Research Article

Influence of Herbal Choline as a Replacement of Synthetic Choline Chloride in Broiler Diets on Serum Biochemical Profile

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Abstract

Three hundred straight-run Cobb-400 day-old broiler chicks were randomly distributed into five treatment groups having three replicates containing 20 chicks in each and reared up to 6 weeks of age on deep letter housing system. The treatment group T1 (Negative control) offered basal diet (BIS, 2007) without synthetic choline chloride-60% (CC) or herbal choline (HC), group T2 basal diet with choline chloride-60% @ 1kg/ton of feed (Control), groups T3, T4 and T5 basal diets with herbal choline @ 250, 350 and 500 g/ton of feed, respectively. The cholesterol level in treatment group T2 and T5 was significantly reduced ($P<0.01$) as compared to treatment group T1. At the end of 6th week, there was significant ($P<0.01$) increase in level of serum total protein and globulin in groups T2, T4 and T5 as compared to treatment groups T1 and T3. The total serum cholesterol and LDL-cholesterol level in treatment groups T2, T4 and T5 was significantly ($P<0.01$) decreased than groups T1. However, the HDL-cholesterol and triglycerides levels were numerically lower in treatment groups supplemented with choline chloride or herbal choline as compared to non-supplemented groups. All other serum biochemical parameters were comparable in all treatment groups. It may be concluded that the broilers fed diets with herbal choline or synthetic choline chloride found to improve biochemical profile compared to non-supplemented groups. Moreover, the supplementation of herbal choline at a level of 0.5 kg/ton of feed resulted in comparable serum biochemical profile in broilers fed synthetic choline chloride at 1 kg/ton of feed.

Keywords: Herbal choline, choline chloride, biochemical parameters, broiler chickens

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Introduction

Choline is a rediscovered critical amino acid for poultry. Supplementation of choline in poultry ration is well established to improve growth, performance and to regulate lipid metabolism [1]. Research studies indicate that supplementation of choline in ration is essential to prevent fatty liver syndrome by regulating lipid metabolism [2]. Choline is usually added to poultry diets in the choline chloride form. However, this source has some disadvantages such as high hygroscopicity, the acceleration of oxidative loss of vitamins in the diet, and the formation of trimethylamine in the gastrointestinal tract of the birds [3]. However, choline is also present in plants in the phosphatidylcholine form, free choline and sphingomyelin. Recently, there are natural products, produced from selected plants, with high content of choline in esterified form and with high bioavailability, which may be an important alternative to the use of synthetic choline chloride. Many researchers have shown that these products can replace choline chloride in diets for poultry [4-5]. Therefore, the present study was undertaken to evaluate the influence of herbal choline as a replacement of synthetic choline chloride in broiler diets on serum biochemical profile.

Material and Methods

Experimental Design and Management

Three hundred straight run 'Cobb-400' day-old broiler chicks were randomly distributed into five treatment groups having three replicates containing 20 chicks in each and reared up to 6 weeks. The treatment group T1 (negative control) offered basal diet (BIS, 2007) without synthetic choline chloride 60% or herbal choline, group T2 (control) basal diet with choline chloride-60% @ 1kg/ton of feed (Control group), groups T3, T4 and T5 basal diets with supplementation of herbal choline @ 250, 350 and 500 g/ton of feed, respectively. The standard and uniform

managemental practices were followed for all treatment groups throughout the experimental period. The birds were offered *ad-lib* fresh and clean drinking water throughout the experiment. At the end of 3rd and 6th week the blood samples were collected from two birds from each replicate i.e. total six birds from each treatment group and separated serum was used for biochemical analysis.

Figure 1 Brooding management of chicks

Figure 2 Experimental broilers in pen

Procurement of Ingredients and Feed Formulation

The good quality feed ingredients were procured from local market for preparation of experimental diets. The rations were formulated as per national standards [6] for pre-starter, starter and finisher phases as presented in Table 1. All the diets were isocaloric and iso-nitrogenous. The herbal choline was supplied by M/s. Vamso Biotec Pvt. Ltd., Gurgaon Haryana, India.

Serum Biochemical Parameters

The birds from the research trial were assessed for the blood biochemical parameters. Two birds from each replication and a total of six birds from each treatment group were randomly selected for the blood collection at the end of 3rd and 6th week of age. The blood samples were collected via wing vein from each bird in serum vacutainer. The serum was separated by centrifugation at 3000 RPM for 20 minutes and decanted into clean, sterile plastic vials and stored under deep freeze at –18º to –20ºC. These serum samples were used for estimation of biochemical parameters using standard analytical kits viz. total protein, albumin, globulin, cholesterol, High-density lipoprotein (HDL), Low density lipoprotein **(**LDL) and triglycerides.

