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EVALUATION OF A COMMERCIAL PROPIOBITIC (BACTOFORT®) AS A REPLACEMENT FOR ANTIBIOTICS ON PERFORMANCE OF BROILER CHICKENS

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ABSTRACT

A feeding trial was conducted to evaluate the growth performance nutrient digestibility and carcass characteristics of broiler chickens fed varying levels of a commercial probiotic (Bactofort®) as replacement for antibiotics. A total of 255-week-old Ross broiler chicks were divided into five groups or 47 chicks per group and the groups assigned to five experimental diets containing 0, 25, 50 and 75g Bactofort® for T1-T4 respectively while T5 contained Oxytetracycline (AGP). Each treatment was replicated thrice in a completely randomized design (CRD) with 17 birds per replicate. Data obtained were subjected to analysis of variance using Statistical Analysis System and significant differences between treatments means were separated using Duncan Multiple Range Test. At the end of the starter phase, chicks fed the control diet had the best results in final weight (1161.20g/bird), weight gain (1034.70g/bird) and FCR (1.44) compared to chicks fed varying levels of Bactofort® in the starter phase. However, treatment group supplemented with 25g Bactofort® performed better in final weight (2524.94g/bird), weight gain (1334.52g/bird), TFI (3139.60g/bird) and FCR (2.36) compared to other treatments in the finisher phase. There were significant (P<0.0.5) differences in all apparent digestibility. Live weight, dressed weight, dressing percentage, prime cuts (drumstick, breast, back, wings), organs (kidneys, gizzard) and intestinal length were significant (P<0.05) across the treatment groups. Supplementation of Bactofort® at 25g/100kg of diet did not improve the growth of broiler chickens compared to the control at starter phase; it however significantly improved growth when compared to AGP at finisher phases.

Keywords: Antibiotic, Probiotics, Growth, Poultry

INTRODUCTION

Several feed additives like synthetic hormones and antibiotics have been extensively used as growth promoters for enhancing poultry production. Antibiotic growth promoters (AGPs) are routinely administered at lower doses than therapeutic to improve birds' performance (Kim *et al*., 2008) as result of improved feed efficiency (Peterolli*et al*., 2012). There has been an increase in frequency of drug residues present in commercial poultry products (Mensah et *al.*, 2011) as a result of the intensive use of antibiotics and anti-coccidiostats which is of growing concern to health-conscious consumers who prefer drug residue-free poultry products (Dakpogan*et al*., 2012). Thus, the use of probiotics as feed additives is better and safer for livestock production in general (Bidarkar*et al*., 2014) and specifically in poultry.

Probiotic species belonging to *Lactobacillus, Streptococcus, Bacillus, Bifidobacterium, Enterococcus, Aspergillus, Candida, and Saccharomyces* have a beneficial effect on performance (Ashayerizadeh, *et al*.2009), digestion and nutrient absorption (Alkhalf*et al*. 2010a), carcass yield (Kioumarsi, *et al*., 2012 and Peng e*t al*., 2016)of broiler chickens. Bactofort® is a multistrain probiotic that consist

of a fungal species - *Saccharomyces cerevisiae* (5trillion cfu/kg) and three other bacterial species - *Lactobacillus acidophilus* (77 billion cfu/kg), *Enterococcus faecium*(44 billion cfu/kg) and *Bacillus subtilis* (2.2 billion cfu/kg). Bactofort® has a well-established beneficial effects on gut environment that optimize the metabolic events in the gut, resulting in enhancement of digestion, absorption and subsequently, improvement in feed efficiency(Peng*et al*., 2016). The combined action of carefully selected probiotic such as Bactofort® is cited to help the bird to increase resistance to pathogens as well as establishing and maintaining a beneficial gut microflora through its synergistic action leading to iimprovements in growth performance which is attributed to enhance microflora activity of the intestine which enhanceincreased digestibility of nutrients, improved intestinal morphology, increased apparent metabolizable energy, decreased gut ammonia and immune system of broiler chicken (Peng*et al*., 2016).

The broad objective of this study therefore was to investigate the potentials of a commercial probiotic (Bactofort®) as replacement for antibiotics as growth promoters in broiler chickens production. The specific objective was to evaluategrowth performance, nutrient digestibility, carcass characteristics and economic advantage of broiler chickens fed diets containing graded levels of Bactofort®.

