

Exploring the Differential Effects of Synthetic Choline and Herbal Choline on Hepatic Lipid Metabolism in Broiler Chicken

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Abstract: *This study examines the effects of synthetic and herbal choline sources on hepatic lipid metabolism in broiler chickens. One hundred - and fifty - day - old Ven Cobb broiler chickens were observed over 42 days. They were randomly divided into three groups: a control group without additional choline chloride and two treatment groups. The control group received feed without added choline chloride. One treatment group was fed with feed containing a herbal product (NATU CHOLINE® DS by Rivansh Animal Nutrition Pvt Ltd, Paonta Sahib India) at a rate of 150 gm/tonne of feed, while the other treatment group received a combination of synthetic choline chloride at 1kg/tonne (60%) and biotin at 150 mg/tonne of feed. Serum triglycerides and cholesterol levels were measured on days 21 and 42 to assess hepatic lipid metabolism. Gross pathological changes in the liver were observed in representative birds from each group at the end of the study. Results showed that both synthetic and herbal choline sources led to reduced cholesterol and triglyceride levels compared to the control group, indicating a decrease in fatty liver occurrence. However, there were no significant differences observed between the two treatments. Gross pathological examination of the liver revealed no noteworthy alterations compared to the control group, suggesting that herbal supplements could potentially replace synthetic counterparts in broiler diets.*

Keywords: Broiler chickens, liver, Natu Choline DS®, Synthetic choline, Herbal, Natural, Lipid Metabolism

1. Introduction

Indian broiler chicken industry is a key contributor to the country's agricultural economy and plays a crucial role in meeting the growing demand for protein - rich food products.

The Indian poultry industry has been experiencing significant growth over the past few decades. It is estimated to be worth billions of dollars and continues to expand due to rising demand for poultry products such as chicken meat and eggs.

Choline is crucial in poultry nutrition, aiding growth, performance, and lipid metabolism regulation (Attia et al., 2005). Herbal choline, often derived from plants like soybeans, can be used as a supplement in broiler chicken feed to support their growth and development. Choline is an essential nutrient for poultry, playing crucial roles in metabolism, nerve function, and the structural integrity of cell membranes.

Incorporating herbal choline into broiler chicken diets can help ensure that they receive adequate levels of this important nutrient. It's often used to promote optimal growth, improve feed efficiency, and support overall health in poultry production.

It helps prevent fatty liver syndrome by modulating lipid metabolism. Choline, along with SAME, combats fatty liver disease, particularly in aged birds. Despite its importance, concerns about residues and effects prompt efforts to regulate synthetic supplements. This study aims to compare synthetic and herbal choline sources' impacts on hepatic lipid metabolism in broilers.

2. Materials and Methods

The study involved 150 - day - old Ven Cobb broiler chicks at Berwal Poultry Farm, Saharanpur, India.

- 1) Experimental birds and management:** Chicks were randomly divided into control (A⁰) and two treatment groups (A¹, and A²), each with 50 birds and 4 replicates. Control group received (A⁰) basal broiler starter and grower feed without added choline chloride. Treatment A¹, received Phyto additive NATU CHOLINE® DS[at]150 gm/tonne of feed, while A², received synthetic choline (60% pure)[at]1 kg/tonne of feed with Biotin[at]150mg/tonne from day 0 - 42. Birds were reared under standard conditions with ad - libitum feeding and watering. NATU CHOLINE® DS is a polyherbal formulation including Soy lecithin, Azadirachta indica, Tachyspermum ammi, Andrographis Paniculata etc mimicking choline's action.
- 2) Biochemical Analysis:** Serum biochemicals were analyzed in ten birds from each group. Serum samples were collected and stored at - 20 °C until analysis. Cholesterol and triglyceride levels were measured using Automatic Biochemical Analyzer. The methodology and the set of reagents used in respect of each parameter were as per the recommendations of the manufacturer of the analyser system.
- 3) Gross pathological examination:** Conducted on ten birds per group at the study's end.

3. Results and Discussion

Serum Cholesterol: The mean values of serum cholesterol in chicks of group A, at 21* day interval were significantly (P=0.05) higher (126.70 ÷ 4.51) than the mean values of

chicks in group T, & T, (119.50 + 2.55 and 106.702.18) respectively (table). On comparison of the mean values of within treatment groups, it was observed that the mean values were at par within the treatment groups at this interval. At 42nd day of study, the trend of mean cholesterol levels appears to be similar as at 21st day interval.

Table 1: The mean serum cholesterol values (gm/dl) for each group at both 21st and 42nd days into the study

Groups	Day 21 st	Day 42 nd
A ⁰	130.70	145.70
A ¹	122.50	124.50
A ²	108.70	117.90

Table 2: The mean serum triglyceride values (mg/dl) for each group at both the 21st and 42nd days of the study.

Groups	Day 21 st	Day 42 nd
A ⁰	155.40	146.00
A ¹	125.40	110.30
A ²	93.40	75.90

The significant (P=0.05) reduction in the mean values of serum cholesterol level in chicks of treatment groups was observed. Control group A⁰ (145.70) had higher mean value than treatment groups A¹ & A² (124.50 and 117.90), respectively, after 6th week. The addition of choline chloride (herbal/synthetic) in the diet of poultry significantly contributed in reducing cholesterol & regulating the fat metabolism in broilers.

Supplementation of herbal choline can replace synthetic choline and biotin as evident by the comparable hypocholesterolaemia effect produced by the two groups. The results in the present experimental study are like that observed by Kulinski et al., (2004), that deficiency of choline in ration exerts a hypercholesterolemic effect inhibiting the phosphatidylcholine synthesis in hepatocytes, thus causing fatty liver.

Serum Triglyceride: Mean values of serum triglycerides (mg/dl) in different groups of chicks at different interval are depicted in Table 2. It was observed that the serum triglycerides in chicks of all groups at 42 day intervals of study were at par with each other, but the mean values serum triglyceride in chicks of group A⁰ were numerically higher than the mean values of all treatment groups. At 21st day interval of study serum triglycerides (mg/dl) in group A¹ (125.40) and group T² (93.40) did not differ significantly with each other. However, serum triglyceride levels in chicks of group A⁰ (155.40) were significantly (P=0.05) higher than the levels in chicks of both the treated groups. From the data, it can be concluded that in chicks of group A⁰, fed diet without any supplementation of choline/herbal source of choline, there was not complete protection to the liver.

The results in the present study are in confirmation with those reported by Lombardi et al., (1968) that choline deficient rats suffered from fatty liver due to an impaired release of hepatic triglycerides into plasma indicating the role of choline in regulating lipid metabolism.

Gross pathological studies: The gross pathological examination of chicks of different groups when conducted did not showed any appreciable changes at 21st day interval of

study period at 42nd day interval the chicks of group A⁰ on gross pathological examination revealed hepatomegaly with occasional necrotic foci in 10 chicks.

In few numbers of chicks, the pectoral muscle showed focal minimal petechial haemorrhages indicative of dehydration whereas, the chicks of group A¹ & A² did not showed any appreciable gross changes.

It was observed that the chicks in groups A¹ & A² did not showed any haemorrhages possibly could be due to addition of herbal product which might have protected the birds from the dehydration condition even after their exposure to summer stress, indicative of beneficial effects of the product used.

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