Table 1 Ingredients and nutrient composition of diets for different phases of growth.

Sr. No.	Feed Ingredients (%)	Pre-starter	Starter	Finisher
1	Maize	52.180	53.440	57.930
2	Soybean meal	40.700	38.200	32.900
3	Vegetable Oil	3.100	4.400	5.250
4	Dicalcium Phosphate (DCP)	1.800	1.800	1.800
5	Limestone Powder (LSP)	1.200	1.200	1.200
6	Salt	0.270	0.250	0.250
	Micro-ingredients			
7	Trace Mineral mixture*	0.150	0.150	0.150
8	Vitamin Premix**	0.050	0.050	0.050
9	DL-Methionine	0.200	0.180	0.150
10	L-Lysine	0.050	0.030	0.020
11	Toxin binder (UTPP)	0.100	0.100	0.100
12	Coccidiostat	0.050	0.050	0.050
13	Sodium Bicarbonate	0.150	0.150	0.150
	TOTAL	100.00	100.00	100.00
	Nutrient composition on dry matter basis			
1	Metabolizable Energy (kcal/kg)	3003.83	3103.04	3202.76
2	Crude Protein (%)	23.01	22.000	20.02
3	Ether Extract (%)	5.48	6.80	7.78
4	Crude Fiber (%)	4.21	4.09	3.88
5	Calcium (%)	1.01	1.00	0.98
6	Total Phosphorus (%)	0.70	0.69	0.67
7	Available Phosphorus (%)	0.42	0.42	0.42
8	Total Lysine (%)	1.31	1.22	1.08
9	Total Methionine (%)	0.55	0.51	0.46

The herbal choline and synthetic choline chloride 60% were incorporated in the treatment groups as described in treatment details above the basal diet.
*Trace Mineral Mixture: - Each kg contains: Copper-15g, Iodine-2g, Iron-90g, Manganese-100g, Selenium-0.3g and Zinc-80g.
**Vitamin Premix: -Each 500g contains: Vit. A12.50MIU, Vit. D3-2.50 MIU, Vit. E-12g, Vit. K-1.50g, Thiamine (B1)-1.50g, Riboflavin (B2)-5g, Pyridoxine (B6)-2g, Cyanocobalamin (B12)- 0.015g, Niacin-15g, Cal D Pantothenate-10g and Folic acid-0.50g.

Statistical analysis

The data generated was subjected to statistical analysis by using Complete Randomized Design [7]. The treatment means were compared by Critical Differences (CD) and Analysis of Variance.

Results and Discussion

The analysis of variance for various biochemical parameters showed significant ($P<0.01$) differences among the treatment groups (**Table 2**). The cholesterol level in treatment group T2 and T5 was significantly reduced ($P<0.01$) compared to treatment group T1 at 3rd week of age. These findings are in accordance with the earlier report in the literature [8]. However, the data revealed non-significant differences in the mean values of total protein, albumin, globulin, high-density lipoprotein **(**HDL), low-density lipoprotein **(**LDL) and triglycerides in all treatment groups. At the end of 6th week, there was significant ($P<0.01$) increase in serum total protein and globulin levels in groups T2, T4 and T5 compared to groups T1 and T3 (**Figure 3**). The total serum cholesterol and LDL-cholesterol level in treatment groups T2, T4 and T5 was significantly ($P<0.01$) decreased than group T1. Similarly, it has been reported

that supplementation of herbal choline can replace synthetic choline and biotin as evident by the comparable hypocholesterolemeic effect produced by these groups [8]. However, in the present study the HDL-cholesterol and triglycerides levels were numerically lower in treatment groups supplemented with choline chloride or herbal choline compared to non-supplemented groups (**Figure 4**). The results of the present study are in accordance with reports stating that the chicks fed diets without supplementation of choline/ herbal source of choline fail to protect the liver completely [9-11].

Table 2 Serum biochemical parameters at different phases of growth in broilers fed various levels of herbal choline

