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Serum Thyroid Hormones and Protein Profile during Growth Period in Broiler Chicken

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Abstract: ***The experiment was conducted on 20 Vencob broiler chickens maintained at Bombay Veterinary College, Poultry Unit No 03, Mummbai. The blood samples from these birds were collected from 3rd week of age and then weekly interval till 6th week of age by jugular veinipuncture in the morning hours (10-11 am). The serum samples were analyzed for total proteins, albumin, globulin, albumin-globulin ratio and uric acid, triiodothyronine, Thyroxine and T_3:T_4ratio.The mean ± SE level of total proteins was 2.96 ± 0.09, 3.08 ± 0.07, 3.07 ± 0.06 and 3.18 ± 0.08 g/dl at 3rd week, 4th week, 5th week and 6th week age of chicken respectively. The mean ± SE level of Albumin were 1.30 ± 0.03, 1.24 ± 0.05, 1.26 ± 0.05 and 1.19 ± 0.02 g/dl at 3rd week, 4th week, 5th week and 6th week of age respectively. The mean ± SE level of Globulin were 1.50 ± 0.07, 1.85 ± 0.09, 1.80 ± 0.08 and 1.97 ± 0.08 g/dl at 3rd week, 4th week, 5th week and 6th week of age respectively. Mean ± SE level of Albumin- globulin ratio were 0.80 ± 0.03, 0.74 ± 0.09, 0.76 ± 0.14 and 0.63 ± 0.03 at 3rd week, 4th week, 5th week and 6th week of age respectively. The mean ± SE level of uric acid were 8.34 ± 0.44, 7.61 ± 0.24, 5.01 ± 0.20 and 5.29 ± 0.28 mg/dl at 3rd week, 4th week, 5th week and 6th week of age respectively. The mean ± S.E. levels of theT_3 were 1.41 ± 0.11, 2.03 ± 0.09, 1.97 ± 0.08, and 2.02 ± 0.15 ng/ml during 3rd, 4th, 5th and 6th week of age respectively. The T_3 has shown significant increase from 3rd week of the age when growing period of broiler starts.Mean ± SE level of thyroxine (T_4) were 10.94 ± 0.73, 8.95 ± 0.50, 8.75 ± 0.58 and 8.03 ± 0.47 ng/ml at 3rd week ,4th week, 5th week and 6th week of age respectively. T_4has shown declining trends as age advances. The mean ± S.E. levels of T_3:T_4ratio were 0.15 ± 0.01, 0.24 ± 0.02, 0.26 ± 0.02, and 0.2 ± 0.03 during 3rd, 4t th, 5 th and 6 th week of age respectively.***

Keywords: Broilers chicken, total proteins profiling, triiodothyronine and Thyroxine

1. Introduction

The poultry industry in India has emerged as the most dynamic and rapidly expanding segment of livestock economy as evident from the production level touching about 40 billion eggs and 1 billion broilers with a compound annual growth rate of 8 % and 15% respectively. India's poultry industry has transformed from a mere backyard activity into a major commercial activity in just four decades. India is now the world's 18th largest producer of broilers (APEDA. 2012). Considering the present status of basic database of metabolites in birds in accordance to the age, weight, sex and seasonal variation, serum biochemical profiling has been used in several species of domestic livestock to monitor herd health and to detect subclinical disease. Albumins serve as a depot of proteins and as a source of amino acids during insufficient intake of food, and also participate in transporting fatty acids, minerals and vitamins (Griminger and Scanes, 1986). In chickens and quails, it was determined that albumins also transport thyroid hormones (Mcnabb and Hughes, 1983). Albumin is one of the main serum protein which serves as the most favourable source of amino acids for synthesis of tissue proteins in the period of quick somatic growth of birds (Yaman et al. 2000). Thyroid is an endocrine organ found in all vertebrates and the avian gland is similar in many respects to that of mammalian (Arzour et al., 2013). The evaluation of the levels of total protein and its fractions supply the information required to interpret the occurrence of dehydration, infections, immune diseases, and inflammatory responses (Silva et al, 2007).Hence, attempts are put forth to establish valuable data base for further research appreciating the correlation of thyroid hormones and protein profile in growing broiler birds.