MATERIALS AND METHODS

Experimental Site

The experiment was conducted at the Poultry Unit of the Department of Animal Science Teaching and Research farm, Ahmadu Bello University, Zaria, Kaduna State. Zaria is in the Northern Guinea Savannah Zone, located on latitude $11^0$09' 01.78''N, longitude $07^0$39' 14.79''E with an altitude of 671m above sea level. The climate is characterized by well-defined dry and wet seasons with a mean annual rainfall ranging from 700-1400mm. Onset of wet season begins in late April or early May, peaks between July and August and ends in mid-October. This is followed by the Harmattan season which comprises of a cold and dry weather. The average minimum and maximum daily temperature vary from 14-24^{0}C during the cold season and 19-38.3^{0}C during the hot season. The relative humidity alternates between 19-35% in the dry season and 63-85% in the wet season, (Institute of Agricultural Research, Meteorological Unit, Ahmadu Bello University, Zaria, 2018).

Experimental design and management of birds

Two hundred and fifty - five (255) day-old broiler chicks of mixed sexes were assigned to five dietary treatments for group brooding for one week after which they were distributed on the basis of equal weight into three replicates per treatment with 17 birds each in a completely randomized design (CRD). The birds were housed in deep litter pens and all necessary routine management practices and vaccinations were observed. Water and feed were administered *ad libitum* for the 7 weeks experimental period.

Experimental Diets

Maize-soya beans cake based diets comprising of five treatments were formulated at both starter and finisher phases with Bactofort® added at the rate of 0, 25, 50 and 75g/100kg for treatment 1, 2, 3 and 4 respectively while treatment 5 contained 66g oxytetracycline (half of the manufacturer's recommendation) Table 1. Treatment 1 was formulated without antibiotics while Treatment 5 was formulated with the inclusion of antibiotics (oxytetracycline). The manufacturer's recommendation for Bactofort® is 250g/ton of feed.

Growth Performance

The initial and final weights of birds were taken at the inception and at the end of both the starter and finisher phases. Final weight, weight gain, average daily gain, feed intake, feed conversion

ratio (FCR) and feed cost (N/ kg gain) were determined on a weekly basis and FCR was calculated as feed intake/body weight gain. Mortality was recorded as it occurred.

$$FCR = \frac{\text{Feed intake}}{\text{Body weight gain}}$$

Nutrient Digestibility

Nutrient digestibility was determined at week 7 of the experiment. Three (3) birds were selected from each replicate and kept in individual cages for total faecal collection. Birds were allowed to adjust for five days in the cages while each of the birds was offered a known amount (200g) of feed daily during the digestibility trial. Water was given *ad libitum*. The total faecal droppings were collected using a faecal tray, dried and weighed over a period of five days. The dried faecal samples were subsequently oven-dried at 65^0c for 24 hours and then taken to the Biochemical Laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria for the proximate analysis using the standard methods of (AOAC 1990). The digestibility nutrient coefficient was calculated using the equation below:

$$\%\ \text{Digestibility of Nutrient} = \frac{\text{Amount of nutrient intake-Amount of nutrient output}}{\text{Amount of nutrient intake}} \times 100$$

Carcass Analysis

At the end of the 7^{th} week of the feeding trial, three birds from each replicate were used for the carcass analysis. The birds were fasted overnight in order to allow for the emptying of the gastro-intestinal tract (GIT) and weighed. The selected birds were slaughtered for carcass analysis by severing the neck with a sharp knife and allowed to bleed completely. They were then defeathered and eviscerated. The liver and gizzard, and the thigh and breast were weighed and expressed as percentages of the live body weight and the carcass weight respectively. The intestinal length was measured in centimeters. The dressed weights were taken and the dressing percentages computed.