Treatment Groups	Total Protein (g/dl)		Albumin (g/dl)		Globulin (g/dl)		Cholesterol (mg/dl)		HDL (mg/dl)		LDL (mg/dl)		Triglycerides (mg/dl)	
	3rd week	6th week	3rd week	6th week	3rd week	6th week	3rd week	6th week	3rd week	6th week	3rd week	6th week	3rd week	6th week
T1 (Without CC or HC)	3.02 ±0.08	3.32 ±0.17^{b}	1.35 ±0.05	1.77 ±0.06	1.67 ±0.06	1.55 ±0.16^{b}	104.58 ±2.61^{a}	125.53 ±4.69^{a}	33.14 ±2.41	41.09 ±2.20	57.95 ±2.08	75.24 ±3.08^{a}	67.43 ±5.37	46.03 ±1.45
T2 (CC @1kg/ ton of feed)	3.29 ±0.12	4.63 ±0.26^{a}	1.38 ±0.05	1.79 ±0.09	1.90 ±0.10	2.84 ±0.20^{a}	94.16 ±4.60^{bc}	109.70 ±4.35^{c}	30.39 ±1.68	39.99 ±2.43	52.27 ±3.04	61.05 ±3.54^{bc}	57.53 ±9.53	43.26 ±1.84
T3 (HC @ 250g/ ton of feed)	3.03 ±0.19	3.33 ±0.15^{b}	1.14 ±0.15	1.54 ±0.11	1.89 ±0.11	1.78 ±0.19^{b}	102.65 ±2.13^{ab}	121.43 ±4.50^{ab}	35.51 ±0.86	44.90 ±1.80	54.50 ±2.67	67.34 ±2.94a^{b}	63.23 ±9.49	45.95 ±2.14
T4 (HC @ 350g/ ton of feed)	3.12 ±0.10	4.39 ±0.62^{a}	1.35 ±0.03	1.63 ±0.10	1.77 ±0.09	2.76 ±0.58^{a}	94.09 ±3.56^{bc}	110.20 ±3.22^{bc}	32.36 ±2.20	42.52 ±1.92	51.77 ±1.63	59.07 ±3.00^{bc}	49.7 ±5.45	43.08 ±1.83
T5 (HC @ 500g /ton of feed)	3.39 ±0.22	4.86 ±0.23^{a}	1.38 ±0.09	1.78 ±0.07	2.00 ±0.18	3.08 ±0.26^{a}	87.70 ±3.36^{c}	102.95 ±2.49^{c}	29.84 ±2.94	40.75 ±1.56	49.11 ±2.65	54.18 ±2.44^{c}	43.76 ±5.59	40.10 ±1.93
CD	NS	1.312**	NS	NS	NS	1.247**	13.239**	15.543**	NS	NS	NS	11.911**	NS	NS
CV (%)	11.730	19.870	15.685	12.958	15.433	32.253	8.514	8.476	16.265	11.737	11.359	11.680	31.978	10.385

Means bearing different superscripts differ significantly within a column. ** P<0.01, NS-Non-Significant, CD-Critical difference, CV-Coefficient of variance.

