20 or 22% level showed marginal increase in cuboidal appearance of acinar epithelium with scanty colloids in few sections. In birds given 0.005% thiourea or 0.05% thiourea showed cuboidal epithelium with more number acini showing scanty colloid which was observed to be dose dependent. In addition

to above changes the size of follicles and presence of RBCs either in colloid or interfollicular spaces revealed increased number of small follicles in birds given low protein diet with or without thiourea which was also dose dependent. Similarly increase number of sections from birds receiving thiourea showed presence of RBCs in colloid or interfollicular spaces suggesting adverse effect of thiourea on thyroid. In addition other changes prominently observed were follicular rupture, epithelial disquamation in colloid, hyperplastic follicle, haemorrhages and congestion were associated with above changes which was more prominent in birds receiving thiourea irrespective of doses suggesting further confirming adverse effect of thiourea on thyroid parenchyma.

Discussion

On the basis of colloid and epithelium it is thus evident that there is hyper activity of thyroid when there is decrease in proteins with or without thiourea which was suggesting a state of exhaustion on the basis of scanty colloid.

The goitrogenic substance suppresses the hormone production from thyroid gland. This stimulates release of thyroid stimulating hormones (TSH) from anterior pituitary which results in compensatory enlargement of the gland². In their study they fed 0.005 per cent methimazole to the layer birds for 60 days. However, in the present study thiourea was fed as goitrogen to broilers with similar effects on thyroid.

Lowered thyroid hormonal level in present investigation can be correlated with by histopathological observation of thyroid glands such as reabsorbed and scanty colloid or no colloid in follicles. This might be due to goitrogenic action of thiourea, as thiourea inhibits the thyroid hormone synthesis by inhibiting the iodination in thyroid glands. The goitrogen inhibits the attachment of iodine to tyrosine leading to no or less synthesis of thyroglobulin⁴.

The numerical increase in T4 (Thyroxin) level in low energy diet with or without thiourea treated groups during present study was in contrast to nature of goitrogen. The probable reason could not be ascertained from the literature. In our opinion it may be due to fact that to the compensate the energy requirement increased levels of T4 is essential which can be broken down to make available more T3, as T3 is biologically more active than T4. Thus, it was observed that level of plasma triiodothyronine (T3) was numerically decreased in the thiourea treated birds except numerical increase in T4 level in the birds received treatment diet containing 22 or 20% protein with or without thiourea as compared to respective control group birds. Increased activity of thyroid glands might be due to compensatory reaction to low levels of plasma T3 and T4 hormones as a result of mild hypothyroidism, this is also

supported by lower level of hormones from this group and increased body weight of birds fed with 0.005% thiourea than their respective control group birds.

It was noted that the more number of red colored thyroid glands were recorded from thiourea fed birds as compared to their respective control group birds. The increased redness of gland might be due to the increased blood supply to the glands. The thiourea fed birds revealed larger size of thyroid glands than glands from control group birds indicating goitrogenic nature of thiourea and confirming the induction of hypothyroidism. The enlargement of thyroid glands by feeding goitrogen has been already confirmed by number of workers, by feeding methimazole⁶. The goitrogen administration suppresses hormone production from the thyroid gland which stimulates an increase in the secretion of TSH from the anterior pituitary and these results in the compensatory enlargement of thyroid gland².

Hypertrophy and hyperplasia of epithelial cells lining the follicles in laying hens treated with 0.005% methimazole². They also observed, signs of quick reabsorption of colloid material as indicated by shrinkage of colloid in other follicles along with heavy invasion of gland by the blood cells and some glands had large number of RBC's with accumulation of lymphocytes in the interacinar spaces. All these changes were attributed to hypofunctional thyroid exposed to heavy visualization as a compensatory physiological mechanism in response to methimazole treatment.

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