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

Statistical Analysis

All data obtained from the experiment was subjected to analysis of variance (ANOVA) using the General Linear Model Procedures (GLM) of the Statistical Analysis Software package (SAS 2005). Significant difference between treatments means were separated using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

Growth Performance of Broiler Chicks (1-4weeks) fed Diets ContainingVarying Levels of Bactofort®

The results of the growth performance of broiler chicks fed different levels of Bactofort® during the starter phase is presented in Table 2. There were significant ($P<0.05$) differences in final weight, weight gain, feed intake, feed conversion ratio and feed cost/ kilogram gain. Birds fed the control diet and antibiotic growth promoter (AGP) had the best results in terms of final weight and weight gain compared to those fed varying levels of Bactofort®. However, experimental diets (25 and 50g Bactofort®) were similar to the control in final weight except for 75g Bactofort® which was significantly lower. Conversely, feed intake was higher in the experimental birds while FCR was best in the control group. This implies that the probiotic and antibiotic stimulated more feed intake which was however not commensurate to body weight gained. There was efficient utilization of feed consumed in the control group where FCR was the best. The results obtained from this study do not agree with the findings of (Kabir*et al.,* 2004) and (Anjum*et al*. 2005) who reported that supplementation of probiotic in diets improved weight gain, feed conversion ratio and feed efficiency of broiler chicks. Also, (Anjum*et al*.,2005) when comparing birds on a control

diet and others fed diets supplemented with Bactofort® (0.25g/kg feed) concluded that chicks fed with Bactofort® showed a significant +7.09% improvement in average body weight, while a lower mortality rate of 45.9% was recorded in the Bactofort® group. The disagreement with these findings may be attributed to the difference in location where this study was carried out, breed/source of the birds and source of the feed ingredients used. Feed cost per kg gain was best in the control group (₦191.10kg) which means the cost of producing one kilogram of meat was cheaper than Bactofort® and AGP group. Mortality was not significantly different (P>0.05).

Growth Performance of Broiler Chickens (5-7weeks) Fed Diets ContainingVarying Levels of Bactofort®

Table 3 shows the growth performance of broiler finisher chickens fed different levels of Bactofort®. The final weight, weight gain, feed intake, feed conversion ratio and feed cost/kg gain were significantly different among the treatment groups. Broiler chickens fed control and Bactofort® levels had significantly higher final weight and weight gain compared to those fed antibiotics. The result shows that supplementation of basal diets with probiotics exerted little or no effect on the growth performance of broiler chickens when compared to the control; however, significantly improved growth performance when compared to AGP. (Mountzouris*et al*.,2007) and (Lee *et al*.,2010) reported that dietary probiotics had little or no effects on the growth performance of broiler chickens. However, there was trend of a higher final weight and weight gain of birds fed 25 and 50g Bactofort® inclusion compared to other treatment groups and better FCR compared to the control. Birds supplemented with 25 and 50g Bactofort® levels had higher feed intake than the control thereby implying that the probiotic was more palatable and stimulated more feed intake which was efficiently converted to meat. FCR was improved in Bactofort® fed broiler chickens though not significantly different compared to the control. Better FCR may be a function of increased efficiency of digestion and nutrient absorption processes as a result of the presence of probiotic bacteria in the feed (Alkhalf*et al*., 2010b). However, similar results can be obtained with birds fed control diet in a disease-free condition. Oxytet (AGP) treated group had the least performance and this could be attributed to poor feed efficiency.

Furthermore, the similarity in body weight gain, feed intake and FCR of broiler chickens fed 25, 50 and 75g Bactofort® with the control were in harmony with the findings of (Olnood*et al*., 2015) who carried out a research to evaluate the effects of feeding a multiple strain probiotic on growth performance, gut development and microbial population of broiler chickens in which insignificant effects on body weight gain, feed intake and feed conversion ratio during both starter and finisher phases of the experiment were reported. Likewise (Ergun *et al*.,2000) reported that multiple strain probiotics (Protexin™) had no effect on feed intake and growth performance of broiler chickens. However, (Alkhalf*et al*., 2010b) reported a significantly higher final weight, weight gain and FCR when *Allium cepa* based diet (200g/100kg) supplemented with 45g Bactofort® was fed to broiler chickens compared to the control. This disparity in result may be due to the combination of the prebiotic (*Allium cepa*) with the Bactofort® in the diet.Feed cost per kg gain was best in birds fed 25g Bactofort® which makes it cheaper and has more advantage than the control. Mortality was recorded across all the treatment groups but was not significantly (P>0.05) different and was not related to the trial.