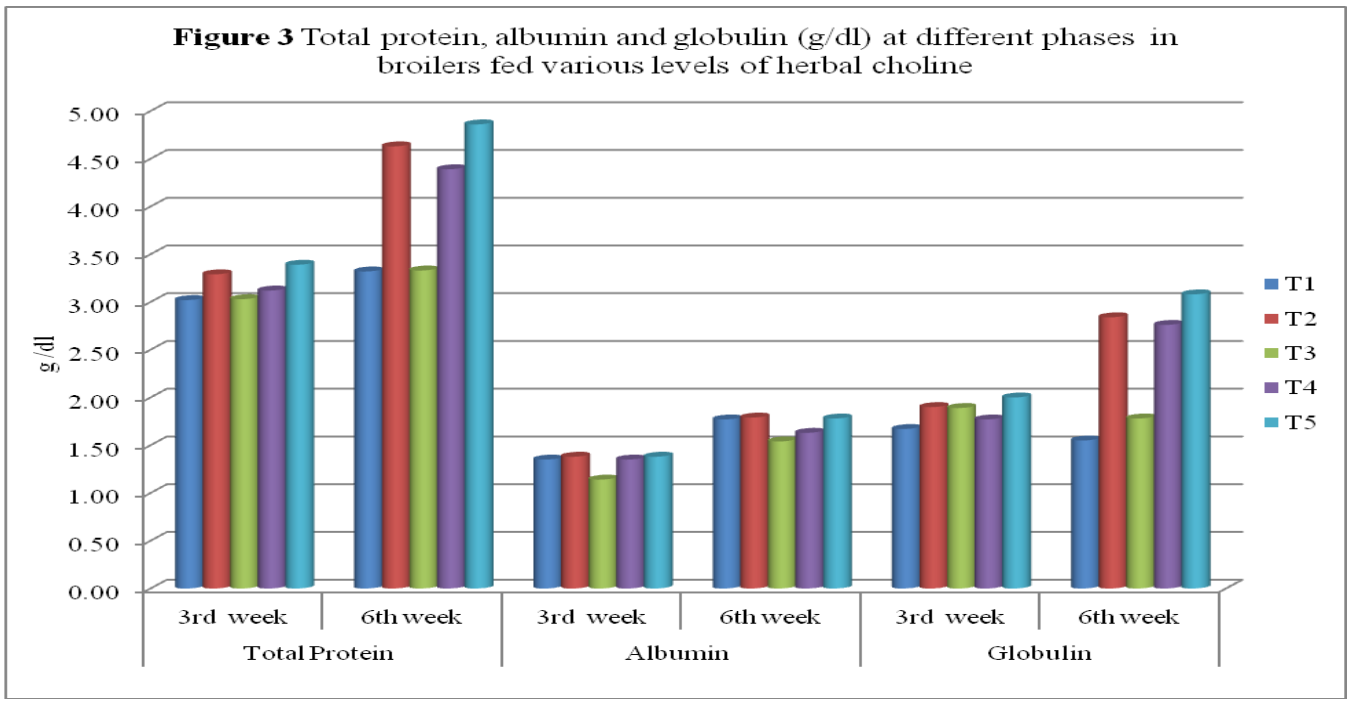

Figure 3 Total protein, albumin and globulin (g/dl) at different phases in broilers fed various levels of herbal choline

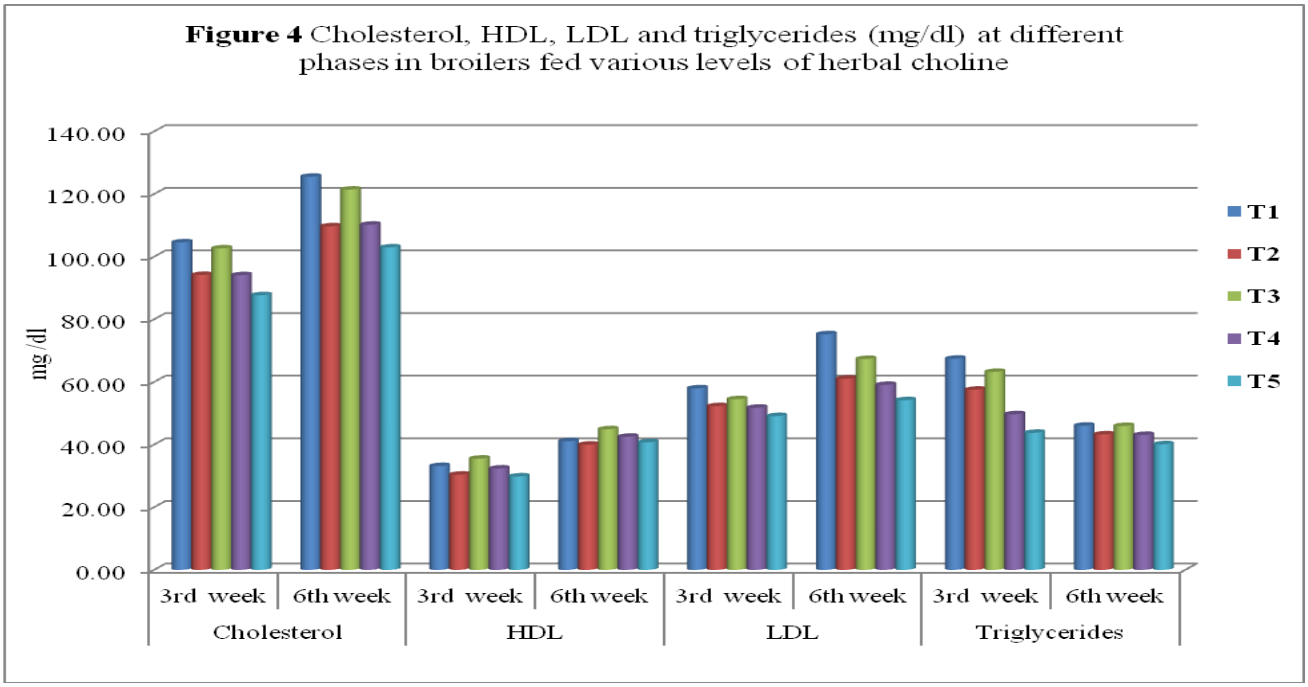

Figure 4 Cholesterol, HDL, LDL and triglycerides (mg/dl) at different phases in broilers fed various levels of herbal choline

Conclusion

It may be concluded that the broilers fed diets with herbal choline or synthetic choline chloride found to improve biochemical profile compared to non-supplemented groups. Moreover, the supplementation of herbal choline at a level of 0.5 kg/ton of feed resulted in comparable serum biochemical profile in broilers fed synthetic choline chloride at 1 kg/ton of feed.

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