Inclusion of a locally produced animal performance supplement in broilers' ration

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Sustainable livestock production which is highly dependent on the availability of quality feed has been the focus of research recently. The present study aims to evaluate the partial replacement of maize and other ingredients with a locally produced Animal Performance Supplement in broilers' rations. Fifteen broiler chicks divided into three groups of 5 chicks each (n=5) and subjected to formulated livestock feeding for four weeks were used for the study. At the end of the study period, venous blood was collected and assayed for the activities of alkaline phosphatase (ALP), alanine aminotransferase (ALT) and aspartate aminotransferase (AST). The inclusion of animal performance supplement reduced the amount of maize required and eliminated the use of lysine, methionine, vitamins/minerals premix, bone meal, limestone, and dicalcium phosphate. Results obtained showed that the animal performance supplement enabled the chicks to convert the complex hemicelluloses in wheat offal and palm kernel cake into digestible sugars. This is further confirmed by the increase in weight gain of birds at the end of the study. In addition, no significant change ($p>0.05$) was recorded in the activities of AST, ALT and ALP of broiler chicks fed with the animal performance supplement when compared with standard control. Thus, the hepatocellular functions of broiler chicks fed with the formulated diets were not compromised. In conclusion, this study showed that animal performance supplement inclusion in feed resulted in birds with better performance wheat offal and palm kernel cake.

Key words: Animal performance supplement, maize, calcium, lysine.

INTRODUCTION

Livestock production forms an important part of the agricultural economy of most countries. Sustainable livestock production is highly dependent on the availability of quality feed of which how to provide a proper nutrition for livestock has been a major problem facing poultry farmers in Nigeria. Poultry production costs have continually increased because of the fluctuation prices of high-quality raw materials such as soybean and maize (Fróna et al., 2019; Marambe et al., 2020; Azizi et al., 2021). Several initiatives have been put in place, such as finding cheaper and locally available materials as partial substitutable protein and energy sources instead of soybean meal and maize in poultry feed formulations (Milazzo et al., 2013; Azizi et al., 2021). Various locally available and low-priced feedstuffs have been proposed but have not been satisfactorily acceptable for poultry and consequently used in small proportions (Sharmila et al., 2014). As a result of fluctuations in price and comparatively inadequate soybean meal supply, the discovery of alternative protein sources for poultry feeding diet has become a particular focus in the current scenario to decrease reliance on soybean meal and maize as the main ingredient of protein in poultry feeds.

Tropical regions have an abundant amount of palm kernel cake. The chemical composition of palm kernel cake differs depending on the kind of the fruits palm, source of sample and process of processing oil extraction (solvent or mechanical extraction) (Kini et al., 2020). The average chemical composition of palm kernel cake was 89.00 to 95.00% for dry matter and 6 to 24.9% for crude fibre, Also, acid detergent fibre being 43.7%, neutral detergent fibre being 66.7% and lignin being 21.1% of palm kernel cake, 0.5 to 3% for ether extract of solvent extracted palm kernel and 4.5 to 19.5% expeller pressed and 3.06 to 5.6% for total ash, which is considered an agro-industrial waste derived from the extraction process of oil from palm fruits (Onifade and Babatunde, 1998; Adesehinwa, 2007; Akinyeye et al., 2011). It has been used in poultry diets as an alternative to corn and soybean meal (Mohamed et al., 2021). Nevertheless, the use of palm kernel cake is limited in monogastrics because of its high content of fibers, coarse texture, and non-starch polysaccharides (Sharmila et al., 2014; Alshelmani et al., 2014; Tonukari et al., 2016). The main non-starch polysaccharides in the palm kernel cake are mannan, xylan, arabinoxylan, and glucoronoxylan (Alshelmani et al., 2013). This is considered a significant issue encountered by nutritionists, and has limited the use of palm kernel cake for feed formulation (Mohamed et al., 2021). It has been reported that 10% is the maximum level of palm kernel cake that can be given to broiler chickens (Alshelmani et al., 2016). However, solid-state fermentation by cellulolytic bacteria may improve the nutritive value of palm kernel cake to be incorporated up to 15% in the diet. The treated palm kernel cake by enzyme, cellulolytic bacteria via solid state fermentation extrusion may contribute to improving the nutritive value and poultry performance. The non-starch polysaccharides are found to be the main reason for increasing the viscosity in the small intestine of the birds, and hence lead to increased moisture content of the excreta. Hence, the productivity and health status of the chickens could be affected.

