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Effect of phytosome complex of phosphatidylcholine and silymarin on broiler growth performance and carcass traits in broilers

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Abstract

High performing hybrid broilers need high-energy diets to match their full genetic potential. Oil and fats as high-energy sources are regularly used in diet to meet his requirement. Liver health has been paramount importance for effective energy and nutrient utilization in broilers. Unutilised fat often accumulate in liver resulting in fatty liver syndrome. Choline is one of the major ingredient that help in mobilisation of excess fat from liver. Silymarin is also used as hepato-protective ingredient.

This study was conducted to seek synergistic effect of herbal formulation containing phytosome complex of phosphatidylcholine and silymarin on growth performance and carcass traits in commercial broiler chickens. Total of 360-day-old broiler chicks were randomly distributed into three treatments with six replicates of twenty chicks each. Treatment groups were fed basal diet with no added natural choline supplement (T_0), basal diet with herbal formulation containing natural Choline supplement @ 500g per tonne of feed (T_1), basal diet with herbal formulation containing phytosome complex of phosphatidylcholine and silymarin supplement @ 500g per tonne of feed (T_2). T_2 at recommended dose had more cumulative body weight 2699g as compared to control T_0 (2613g) and T_1 (2586g), ($p<0.05$). T_2 cumulative FCR was also best 1.44 as compared to T_0 (1.49) and T_1 1.47 ($p<0.05$). It had shown almost similar carcass yield of 63% ($p>0.05$). T_2 had shown one of the lowest abdominal fat percentage of 1.25% as compared to 1.35% of T_1 . Breast meat percentage was best in T_2 among all of 25.02% as compared to least 24.71% of T_1 ($p<0.05$). It can be concluded from trial data that herbal formulation containing Phytosome complex of phosphatidylcholine and silymarin had better impact on bird performance and carcass yield as compared to supplementing with herbal choline formulation containing only natural phosphatidyl choline source.

Keywords: Carcass characteristics, broilers, natural choline, silymarin, herbal choline, performance, liver

Introduction

With increased ongoing world requirement for lean protein, poultry stands out to be prime source for meeting this high demand ^[1]. High performance hybrid birds are fed dense feed to perform up to its limits but this can easily lead to the development of fatty liver ^[2]. Choline and phosphatidylcholine (PC) are known to prevent fatty liver in NAFLD ^[3]. Broilers are mainly fed with corn-soya diet to provide nutritional requirement. Soya doc rich in protein contains approx. 2640 mg/kg of choline sources and corn contains approx. 506mg/kg of phosphatidylcholine ^[4]. However digestibility of this source often varies depending on source, season and quality leading to large variation of digestible choline content.

Herbal interventions are often helpful in increasing the actual choline conjugates (mainly *Phosphatidylcholine*, *Phosphocholine*, *Sphingomyelin*, *acetylcholine* and free choline moiety) ^[5]. Phosphatidyl choline is the most prominent form of choline conjugate or derivative accounting more than 95% of total choline in tissues ^[6].

Herbs are often extracted with water or solvents or through supercritical fluid to produce PC enrich extracts for use as feed additive.

Silymarin, a member of *Carduus marianum* family is a potent hepatoprotective agent in poultry industry. Silymarin is the active component of this herb, which is a complex of other components, mainly silybin A, silybin B, isosilybin A, isosilybin B and also other flavonolignans such as silychristin, neosilyhermin, silyhermin and silydianin which exists in its fruit and seeds more than the other parts. The mode of action by which silymarin might protect liver cells includes stabilisation of membranes, free radical scavenging, stimulation of hepatocyte protein synthesis and modulation of the immune response. In addition, silymarin can be used to treat jaundice disorders by ameliorating the levels of various hepatic enzymes such as Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), and Alkaline Phosphatase (ALP). Moreover, silymarin is able to moderate the immune system, by boosting IL-4, IFN- γ , and IL-10 [7]. Combination of silymarin and choline is often used in different dosage form to treat non-alcoholic fatty liver disease (NAFLD) [8]. Comparative efficacy of silymarin and choline chloride in alleviating effect of Aflatoxin B1 has been reported [9].

Giannetto *et al.* reported the Antioxidant and hepatoprotective effect of silymarin phytosome complex along with choline chloride, l-cysteine, antichoke extract and vitamin E in dogs [9]. Phytosomes formation is a novel emerging technology in Phytomedicine. Most of the phytochemicals in silymarin are flavonoids, which are poorly absorbed [10]. Water-soluble flavonoid molecules can be converted into lipid-compatible molecular complexes called Phytosomes. Phytosomes are able to transits to lipid-friendly environment of enterocytes cell membrane and from there into cell, finally reaching the blood. Soya Phosphatidylcholine a lipid compatible substance forms phytosome complex with Silymarin flavonoids to give a phytosome, a hybrid molecule that is more bioavailable. Silybin-phosphatidylcholine complex on one hand protect the liver by conserving glutathione in the parenchymal cells and on other hand, helps repair and replace cell membrane [11].