2. Material and Methods

2.1 Experimental birds

The experiment was conducted on 20 Vencob broiler chickens maintained at Bombay Veterinary College, Unit No 13, Goregaon sub campus, Mumbai. Birds were reared in deep litter system for 42 days. Birds were given *ad lib* feed and water during the course of experiment. The chicks were vaccinated as per routine vaccination schedule.

2.2 Collection of serum samples

The blood samples from these birds were collected from 3rd week of age and then weekly interval till 6th week of age by jugular veinipuncture in the morning hours (10-11 am). Clear serum was separated by centrifugation at 3000 rpm for 10 min. Total 80 serum samples were analyzed for total proteins, albumin, globulin, A:G ratio, uric acid, tri-iodothyronine (T_3), thyroxine (T_4) and T_3:T_4 ratio. Biochemical parameters Viz total protein, albumin, A: G ratio were estimated by using standard biochemical kit. The activity and concentration were estimated by using semiautomated biochemistry analyzer.

2.3 Statistical Analysis

Analysis of variance of the data of the concentrations of total proteins, albumin, globulin, albumin-globulin ratio, Uric

acid, tri-iodothyronine, thyroxine and T3:T4 ratio were done according to Snedecor and Cochran (1994) using Completely Randomized Design (CRD). Differences in means were tested using critical difference (CD) test.

3. Result and Discussion

3.1 Tri-iodothyronine (T_3)

The tri-iodothyronine concentration in the serum of experimental broiler birds is presented in Table 1. Levels of T_3 were ranged between 1.41 ± 0.11 to 2.03 ± 0.09 ng/ml with minimum level at start of growing period i.e. 3rd week of age. The maximum level of 2.03 ng/ml was obtained at 4th week of age which is then lowered to 1.97 ± 0.08 ng/ml at 5th week and showed again increase up to 2.02 ± 0.15 ng/ml at 6th week but not statistically significant.

The serum values of T_3 are in closely resemblance with the finding of Stojevic*et al.* (2000) in Heavy Ross bred chickens for 4 th week, 5 th week and 6 th week of their age. Also the values of present study are in agreement with Mohammed Al-Gamal, (2014) who had recently reported the values of T_3 in racing pigeons. Serum T_3 concentration of this study also match with previous study of Giachetto*et al.* (2003) in study of performance and hormonal profile in broiler chickens fed with different energy levels during post restriction period.

3.2Thyroxine (T_4)

The thyroxine concentration in the serum of experimental birds is presented in Table 1.

Levels of T_4 were 10.94 ± 0.73 and 8.95 ± 0.50 ng/ml with minimum level at start of growing period i.e. 3rdand 4 thweek of age. The maximum level of T_4 was obtained at 3rd week of age which is then lowered to 8.03 ± 0.47 ng/ml at 6th week and showed decreasing trends at 6th week but not statistically significant.

Findings of our study are not in agreement with the levels reported in findings in previous studies by Ladmakhi*et al.* (1997), Stojevic*et al.* (2000) and Giachetto*et al.* (2003) in chicken. They observed an increasing trend of serum T_4 at various growing stages in their studies.

The decrease in concentration of serum T_4 levels as age advances was may be due to the increased activity of monodeiodinase enzyme in the metabolism of thyroid hormone which cause deiodination and converts more T_4 and hence T_4 play an important role in thermoregulation of broiler chickens during summer season.

T_3:T_4ratio:
T_3:T_4 ratio in the serum of experimental broiler birds is presented in Table 1. There are scanty references available for T_3:T_4 ratio in growing broiler birds however, Mohammad Al-Gamal (2014) studied effect of age on thyroid hormone and some biochemical constituents in racing pigeon and observed constant T_3:T_4 ratio (0.24, 0.23 and 0.22) at 5th week, 6 th week and 30 th week which are in agreement with this study.

Total protein:
The total protein concentrations in serum of broiler bird are presented in Table 1. The mean ± SE level of total proteins was 2.96 ± 0.09, 3.08 ± 0.07, 3.07 ± 0.06 and 3.18 ± 0.08 g/dl at 3rdweek, 4th week, 5th week and 6th week of age respectively. There was a trend of non - significant increasing levels from 3rd to 6th week.

