Research Article

Biochemical Alterations in Broilers Fed with Low Energy Diet and Thiourea During Summer

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Abstract

A total of one hundred and seventy five day old broiler chicks divided into seven equal groups out of which three groups viz. G1 was fed commercial diet, G2 treatment diet (2600Kcal ME/Kg) containing 22% protein and G5 treatment diet (2600Kcal ME/kg) containing 20 % protein, and these were considered as control groups. The positive treatment group G3 and G4 were fed a treatment diet (2600Kcal ME/kg) + 22% protein + 0.005 or 0.05% thiourea respectively and birds from G6 and G7 group were fed treatment diet + 20% protein + 0.005 or 0.05% thiourea, respectively. At the end of 3rd and 6th week plasma samples were collected from 6 birds in each group whereas same birds from each group were slaughtered and plasma biochemical levels at the end of 3rd and 6th week, exhibited low blood glucose levels in the thiourea treated group. The low levels of blood glucose in thiourea fed birds might be due to reduced absorption of glucose or glycogenolysis during the state of thyroid insufficiency. The increased plasma cholesterol levels in thiourea treated groups might be due to reduced excretion and enhanced capacity for cholesterol transport in blood in the state of hypothyroidism. Whereas numerical increase in the plasma calcium and phosphorus was recorded in the thiourea treated groups. The plasma total protein, plasma pre meal and post meal glucose from all birds was not comparable.

Keywords: Thyroid gland, thiourea, broiler, biochemical alterations

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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 vein [1].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 gland [2]. 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 effect[3]. 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 thyroglobin [1]. 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 deposition [4]. 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 and Biochemical parameters.

Material and method

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 2600Kcal ME/Kg + 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 energydiet + 20% protein + 0.05% thiourea) respectively. The plasma samples collected form heparinized blood at the end of 3rd and 6th week were used for the estimation of biochemical parameters viz. glucose, cholesterol, calcium, phosphorus and total protein. Statistical analyses [5] were done with Simple CRD for plasma biochemical parameters.

Results and Discussion

Glucose Levels (mg/dl)

Amongst the all experimental groups, at the end of 3rd week, significant higher (251.7 ± 24.14) levels of glucose was recorded in G1 group birds and significant in lower levels (189.3 ± 9.44) were recorded in G4 group birds. However, at 6th week the significant higher levels (341.9 ± 5.63 mg/dl) of glucose were recorded from G5 group birds and significantly lower levels (223.5 ± 24.01) of plasma glucose were recorded from G4 group birds. It was observed that as level of thiourea increased, the plasma level of glucose progressively reduced from birds which received treatment diet + 22 % protein and either 0.005% or 0.05% dose of thiourea as compared with treatment diet + 20% protein + 0.005 or 0.05% thiourea.

Amongst the all groups at end of 3rd week, the birds which received treatment diet containing 22 or 20% protein with or without thiourea, the non significant decrease in the plasma glucose level was recorded where as at the end of 6th week these birds shown significant decrease in the plasma glucose level as compared to their respective control group birds. Hence significant higher glucose level at 3rd week was from G5 group.

However significant lower values were recorded from G4 group at 3rd and 6th week also and depicted in **Table 1**. Pre meal and post meal glucose levels were not comparable. The lowered plasma glucose level from thiourea fed birds might be due to reduced absorption of glucose or glycogenolysis during the state of thyroid insufficiency [6] by feeding of 0.01% methimazole to the layer chicks [7], [8] also reported similar findings.

Table 1 Plasma Glucose (mg/dl) level in various treatment groups

Glucose			Glucose	
Group	**Periods (Weeks)**		**Pre meal**	**Post meal**
	3rd Week	**6th Week**		
G 1	$251.73^{b} \pm 24.13$	$257^{bc} \pm 24.49$	193.8± 23	198 ± 12.06
G 2	$199.38^{a} \pm 21.09$	$242.45^{ab} \pm 11.95$	192 ± 9.9	231.5 ± 12.92
G 3	$192.63^{a} \pm 8.16$	$236.65^{ab} \pm 14.11$	209.5 ± 4.92	194.3 ± 16.19
G 4	$189.33^{a} \pm 9.44$	$223.54^{a} \pm 24.00$	222.3 ± 8.5	219.8 ± 11.44
G 5	$268.38^{b} \pm 5.85$	$341.86^{e} \pm 5.63$	225.3 ± 3.11	225.8 ± 24.68
G 6	$262.85^{b} \pm 20.31$	$309.98^{de} \pm 16.79$	197 ± 9.33	233.3 ± 18.2
G7	$239.6^{b} \pm 8.63$	$287.38^{cd} \pm 18.36$	240.5 ± 14.49	237.8 ± 24.2
Pooled Mean	181.04 ± 13.10	235.20 ± 12.28	211.5 ± 10.47	220 ± 17.1

