EFFECT OF BILE ACID SUPPLEMENTATION ON GROWTH PERFORMANCE OF BROILER CHICKEN

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Abstract
A trial was conducted to determine the effect of bile acid supplementation on the growth performance indices of broiler chickens. Two hundred and Forty day-old chicks were randomly allocated to three experimental treatments of 0g (T_1), 100g (T_2), and 200g (T_3) of powdered synthetic bile acid per tonne of commercial broiler rations at both starter and finisher phases. Necessary prophylactic and vaccination procedures were observed, while water and feed were provided ad libitum for the eight-week duration of the experiment. Results obtained at the starter phase showed the highest feed intake per bird in T_3 followed by T_2, both being significantly higher ($P<0.05$) than in T_1. The average weight gain per bird followed a similar trend, while T_2 gave the best feed conversion ratio. However, at the finisher phase, the feed intake followed the same trend as that in the starter phase, but without commensurate improvement in weight gain. Also, the feed conversion ratio did not favour any supplementation with bile acid. It can therefore be concluded that bile acid supplementation was favourable to growth performance indices of the birds at starter phase only, but not further. It is recommended that synthetic bile acid should be utilized only at the starter phase in broiler chicken production.

Key words: bile acid, supplementation, growth performance, broiler chicken

Introduction

Most commercial broilers reach slaughter weight between four to seven weeks of age, although slower growing breeds reach slaughter weight at approximately 14 weeks of age (Ahmad, 2004).Bile acids are steroid acids found predominantly in the bile of mammals and other vertebrates. Bile or gall is a dark green to yellowish brown fluid, produced by the liver of most vertebrates, which aids the digestion of lipids in the small intestine (Barret, 2012). Bile or gall acts to some extent as a surfactant, helping to emulsify the lipids in food. Bile acids are steroid acids found predominantly in the bile of mammals and other vertebrates. Different molecular forms of bile acids can be synthesized in the liver by different species (Hagey and Hofmann, 2010). Bile acid synthesis occurs in liver cells which synthesize primary bile acids, cholic acid and chenodeoxycholic acid. Approximately 600mg of bile salts are synthesized daily to replace bile acids lost in the feaces, although much larger amounts are secreted, re-absorbed in the gut and recycled. Primary bile acid is synthesized by the liver. Secondary bile acids result from bacterial actions in the colon (Hofmann *et al*., 2010). Bile acids can also be synthesized commercially and used in nutrition studies. As surfactants or detergents, bile acids are potentially toxic to cells, and so their concentrations are highly regulated.Bile acid-containing micelles aid lipases to digest lipids and bring them near the intestinal brush border membrane, which results in fat absorption (Hofmann and Borzstrom, 1962). Bile acids have other functions including eliminating cholesterol from the body, driving the flow of bile to eliminate certain catabolites including bilirubin, emulsifying fat soluble vitamins to enable their absorption and bacterial flora found in the small intestine and biliary tract.The quantity of bile acid in broiler chicken bile may not be enough to emulsify the fats in the feed which calls for the need of synthetic bile acid to help convert the feed to flesh effectively, especially during the early stages of growth. This experiment could provide some insight on the effect of the use of synthetic bile acid on some growth performance parameters of broilers chickens. Lower concentrations of bile acids or phospholipids in bile reduce cholesterol solubility and lead to microcrystal formation. Excess concentration of bile acids in the colon causes chronic diarrhea.

Materials and Methods

The trial was carried out at the training and research farm of Federal College of Animal Health and Production Technology, National Veterinary Research Institute, Vom, Plateau State.240 day-old birds were randomly allocated to three treatments with 80 birds per treatment, further subdivided in to 4 replicates of 20 birds each in a Completely Randomized Design (C.R.D).The birds in treatment 1 (T_1) were fed diets with zero bile acid while birds in treatment 2 (T_2) were fed diets containing 100g of bile acid per tonne of feed, birds in treatment 3 (T_3) were fed diets containing 200g of bile acid per tonne of a commercial broiler starter and finisher feed respectively. The experiment lasted for 8 weeks. Routine vaccination of the experimental animals was strictly adhered to in the course of the study. Feed and water were provided *ad libitum.*Daily feed consumption was measured as the difference betweenthe quantity supplied and the remnant. Live weights of the birds were measured weekly in grammes using sensitive weighing scale. Daily feed intake, daily weight gain, total feed consumed and feed conversion ratio were computed for each treatment. Data obtained from the study were subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1980). Duncan's Multiple Range Test (Duncan, 1955) was used to separate the means.

Results and discussion

Table 1: Effect of bile acid supplementation on growth performance of broiler starter chicken

Bile Acid Parameters	T_1 0g/tonne	T_2 100g/tonne	T_3 200g/tonne
Initial live weight/bird (g)	84	84	84
Final live weight/bird (g)	258.38	487.56	419.93
Total feed intake/bird (g)	1150.66^{b}	1531.75^{a}	1689.43^{a}
Total weight gain/bird (g)	520.31^{b}	875.01^{a}	904.39^{a}
Feed Conversion Ratio	2.73	1.75	1.86

^{abc}: means with different superscripts are statistically significant at 5% level.