Enzymes are the most important and useful additives in the animal feed industry. Studies suggest that multienzyme preparations may provide a feasible approach to develop nutrient utilization in livestock/poultry diets (Cowieson et al., 2006; Selle and Ravindran, 2007; Egbune et al., 2021). A multi-enzyme preparation with cellulolytic and proteolytic activity can degrade the structural polysaccharides and proteins. The application of enzymes may result in additive, subadditive, or synergistic effects on nutrient utilization and livestock growth/production (Juanpere et al., 2005; Ravindran et al., 1999).

Animal performance supplement is a novel product manufactured by Harmony Path Ltd. in Nigeria. According to the manufacturer, animal performance supplement is rich in enzymes including amylase, cellulase, glucanase, lipase, mannanase, pectinase, phytase, protease and xylanase. It also contains vitamins, calcium and other minerals, probiotics, lysine and methionine. The use of active enzymes against non-starch polysaccharides, the structural polysaccharides of plant cell walls and storage polysaccharides of some legume seeds is now an established part of the feed industry (Venkidasamy et al., 2019; Moughan, 2018). Thus, the present study aims to evaluate the partial replacement of maize and other ingredients with animal performance supplement in broilers' rations.

MATERIALS AND METHODS

Experimental design

Fifteen broiler chicks of a day-old were used for the study. The broiler chicks were of the traditional white Cornish breed (Cornish White × White Plymouth Rock), and were purchased from CHI Farms Ibadan, Oyo State. They were randomly allocated into three groups of 5 chicks each (n=5) and subjected to formulated livestock feeding for four weeks (Table 1). All birds were wing tagged and placed in pens with a deep litter of wood shavings, which were previously sterilized in an autoclave at 121°C for 20 min. All groups were kept in the specially designed experimental facilities of the Harmony Path Research Laboratory, Songhai Delta, Amukpe, Sapele, Delta State. The weights of the chicks were taken on day 1 of the experiment and also at the end of the fourth week, marking end of feeding period. The difference in weight (g) from weeks 1 to 4 was recorded as weight gained. Venous blood was collected using sterile syringes and needle from pronounced veins in the wings of

Table 1. Formulation of diets for the broiler chicks (kg).

Ingredient	A: Control	B: Feed with Animal Performance Supplement I	C: Feed with Animal Performance Supplement II
Maize	60	45	30
Wheat offal	4.48	9.7	19.7
Palm kernel cake	0	5	10
Soybean meal	30	30	30
Animal Performance Supplement	0	10	10
Bone meal	2	0	0
Limestone	2	0	0
Dicalcium phosphate	0.5	0	0
Lysine	0.25	0	0
Methionine	0.2	0	0
Premix	0.25	0	0
Enzymes	0.02	0	0
Salt	0.3	0.3	0.3
Total	100	100	100

the chicks and transferred into clean-test tubes. The blood was allowed to clot for some time and thereafter, dislodged and centrifuged at 2000 rpm for 10 min to obtain the serum as supernatant. The supernatants (sera) were safely stored at 4°C and used for biochemical analyses.

Analytical procedures

The biochemical impact of formulated feeds on poultry birds (Broiler chicks) liver function was evaluated. The liver function was characterized based on alkaline phosphatase (ALP), alanine aminotransferase (ALT) and aspartate aminotransferase (AST) activities in accordance with stated procedures in the diagnostic assay kits, respectively.

Statistical analysis

All data were subjected to statistical analysis. Values were reported as Mean ± Standard deviation. The experimental results were analyzed using analysis of variance (ANOVA), and a Fischer test of least significance (LSD) was performed to compare the various group means. The results were considered significant at p-values of less than 0.05, that is, at 95% confidence level ($p<0.05$).