Mean values with common alphabet as superscript do not differ significantly.
CD for treatment = 32.6(Significant at 1% and 5% level)

Calcium (mg/dl)

The plasma calcium level amongst all groups was not comparable. The samples collected at the end of 3rd week, revealed numerical increase in the plasma calcium level from all thiourea treated birds as compared to their respective control group birds. Amongst the all experimental group birds and which received treatment diet containing 22 or 20% protein with or without thiourea, the highest level (8.91± 0.56) of calcium was recorded in G6 group birds and

lowest (7.13 ± 0.9) in G2 group. Sample were collected at the end of 6th week from all experimental group birds and which received treatment diet containing 22 or 20% protein with or without thiourea. The highest level (10.7± 2.17) of calcium was recorded from G1 and lowest level (7.8 ± 0.55) from G7 group birds (**Table 2**).

Table 2 Calcium (mg/dl) and Phosphorus (mg/dl) level in various treatment groups

Calcium			**Phosphorus**		
Group	**Periods (Weeks)**		***Group***	**Periods (Weeks)**	
	3rd Week	**6th Week**		**3rd Week**	**6th Week**
G1	7.71 ± 0.87	10.7 ± 2.17	**G1**	3.95 ± 0.41	5.08 ± 0.92
G2	7.13 ± 0.89	9.11 ± 0.25	**G2**	3.40 ± 0.38	4.36 ± 0.12
G3	7.3 ± 0.61	9.31 ± 0.86	**G3**	3.68 ± 0.59	4.64 ± 0.37
G4	7.4 ± 0.94	10.4 ± 0.02	**G4**	3.72 ± 0.45	5.05 ± 0.39
G5	8.9 ± 1.42	8.1 ± 2.29	**G5**	4.3 ± 0.54	3.8 ± 0.90
G6	8.91 ± 0.56	8.53 ± 1.46	**G6**	4.45 ± 0.30	4.51 ± 0.47
G7	8.08 ± 0.73	7.8 ± 0.55	**G7**	3.98 ± 0.29	3.91 ± 0.19
Pooled Mean	7.13^{a} ± 1.00	9.13^{b} ± 1.23	**Pooled Mean**	3.92^{a} ± 0.42	4.48 ± 0.48

Mean values with common alphabet as superscript do not differ significantly
CD for Week = 17.42(Significant at 1% level)

Increased plasma calcium level in the control group birds which received commercial feed in the present study is also supported by [8] increased serum calcium level from control birds as compared to the birds fed 0.2% thiourea in the feed with different energy levels. He opined that higher level of calcium from control birds might be due to fatty liver in control birds fed with high energy diet, whereas fatty changes were not observed in thiourea fed groups. In the present study also fatty changes were recorded from control (G1 group) birds, which received commercial feed as revealed by histopathological observation.

Phosphorus (mg/dl)

The plasma phosphorus level amongst the all groups were not comparable. The sample collected at the end of 3rd week exhibited numerical increase in the plasma phosphorus from all thiourea treated birds as compared to their respective control birds. Amongst the all experimental group birds, and which received treatment diet containing 22 or 20% protein with or without thiourea, the highest level of phosphorus (4.45± 0.30) was recorded in G6 group and lowest (3.40 ± 0.38) in G2 group.

Sample collected at the end of 6th week from all experimental group birds, and which received treatment diet containing 22 or 20% protein with or without thiourea, the highest level (5.08± 0.92) of phosphorus was recorded in G1 and lowest level (3.91 ± 0.19) was in G7 group birds and depicted in Table 2.