Table 2: Effect of bile acid supplementation on growth performance of broiler finisher chicken

Bile acid Parameters	T_1 0g/tonne	T_2 100g/tonne	T_3 200g/tonne
Initial live weight/bird (g)	258.38	487.56	419.93
Final live weight/bird (g)	875.94	1197.97	1058.37
Total feed intake/bird (g)	2052.24	2104.12	2322.07
Total weight gain/bird (g)	716.15	635.42	588.90
Feed Conversion Ratio	2.86	3.31	3.94

^{abc}: means with different superscripts are statistically significant at 5% level.

Data oneffect of bile acid supplementation on growth performance of broiler chicken are presented in Tables 1 and 2for the starter and finisher phases respectively. Initial live weight of birds was 48g for T_1, T_2 and T_3 at the starter phase.Average initial live weights were 258.38 for T_1, 487.56 for T_2 and 419.93 for T_3 respectively at finisher phase.Data for average final live weight of the birds for the starter and finisher phases are presented in Table1 and Table 2 respectively. The data show that average final live weight (g) per bird at starter phase was 258.38 for T_1, 487.56 for T_2 and 419.93 for T_3. Birds in T_3 had the highest final live weight followed by birds in T_2,while birds in T_1 had the lowest final live weight. The lowest live weight in T_1 could be due to the fact that their diet contained no bile acid supplement. However, statistical analysis showed no significant difference among the treatment means ($P>0.05$). At the finisher phase, the highest average final live body weight per bird (g)was observed in T_2 (1197.97g), followed by T_3 (1058.37g), while the lowest was observed in T_1 (875.94g). There was no significant difference among these means. This result agrees with that of Adesina *et al*. (2006) that increase in dietary level of enzymes treated-fibre diet allowed chicks to exhibit better feed utilization which also translated into heavier body weight.This could be attributed to improved digestibility of the diets supplemented with bile acid.

For average feed intake (g) per bird at the starter phase, results were: T_1 1150.66, T_2 1531.75 and T_3 1689.39 while at the finisher phase they were: T_1 2052.24, T_2 2104.1 and T_3 2322.07. Birds in T_3 had the highest average feed intake, followed by birds in T_2 while birds in T_1 had the lowest feed intake. This could be attributed to non supplementation of diet in T_1 with bile acid,while dietsT_2 and T_3 had bile acid supplementation. The increase in feed intake is T_2 and T_3 over that of T_1(control) could be attributed to better digestibility offered by the diets supplemented with bile acid. This agrees with submission of Adesina *et al*. (2006) that enzyme supplementation enabled chicks to exhibit better feed utilization.

For average weight gain (g) per bird at the starter phase: T_1 420.31, T_2 875.01 and T_3 904.39, while the average weight gain(g) for finisher phase were: T_1 716.15, T_2 635.42 and T_3 588.20. Birds in T_3 had the highest weight gain of 904.39, at starter phase, followed by birds in T_2 with 875g/bird while birds in T_1 had the lowest weight gain of 420.31g/bird. The weight gain of birds in $T_3$and T_2 were statistically similar, but higher than that of birds in T_1 ($P<0.05$).This could be attributed to the supplementation of the diets in T_2 and T_3 with bile acid.Adesina *et al*. (2006) observed better feed utilization to be positively related to heavier body weights.

The feed conversion ratio of birds at the starter phase were: T_1 2.73, T_2 1.75 and T_3 1.86; while at the finisher phase were as follows: T_1 2.86, T_2 3.31 and T_3 3.94. Birds in T_2 had the best feed conversion ratio at starter phase, while birds in T_1 had the best conversion ratio at finisher phase. The implication here is that bile acid supplementation seemed not to be positively related with feed conversion at the finisher phase.Feed conversion ratio (FCR) is a measure of how well a flock converts feed intake, a measure of management performance and also profit at any given feed cost. Nesheim*et al*. (1979) had earlier listed the ability to digest nutrients the feed contain among factors influencing feed conversion. Tsado*et al*. (2019) observed that feed efficiency values of enzyme treated diets were superior and significantly higher than those of the control diet; also, birds in treated diets had a similar level of feed efficiency. Adedeji*et al*. (2019) also observed that the lower the feed conversion ratio value, the better the feed utilization. Ogbonna*et al*. (2000)submitted that the higher the feed conversion ratio, the poorer the diet. Therefore diet T_2 and T_3 appeared to be superior to T_1 due to their supplementation with bile acid.

Conclusion and Recommendation

Based on the findings of the trial, it is obvious that supplementation of bile acid in broiler starter diets improved both feed intake and weight gain especially at the starter phase. Also at the finisher phase, there was an increase in feed intake, but without corresponding significant improvement in weight gain of the birds.It is recommended that poultry farmers could use synthetic bile acid as supplement to improve feed conversion ratio and weight gain of broiler chickens at starter phase, but not at the finisher phase since it does not confer any advantage on the productivity of both birds and the farmer.

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