Haddad and colleagues evaluated the effects of an oral administration of silibinin-phosphatidylcholine complex (silibinin 200 mg/kg) given to HFD-fed rats in controlling NASH [12]. There is no prominent study on effect of Silymarin-phosphatidylcholine Phytosome complex on

broiler growth performance and carcass traits. Therefore, a study is conducted to evaluate the effect of polyherbal formulation containing Silymarin-phosphatidylcholine Phytosome complex on broiler performance and various carcass traits.

Materials and Methods

Experimental Design and Diets

The present experiment was conducted during the month of October to November, 2019 at Poultry Advisory and Technical Service Farms, Sohana, Gurgaon, Haryana, India. A total of 360 day old Vencobb-430 broiler chicks belonging to single hatch were purchased from local hatchery, wing banded, weighed and randomly distributed into on the basis of Live Weight (LW) in pens on litter following a completely randomized design. A single pen measured 1.2 m x 1.2 m and each of the pens was equipped with individual feeders and drinkers. There were three treatments with six replicates of twenty chicks each. Feed and water were provided ad libitum for all the chicks. Lighting was given continuously for 24 h during the first 7 days followed by 20 h a day till the termination of the experiment. Temperature in the room was maintained around 30-32°C with the help of gas brooders during the first 7 days of the experiment. Daily temperature and relative humidity was measured at hourly intervals with the help of data loggers installed at 4 corners of the room. The recordings of 24 h period were pooled together, and the daily maximum, minimum and mean temperature and relative humidity values were recorded. All the chicks were reared under standard managerial conditions throughout the experimental period in deep litter system. Iso nitrogenous experimental diets were prepared (Table 1) as per Bureau of Indian Standards (BIS, 2007) [4].

Three treatments were planned. Chicks were offered (i) T₀-basal diet without choline supplementation (ii) T₁-basal diet supplemented with herbal formulation containing natural choline supplement at the rate of 500g per MT of feed (iii) T₂-basal diet supplemented with herbal formulation containing natural choline and silymarin phytosome complex supplement at the rate of 500g per MT of feed.

Table 1: Ingredients and chemical composition of broiler Pre starter, Starter and finisher diets (%)

Ingredients	PBS	BS	BF
	T ₀	T ₁	T ₂
Maize	50.71	50.66	50.66
Soya	41.8	41.8	41.8
Salt	0.5	0.5	0.5
Calcite	1.2	1.2	1.2
DCP	2.00	2.00	2.00
Crude Soya Oil	3.00	3.00	3.00
Methionine	0.32	0.32	0.32
Lysine	0.22	0.22	0.22
Vitamin Px	0.05	0.05	0.05
Mineral Premix	0.2	0.2	0.2
Natural Choline	0	0.05	0.05

Nutrient Composition (Calculated)

Parameter	PBS	BS	BF
Crude Protein (%)	23	23	23
Crude Fibre (%)	3.51	3.51	3.48
Ether Extract (%)	3.00	3.00	3.00
Metabolizable Energy (Kcal/kg)	3000	3000	3000

Vit Px(per kg): Vit A 11,500 IU; Vitamin D3 3000IU; Vitamin E 30mg; Vitamin K 1.5 mg; Vitamin B1 2.5mg, Vitamin B2 6.0mg, Niacin 40mg; Pantothenic acid 12 mg; Vitamin B6 5.0mg, Folic acid: 1mg; Vitamin B12 15 ug
Mineral Px(Per Kg): Mn 100mg; Zn 80mg Fe 80mg Cu 12mg Iodine 1.2 mg Se 0.15

Determination of Growth Performance

Cumulative Body weight of chicks and cumulative feed consumption were recorded weekly for each pen and mean feed conversion ratio was calculated.

Determination of Carcass traits

At the end of 42 days, two birds from each pen having BW close to the pen average was selected (12 birds each from each of the dietary treatments). The birds were mechanically stunned, manually slaughtered, and bled out, scalded (at 55°C with intermittent dipping for 20 seconds at a time) and picked up using a de-feathering equipment. The carcass was then manually eviscerated and rinsed. Chilling was not performed, and all measurements were done with hot carcass only. Dressing percentage was determined a percentage ratio of carcass weight and live weight. After sectioning into various commercial cuts breast and drumstick percentage weight was expressed relative to carcass weight. Additionally abdomen fat was weighed and its ratio to slaughter weight was calculated.

Statistical Analysis

Data were analysed using completely randomized design with one way analysis of variance as per the procedures of Snedecor and Cochran (1989) using statistical analysis software (IBM SPSS version 20.0 for windows).