Apparent Nutrient Digestibility (%) of Broiler Chickens (7weeks) fed Diets Containing Varying Levels of Bactofort®

Table 4 shows the apparent nutrient digestibility of broiler chickens fed Bactofort® levels. There were significant (P<0.05) in all the parameters measured (dry matter, crude protein, crude fibre,

ether extract, ash retention and nitrogen free extract). Birds fed 25g Bactofort® had the best digestibility in all the parameters measured (DM, CP, CF, EE, and NFE) however, not different from the control. This implies that addition of the probiotic to a little extent increased the efficiency of digestion and nutrient absorption processes of the intestinal tract of the birds as a result of the probiotic component of Bactofort® which improves metabolism by increasing digestive enzyme activity and decreasing bacterial enzyme activity and ammonia production. Although birds fed 50 and 75g Bactofort® had lower digestibility in all parameters compared to the control, they reported a better performance (compared to AGP group) in final body weight, weight gain and FCR implying efficient nutrient absorption.

The result in this study supports the findings of (Zhang and Kim, 2009) who reported that the supplementation of multi-strain probiotics does not affect the coefficients of apparent ileal nutrient digestibility of dry matter, crude protein and nitrogen-free extract.However, several other authors reported significantly higher crude protein, dry matter (Kumar *et al.*,2015) and crude fibre (Olnood*et al*., 2015) digestibility in group supplemented with probiotics than the control group.Olnood*et al*., (2015), also recorded a higher percentage of apparent dry matter, crude protein, crude fibre, ether extract and nitrogen-free extract digestibility in the treatment group fed 60g Bactofort® addition compared to other treatment groups. According to the author, this could be due to the lower percentage of pathogenic microbes (*Salmonella spp, E.coli* and *coliform*) recorded in the study. It can be deduced from the result of this study that apparent nutrient digestibility numerically increased and peaks at 25g Bactofort® level thereby implying that adding the probiotic above the optimum level will affect nutrient digestibility.

Effect of Varying Levels of Bactofort®on Carcass Characteristics of Broiler Chickens (7weeks)

The effect of feeding varying levels of Bactofort® on carcass characteristics of broiler chickens are presented in Table 5. Live weight, dressed weight and dressing percentage were significantly different across all the treatment groups. It was observed that the live weights of Bactofort® treated birds were significantly ($P<0.05$) high compared to AGP treated birds but similar ($P>0.05$) to the control. However, birds fed the control diet had a significantly higher ($P<0.05$) dressed weight and dressing percentage (1883.33g/bird and 74.21%) similar ($P>0.05$) to birds receiving 50g (1806.67g/bird and 72.03%) Bactofort® inclusion but different from other Bactofort® and AGP supplemented groups. The primal cuts expressed as percentages of dressed weights such as the drum stick, breast, back and wings were significantly different across the treatment groups while the thigh was not significantly different. The statistically similar live weight, dressed weight and dressing percentage of birds fed 50g Bactofort® inclusion to the control is supported by (Mountzouris*et al*., 2007) who recorded an insignificant difference in dressing percentage and gizzard weight of broiler chickens fed diets containing multi-strain probiotic compared to the control. Olnood*et al*., (2015) also reported insignificant difference in carcass characteristics. However, an improvement was observed in some prime cuts (drumstick, breast and wings) of Bactofort® supplemented birds, likewise in some internal organs (kidneys, gizzard and intestinal length). This result agrees with the findings of (Kioumarsi*et al*., (2012), who reported significant difference in breast muscle, drum stick and gizzard of broilers fed probiotics compared to those of the control. Kioumarsi*et al*., (2012) also reported significant improvement in prime cuts (breast and drum stick) of birds supplemented with Bactofort® + 200g Allium cepa.

CONCLUSION AND APPLICATIONS

Bactofort® a multi-strain probiotic did not significantly improve growth and carcass characteristics of broiler chickens above the control diet; it however improved growth of birds compared to the AGP supplemented diet.Bactofort® supplementation had little or no significant influence on the nutrient digestibility of broiler chickens.

AUTHORS' CONTRIBUTIONS

CZ conceived the experiment and drafted the initial manuscript. CZ, T.S and O contributed equally to this study, they jointly conducted the animal experiment and provided advice on the experiment and reviewed the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST DECLARATION

The authors have no conflict of interest relative to the work reported in this paper.

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