RESULTS AND DISCUSSION

The inclusion of Harmony Path Ltd. animal performance supplement reduced the amount of maize required and eliminated the use of lysine, methionine, vitamins/minerals premix, bone meal, limestone and dicalcium phosphate. The results obtained for the partial replacement of maize and other ingredients with animal performance supplement in broilers' diet between 0 and 28 days showed that the inclusion of wheat offal and palm kernel cake (Table 1) in the diets as well as reduction in maize in the feeds with animal performance supplements I and II (Table 2) did not affect parameters analyzed for ALT, AST and ALP, excluding feed cost. The animal performance supplement enabled the chicks to convert the complex hemicelluloses in wheat offal and palm kernel cake into digestible sugars. Also, wheat offal and palm kernel cake have more proteins (approximately 14 to 16%, respectively) than maize (8 to 10%) (Azizi et al., 2021; Jiwuba et al., 2021). The enzymes in the animal performance supplement make these proteins, which are mostly unavailable previously because of strong bonds to lignin and hemicelluloses, to become soluble. The increased weight gain of birds on diets with animal performance supplement may have been as a result of the better degradation of the nutrients in the feed by enzymes, making them more available for utilization. Improved weight gain observed in this experiment also buttressed the findings of Zanella et al. (1999), who investigated the effect of a commercial enzyme cocktail containing xylanase, protease and amylase on performance

Table 2. Reduction of the regular feed ingredients (%).

Parameter*	A: Control	B: Feed with Animal Performance Supplement I	C: Feed with Animal Performance Supplement II
Reduction in maize (%)	0	25	50
Reduction in lysine (%)	0	100	100
Reduction in methionine (%)	0	100	100
Reduction in vitamins/minerals premix (%)	0	100	100
Reduction in enzymes (%)	0	100	100
Reduction in bone meal (%)	0	100	100
Reduction in limestone (%)	0	100	100
Reduction in dicalcium phosphate (%)	0	100	100

*The amount of soybean meal and salt was the same in all three groups. The reductions were compensated by adding inexpensive wheat offal and palm kernel cake.

of broilers fed corn-soybean based diets and found that enzyme supplementation improved body weight gain.

The weight gains of chicks fed formulated diet with replacement of maize and other ingredients with animal performance supplement are shown in Figure 1. Birds maintained on feed with animal performance supplement II (0.775 ± 0.1 kg) had significantly higher ($p<0.05$) weight gain when compared with the control group (0.65 ± 0.1 kg). Supplementation with animal performance supplement increases the value of nutritionally poor samples and lessens the difference between high- and low-quality samples of a specified feed ingredient. This improves the degree of accuracy of the ration formulation (Ravindran, 2013; Ojha et al., 2019). Another incentive for enzyme additions to feed is the release of micronutrients, such as the phosphates and other nutrients (e.g., iron, zinc, vitamins A, D, E, and K) from phytic acid with phytase (Greiner and Konietzny, 2006; Singh et al., 2016). Research has shown that enzyme supplementation certainly may have an effect on nutrient utilization. Because digestion has become more efficient and fewer amounts of undigested nutrients are reaching the lower gut, plus beneficial microbes altering gut flora, improves gut health (Owens and Basalan, 2016; Ojha et al., 2019). It has been reported that the combination of a carbohydrase enzyme with predominantly xylanase activity and a microbial phytase in wheat-based broiler rations provides complete benefits in terms of nutrients (protein and energy), utilization, and growth performance (Zduńczyk et al., 2020; Majeed et al., 2020; Musigwa et al., 2021).

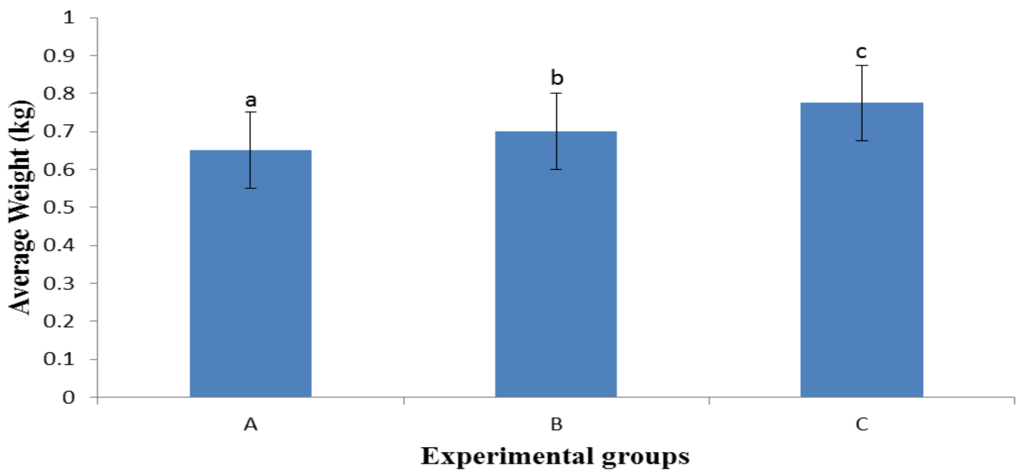

Figure 1. Average weight gain of chicks fed formulated diet with replacement of maize and other ingredients with Animal Performance Supplement. A: Control; B: Feed with Animal Performance Supplement having 25% maize replacement; C: Feed with Animal Performance Supplement having 50% maize replacement. Each bar is an expression of mean ± SD, an equivalent of five replications (n=5), and designation of each bar with different letters showed marked significant difference at p<0.05.