Results and Discussion

Growth performance

The mean cumulative body weight is given in Table 2. There was significant difference ($p<0.05$) in cumulative body weight between treatment groups in all weeks of age except in first and second week of age. Feed containing herbal formulation of Silymarin-Phytosome complex (T_2) showed significantly higher body weight than T_0 and T_1 groups from 2nd to 6th weeks. The cumulative body weight of T_1 group is lower than T_0 in 5th and 6th week which indicates that T_1 natural choline source used may be having variations in sourced herbs. At 6th week of age highest cumulative body weight was recorded in T_2 group (2699g) followed by T_0 group (2613g) and T_1 group (2586 g). Results of this experiment agreed with Gabriel, *et al.* (2022) who revealed that the addition of herbal additive with natural choline and silymarin shows significant average final weight at finisher stage

Table 2: Mean cumulative body weight (g) of broilers in various periods

Period	T_0	T_1	T_2
Hatch weight	46.04±0.76	46.03±1.27	46.23±0.38
1 st week	174±3.10	175±2.87	174±2.91
2 nd week	436±2.26	454±2.87	466±2.94
3 rd week	764±7.21	762±5.65	885±8.21
4 th week	1308±12.56	1310±10.25	1386±11.23
5 th week	1932±25.26	1909±14.53	1984±16.28
6 th week	2613±12.54	2586±32.25	2699±28.47

Mean of 10 observations. Mean value sharing any one common superscript in a row did not differ significantly ($p<0.05$)

The mean cumulative feed intake was initially less for comparable in all treatments. After 4th week, there is significant increase in feed intake. T_2 has highest feed intake followed by T_0 and T_1 . High feed intake of T_2 can be due to effect of Phosphatidylcholine-silymarin complex and enriched herbs extracts on digestibility.

Table 3: Mean cumulative feed intake (g) of broilers in various periods

Period	T_0	T_1	T_2
1 st week	151±3.29	152±2.80	152±2.99
2 nd week	498±6.29	503±3.84	523±4.23
3 rd week	978±13.18	983±8.50	1041±11.10
4 th week	1727±25.16	1674±18.13	1708±20.35
5 th week	2610±54.21	2553±61.34	2600±52.16
6 th week	3887±90.24	3854±81.19	3883±56.29

*Mean of 10 observations

Mean value sharing any one common superscript in a row did not differ significantly ($p<0.05$)

The feed conversion ratio of T_2 group (1.44±0.02) is the best among all groups followed by T_1 (1.47±0.02) and T_0 (1.49±0.03).

Results further reinforce that bird's performance is enhanced by feed containing herbal formulation of Phosphatidylcholine-Silymarin phytosome complex (T_2).

Table 4: Mean feed conversion ratio of broiler in various periods

Period	T_0	T_1	T_2
1 st week	0.87±0.03	0.87±0.01	0.87±0.03
2 nd week	1.14±0.02	1.10±0.02	1.12±0.01
3 rd week	1.28±0.02	1.29±0.03	1.18±0.02
4 th week	1.32±0.04	1.28±0.02	1.23±0.03
5 th week	1.35±0.03	1.34±0.04	1.31±0.01
6 th week	1.49±0.03	1.49±0.02	1.44±0.02

Mean of 10 observations ($p<0.05$)

Carcass traits

The effects of supplementing herbal formulation containing natural choline and silymarin phytosome complex on carcass parameters are given in Table 5. The data revealed that there is no significant difference ($p>0.05$) noticed in dressing percentage, breast meat percentage and drumstick percentage and abdominal fat percentage among treatment groups. Numerically Similar dressing percentage was noticed in T_2 (63±0.03) and T_1 group (63±0.01) followed by T_0 group (61±0.03). Breast meat percentage is highest among T_2 (25.02±0.01). Drumstick percentage is almost similar in all groups. Abdomen fat% is lowest in T_2 (1.25±0.03) and highest in T_1 (1.35±0.02). Similarly, results were observed by Ramalho *et al.* [13] (2024).

Table 5: Mean value of slaughter studies of broiler chickens (%)

Trait	T_0	T_1	T_2
Dressing%	61±0.03	63±0.01	63±0.03
Breast%	24.17±0.02	24.71±0.02	25.02±0.01
Drumstick%	0.81±0.02	0.82±0.03	0.82±0.02
Abdomen fat%	1.89±0.04	1.35±0.02	1.25±0.03

Mean of 12 observations ($p>0.05$)

Conclusion

The results shows that herbal formulation containing phytosome complex of choline and Silymarin has prominent effect over using herbal formulation with only natural phosphatidylcholine source. It improved bird's growth

performance and yield better or almost similar carcass traits due to its better bioavailability.

Conflict of Interest

The Authors declare no conflict of interest

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