It was observed that the plasma phosphorus level progressively increased with increased level of thiourea, except G7 group, which fed with thiourea either with 20% or 22% protein in treatment diet. Similar findings [8] by feeding 0.005, 0.05, 0.1, 0.2 and 0.4% thiourea to the broilers. Increased phosphorus level might be due to increase in phospholipids [9] in radiothyroctized birds.

Cholesterol (mg/dl)

At the end of 3rd week, significantly higher plasma cholesterol level (110.2 ± 3.67) was recorded in G4 group birds. Whereas, the significantly lower (92.96 ± 3.325) cholesterol level was recorded in G5 group birds. The plasma cholesterol level from all thiourea treated birds was higher as compared to their respective control birds. It was observed that as the level of thiourea increased in treatment diet either in 22 or 20% protein, the cholesterol level was also progressively increased.

At the end of 6th week, significantly higher level of plasma cholesterol (132.7 ± 2.096) was recorded G4 group birds, whereas significantly lower level of plasma cholesterol (103.2 ± 2.0) was recorded in group G5 birds (**Table 3**).

Table 3 Total Protein (mg/dl), Cholesterol (mg/dl) level in various treatment groups

Total Protein			**Cholesterol**		
Groups	**Periods (Weeks)**		***Group***	**Periods (Weeks)**	
	3th Week	**6th Week**		**3rdWeek**	**6th Week**
G1	3.01 ± 0.18	3.01 ± 0.25	**G1**	99.63^{b} ± 4.02	114.08^{c} ± 3.57
G2	3.41 ± 0.14	3.9 ± 0.69	**G2**	97.61^{b} ± 3.64	108.8^{b} ± 3.37
G3	3.95 ± 0.44	2.98 ± 0.13	**G3**	104.7^{c} ± 3.61	121.63^{d} ± 3.23
G4	3.93 ± 0.32	2.88 ± 0.23	**G4**	110.16^{d} ± 3.67	132.73^{e} ± 2.09
G5	4 ± 0.23	2.83 ± 0.12	**G5**	92.96^{a} ± 3.31	103.2^{a} ± 2.09
G6	4.53 ± 0.24	3.66 ± 0.35	**G6**	99.36^{b} ± 3.29	110.18^{b} ± 3.55
G7	3.73 ± 0.30	3.06 ± 0.17	**G7**	103.53^{c} ± 3.42	119.14^{d} ± 3.27
Pooled Mean	3.79^{a} ± 0.26	3.19^{b} ± 0.28	**Pooled Mean**	101.13 ± 3.57	115.68 ± 3.02

Mean values with common alphabet as superscript do not differ significantly
CD for treatment = 6.55 (significant at 1% and 5% level)
CD for treatment = 3.55 (Significant at 1% and 5% level)

Increased cholesterol level in thiourea fed birds might be due to reduced cholesterol excretion and enhanced capacity for cholesterol transport in blood in the state of hypothyroidism [6], [10], and [11] were recorded lower levels by feeding 0.01% thiourea and 0.05% methimazole used for inducing hypothyroidism.

Hypercholesterolemia in goitrogen induced hypothyroidism [12] @ 0.1% thiourea, [7] @ 50mg/kg body weight of thiourea, [13] at 400 mg/dl birds of propyl thiouracil, and [8] @ 0.005, 0.05, 0.1, 0.2, 0.4% thiourea.

Total Protein (g/dl):

The plasma total protein level amongst the all groups was not comparable. Amongst the all experimental group, samples were collected at the end of 3rd week. The numerical increase in (3.95 ± 0.44) protein level was recorded from G3 group birds. Whereas numerically decreased level (3.01 ± 0.18) was recorded from G1 group birds.

However, at the end of 6th week, the numerically highest level (3.9 ± 0.7) was recorded from G2 group birds. Whereas, lowest level (2.83 ± 0.12) was recorded from G5 group birds (Table 3).

Similar findings were found [14] in turkey, fed with low iodine diet and 0.5% sodium per chlorate. Non significant change [8] in total protein levels from birds fed 0.005%, 0.05%, 0.1%, 0.2% and 0.4% thiourea.

Acknowledgements

The authors are grateful to the Associate Dean, Post Graduate Institute of Veterinary and Animal Sciences, Akola for providing the necessary facilities to carry out the research work.

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Publication History
Received 11th Mar 2017
Revised 18th Mar 2017
Accepted 20th Mar 2017
Online 30th Mar 2017