ALT, AST and ALP activities of broiler chicks fed with the control and animal performance supplement diets are as shown in Figure 2. No significant change (p>0.05) was observed for sera AST, ALT and ALP activities of broiler chicks fed with animal performance supplement when compared with the control. Scientific reports have shown that intense elevation of serum AST and ALT activities may be considered as factual biomarkers for hepatocellular damage while serum ALP activity is a primary bioindicator of hepatobiliary damage and cholestasis, respectively (Ezedom and Asagba, 2016; Lala et al., 2021; Oda and Yokoi, 2021). Consequently, the hepatocellular functions of broiler chicks fed with the formulated diets were not compromised. The results obtained from broiler chicks fed with this animal performance supplement hereby suggest it is safe for consumption.

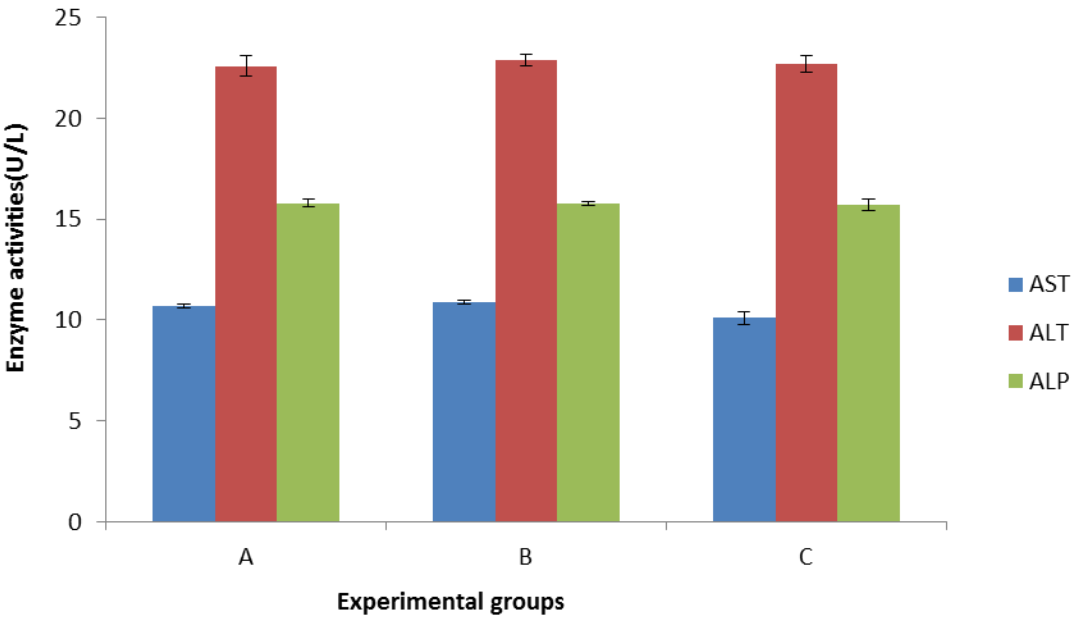

Figure 2. Alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) activities in the sera of chicks fed formulated diet with replacement of maize and other ingredients with Animal Performance Supplement. A: Control; B: Feed with Animal Performance Supplement having 25% maize replacement; C: Feed with Animal Performance Supplement having 50% maize replacement. Each bar is an expression of mean ± SD, an equivalent of five replications (n=5), and designation of each bar with different letters showed marked significant difference at p<0.05.

Conclusion

The inclusion of animal performance supplement reduced the amount of maize required and eliminated the use of lysine, methionine, vitamins/minerals premix, bone meal, limestone and dicalcium phosphate. The possible benefits of adding enzymes to feed which include improving nutrient utilization and animal performance are well accepted. Suitable use of enzymes in feeds results in strategic reductions in the expensive maize content. The locally produced animal performance supplement inclusion in the feeds resulted in birds with better growth performance.

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