Effects of Lipotropic Products on Productive Performance, Liver Lipid and Enzymes Activity in Broiler Chickens

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Abstract
In a 42-d experiment, 576 one-day-old Vencobb 308 broiler chicks were used to investigate the effects of lecithin extract (0.5 g/kg), choline chloride 60% (1 g/kg) and Bio choline (1 g/kg) in diets of moderate and high energy in a 4 × 2 factorial arrangement on performance and certain physiological traits in broiler chickens. The inclusion of Bio choline and lecithin extract in the diet significantly increased average daily gain and improved feed conversion ratio in overall (1 to 42 d) period (P < 0.05). Performance efficiency index was improved in the birds fed with Bio choline compared to those fed control diet. Broilers fed diets containing Bio choline and lecithin extract had less abdominal fat percentage than those fed choline chloride or control diet. Regardless of dietary energy level, supplementation of diet with Bio choline, choline chloride and lecithin extract significantly decreased liver lipid concentration (P < 0.05). Aspartate aminotransferase activity increased in the serum of broilers fed high energy diets while it was decreased in the birds received diets containing choline chloride. Lipotropic compounds decreased serum aspartate aminotransferase activity in the birds fed on high energy diets. The addition of Bio choline and lecithin extract to diet significantly decreased serum γ-glutamyltransferase activity (P < 0.05). Results of the present study revealed that dietary supplementation of commercial lipotropic compounds could remove potential detrimental effects from high energy diets through reducing liver fat and maintaining liver health.

Introduction
The use of high energy diets aim at shortening the rearing period may increase metabolic disorders such as fatty liver syndrome (FLS) in broiler chickens (Leeson et al., 1995). Increased abdominal fat pad (Corduk et al., 2007), the incidence of leg problems (van Emous et al., 2015) and hypertension (Gopi et al., 2014) are some other detrimental responses associated with high energy diets (Buyse et al., 2001). Fatty liver syndrome is a condition that generally affects fast growing broilers fed high energy diets and caged layers with an inadequate chance to move and exercise freely (Jiang et al., 2013). FLS is described as a metabolic disorder caused by a deficiency of methyl group donors in feed and decreased gluconeogenesis in the
Liver due to biotin deficiency in commercial chicken (Jiang et al., 2013). Death may be triggered by insufficient levels of the key biotin-dependent enzyme pyruvate carboxylase. Therefore, the inclusion of choline and biotin in commercial poultry diets may noticeably reduce the risk of FLS in birds.

Many studies have revealed that broiler health and performance and in a broad sense economy of production could be influenced by dietary supplementation of commercially available herbal and synthetic choline-containing compounds or lipotropic feed additives (Gujral et al., 2002; Singh et al., 2003; Waldroup et al., 2006). Dietary suplements of such compounds provide an effective nutritional strategy to decrease the adverse metabolic consequences of a high energy diet in broiler chicken (Leeson and Summers, 2005). Lipotropic agents are compounds serving broiler chicken to efficiently utilize the high energy diets (Corduk et al., 2007). These additives may also decrease fat deposition in liver, in part, due to stimulating the liberation of lipids from liver (Wen et al., 2014). However, different lipotropic agents may exert dissimilar metabolic supports in broiler depending on diet composition, bird’s metabolic status as well as environmental conditions (Azadmanesh and Jahanian, 2014). Research on the efficacy of lipotropic agents for efficient utilization of high energy diets are not scanty but provide contradictory and confusing results, thus warranting further characterization of the broilers performance and liver function with the dietary administration of different lipotropic agents. This study was conducted to evaluate the responses in liver function and productive performance to dietary supplementation of three commercial lipotropic compounds in broiler chickens fed diets with moderate and high energy levels.

Materials and Methods

Birds and diets

Five hundred seventy-six one-day-old Vencobb mixed-sex broiler chicks were randomly allocated to eight experimental groups, comprising of four replicates of 18 birds. The birds were reared in floor pens furnished with rice husk in a grow-out broiler house under standard management practices. The environmental temperature was kept about 32°C during the first week and then gradually reduced by 2°C weekly to reach about 24°C during the fourth week. A 1 : 23 darkness to lighting regimen was followed throughout the experimental period. Two corn-soybean basal diets with moderate and high energy levels were formulated based on Vencobb breeder company recommendations for starter (1 to 14 days) and grower (15 to 42 days) periods in broiler chicks. Chemical composition and the proximate analysis of the experimental diets are shown in Table 1. Each basal diet was supplemented with lecithin extract (0.5 g/kg), choline chloride 60% (1 g/kg) and Bio choline (1 g/kg) and provided to the birds in mash form for ad libitum consumption. All the lipotropic additives were provided from Peekay Agencies Pvt. Ltd. Kolkata - 700071, West Bengal, India, and supplemented in the diets based on the doses recommended by the company.

Growth performance

Considering pen as the experimental unit, data on body weight (BW) and feed intake (FI) were collected weekly for starter and grower periods and data were used to calculate average daily gain (ADG), average daily feed intake (ADFI), and feed conversion ratio (FCR). Mortality was recorded upon occurrence. Performance efficiency index (PEI) was calculated based on the following equation: PEI= [(LW × S) / (FCR × AS)] × 100, where LW is live weight (kg), S is survival rate (%), FCR is feed conversion ratio and AS is age of slaughter (day) (Euribrid, 1994).

Blood and carcass measurements

At 42 d of age, 5 mL blood were collected from four birds in each replicate by the brachial vein puncture in non-heparinised tubes and kept on slush-ice until they were subjected to serum collection by centrifuging the whole blood sample at 2,500 × g for 10 min. The serum samples were analyzed for activity of γ-Glutamyltransferase (GGT, E.C.2.3.2.2), and aspartate aminotransferase (AST, E.C.2.6.1.1) (as the indicators of liver health) using the Express Plus (Ciba-Corning Diagnostics Corp., Medfield, MA) automated clinical chemistry analyzer according to the manufacturer’s directions (Elliott, 1984).

Four randomly selected birds from each replicate were sacrificed by cervical dislocation at day 42 of age to collect the data on carcass yield (%) and abdominal fat percentage. Liver total lipids were measured in all the sacrificed birds using the method of Folch et al. (1957).