Concentration of serum total protein in this study are in agreement with previous studies of Bowes *et al.* (1989) in male broiler, female broilers and white leghorn chickens, Talebi (2006). Levels at 6thweek from this study coincides with the findings in the recent study of Nohavandi-nejad *et al.* (2014) in control group while estimating blood biochemical parameters of broilers fed differently thermal processed soybean meal.

Albumin:
Concentration of serum albumin during various growing stages of broilers is presented in 1.The mean ± SE level of albumin were 1.30 ± 0.03, 1.24 ± 0.05, 1.26 ± 0.05 and 1.19 ± 0.02 g/dl at 3rd week, 4th week, 5thweek and 6th week of age respectively.

The serum concentration of albumin neither showed any decreasing or increasing trend nor does the value showed significant difference between the groups. Values obtained in our study corroborates with the findings of Bowes *et al.* (1989) in male and female broilers, Piotrowska *et al.* (2011) in Ross 308 chickens, Silva *et al.* (2007) in Hybro-PG broilers during various stages of growth period. Values at 6th week of this study match with values obtained by Jahanpour *et al.* (2013) while studying effects of feed restriction on broiler's blood biochemical parameters, Nahavandi- nejad *et al.* (2014) in study of effects of differently thermal processed soybean meal on biochemical constituents.

Globulin:
Concentration of serum Globulin in experimental birds during various growing stagesog broilers is presented in Table1.The mean ± SE level of globulin were 1.50 ± 0.07, 1.85 ± 0.09, 1.80 ± 0.08 and 1.97 ± 0.08 g/dl at 3rd week, 4th week, 5th week and 6th week of age respectively.

The globulin levels in the present study corroborates with the findings of Filipovic*et al.* (2007) for 4th and 6th week in Ross broiler chicken.Also the values at 3rd and 4th week match with values reported by Mohammed Al-Gamal (2014) in racing pigeon.

Albumin: Globulin (A: G) ratio:
Albumin globulin ratio in experimental birds during various growing stages is presented in Table1. The mean ± SE level of A:G ratio were 0.80 ± 0.03, 0.74 ± 0.09, 0.76 ± 0.14 and 0.63 ± 0.03 at 3th week, 4th week, 5th week and 6th week of age respectively. The highest ratio 0.80 was reported on 3rd week of age at the start of growth period. Then it was decreased to 0.74 ± 0.09 at 4th week of age which is then almost remain constant to 0.76 ± 0.14 at 5th week and again decreased to 0.63 ± 0.03 at 6th week of age.

Values of A:G ratio in the present study match with the values of previous study reported by Filipovic *et al.* (2007)

and Kudair*et al.* (2010) in broiler birds. Values of A:G ratio at 3rd and 4th week of this study match with values in the finding of Mohammed Al-Gamal (2014) in racing pigeon. The A:G ratio is important in the interpretation of diagnostic because it changes at different pathological stages in broiler chicken (Kaneko, 1997). Therefore, establishing their referential values is important. Non significant decrease in albumin globulin ratio during growing period is probably a consequence of relative increased level of serum globulin over serum albumin during growth period is in accordance of Tumbleson et al. (1972).

Uric acid:

Concentration of serum uric acid in experimental birds at various stages during growing period is presented in Table 1. The mean ± SE level of uric acid were 8.34 ± 0.44, 7.61 ± 0.24, 5.01 ± 0.20 and 5.29 ± 0.28 mg/dl at 3rd week, 4th week, 5thweek and 6th week of age respectively. Concentration of serum uric acid again increased to 5.29 ± 0.28 mg/dl at 6th week of age. There was a specific trend of significant decreasing levels of uric acid from 3rd to 5th week of age with exception of non-significant increased from 5th to 6th week of age.

Specific trend of significant decrease from start to mid of growing period and again increase at adult stage of growth showed close resemblance with studies by Bowes *et al.* (1989) in male, female broilers and in Hybro PG broilers, Piotrowska*et al.* (2011) in growth period. In the present study, significantly elevated levels of serum uric acid in 3rd and 4th week were probably due to addition of high protein percentage in commercial broiler starter feed and our results are in accordance with Silva *et al.* (2007) who had observed direct relation between amount of ingested protein in commercial broiler starter feed and serum uric acid level.

4. Conclusion

Present study investigated the level of thyroid hormones and protein profile in serum and compared their concentrations in different stages of growing period in broiler birds.The lower values of triiodothyronine in serum of broiler bird was observed at 3rd week of age which was then significantly increased in 4th week and then remained constant up to 6th week of age. The decrease in concentration of serum T_4 levels as age advances was may be due to the increased activity of monodeiodinase enzyme in the metabolism ofthyroid hormone which cause deiodination and converts more T_4.There was increasing trend observed in the levels of total proteins in growing period from 3rd week to 6th week of age though levels of total proteins did not significantly differ in the experimental period of 3th week to 6th week. The values of albumin seems to be lower than some previous studies because relative increase of serum globulin over serum albumin without significantly affecting level of total protein.

Serum uric acid showed decreasing trend from 3rd week to 5thweek where significantly higher serum concentrations were seen at 3rd and 4th week of age thereafter significantly decreased at 5thweek and then non significantly increased at 6th week. It can be therefore concluded that these results may be useful as the complementary diagnostic tool in clinical evaluation of growing broiler birds and could contribute to physiological knowledge on some baseline values of biochemical metabolites in the birds.

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Table 1: Mean ± S.E serum thyroid and protein profile during growth phase of broilers.[NS]

Biochemical Metabolites →									
Sr. No	Age of Broilers↓	Total Protein (g/dl)	Albumin (g/dl)	Globulin (g / dl)	Albumin : Globulin (A:G) ratio	Uric acid (mg/dl)	Tri-iodothyronine (T3)(ng/ml)	Thyroxine (ng/ml)	T3:T4 ratio
1	3rd week	2.952±0.09	1.295 NS±0.03	1.499b±0.07	0.80 ± 0.03	8.34 ± 0.44	1.41 ± 0.11	10.94 ± 0.73	0.15 ± 0.01
2	4th week	3.081± 0.07	1.236 NS±0.05	1.845a±0.09	0.74 ± 0.09	7.61 ± 0.24	2.03 ± 0.09	8.95 ± 0.50	0.24 ± 0.02
3	5th week	3.068±0.06	1.258 NS±0.05	1.804a±0.08	0.76 ± 0.14	5.01 ± 0.20	1.97 ± 0.08	8.75 ± 0.58	0.26 ± 0.02
4	6th week	3.182±0.08	1.192 NS±0.02	1.972a±0.08	0.63 ± 0.03	5.29 ± 0.28	2.02 ± 0.15	8.03 ± 0.47	0.2 ± 0.03

Table 2: ANOVA table for biochemical metabolites during growth phase of broilers

ANOVA → Biochemical Metabolites ↓	Source of Variation	Degree of Freedom	Sum of Squares	Mean sum of squares	F cal	C.D.
Total Protein (g/dl)	Groups	3	1.048	0.346	**2.812**	**Non Significant**
	Error	14	1.741	0.123		**Non Significant**
	Total	17	-	-		
Albumin (g/dl)	Groups	3	0.463	0.154	**1.662**	**(0.01) = 0.262**
	Error	14	1.288	0.099		**(0.05) = 0.196**
	Total	17	-	-		
Globulin(g/dl)	Groups	3	2.508	0.836	**4.53**	**Non Significant**
	Error	76	13.992	0.181	**-**	**Non Significant**
	Total	79	-	-	**-**	
Albumin : Globulin Ratio	Groups	3	0.325	0.105	**0.724**	**Non Significant**
	Error	76	11.502	0.153	-	**Non Significant**
	Total	79	-	-	-	
Uric acid(mg/dl)	Groups	3	165.151	55.057	**30.493**	**1% = 1.126**
	Error	76	137.219	1.804	-	**5% = 0.844**
	Total	79	-	-	-	
Tri-iodothyronine (T3)(ng/ml	Groups	3	5.267	1.752	**7.364**	**1% =0 .408**
	Error	76	18.1	0.232	-	**5% =0.304**
	Total	79	-	-	-	
Thyroxine(ng/ml)	Treatments	3	92.31	30.773	**4.656**	**1% =2.146**
	Error	76	502.199	6.608	-	**5% =1.612**
	Total	79	-	-	-	