ISSN:
Print - 2277 - 0755
Online - 2315 - 7453

Journal of Agricultural Science and Environment

PERFORMANCE AND CARCASS CHARACTERISTICS OF FINISHING BROILERS FED DIETS SUPPLEMENTED WITH COMBINATION OF PROBIOTICS (*B. cereus*) AND PREBIOTICS (MANNOSE [MOS])

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ABSTRACT

The experiment aimed to investigate effect of combination of probiotics and prebiotics on the performance and carcass characteristics of broilers at finishing phase. A total number of 300 day-old Anak broiler chicks were used to determine the response of broiler chicks to diets supplemented with probiotics (Bacillus cereus) and prebiotics (Mannose). The chicks were randomly allotted to four treatment groups of 75 birds with 25 birds per replicate in a completely randomized design. The four dietary treatments comprised 500ppm MOS; 250ppm B. cereus + 500ppm MOS; 500ppm B. cereus + 500ppm MOS and 750ppm B. cereus + 500ppm MOS, respectively. Results showed that feed conversion ratio decreased significantly ($P< 0.05$) from 1.21 for groups fed det supplemented with 250ppm B. cereus + 500ppm MOS to 1.05 for groups fed with 750ppm B. cereus + 500ppm MOS as more prebiotics were added to the probiotics. Final live weight, eviscerated weight and dressing percentage were significantly ($p<0.05$) influenced by combination of probiotics and prebiotics in finishing broilers. Final live weight values ranged from 2453.30g in birds fed 250ppm B. cereus + 500ppm MOS to 2488.30g in birds fed 750ppm B. cereus + 500ppm MOS, while eviscerated weight ranged from 1063.30g at 500ppm MOS to 1396.70g at 750ppm B. cereus + 500ppm MOS. The same trend was observed for dressing percentage, neck, whole gizzard and liver. It was concluded that combination of probitics and prebiotics at 750ppm B. cereus + 500ppm MOS had positive effect on growth performance and carcass qualities of broilers at finishing phase.

Keywords: Prebiotics, probiotics, Broiler finishers, Mannose and B cereus.

INTRODUCTION

There's great emphasis recently on food security, this might be as a result of high disease rate, especially cancer which up till now, no solution has been proffered to curtail the effects. For many years, poultry industry has been looking for a way to provide solution to this menace caused as a result of food consumption. There are so many factors that affect meat qualities which might pose a threat to the consumers. The most directly related to meat quality are pre and post slaughter practices, age of the bird, sex, environment and Nutrition (feed, supplement or additives).

Antibiotics over the years have been the common supplement used for poultry production. There's currently a world's trend to reduce the use of antibiotics intake due to the contamination of meat intake as a result of antibiotics residue (Menten, 2001). Also, there's concern that therapeutic treatment of

human's might be jeopardized due to the appearance of resistant bacteria (Dale, 1992). Also, scientific evidence suggests that the massive use of these compounds has led to increased problem of antibiotics resistance (Diarra *et al*., 2007, Forgetta *et al*.,2012, Furtula *et al*, 2010) and presence of antibiotics residues in feed and environment (Carvalho and Santos, 2016, Gonzalez Ronquillo *et al*., 2017) compromises human and animal health (Diarra *et al*., 2010).

Consumers' pressure and worries towards harmful effects or antibiotics use and ban of antibiotics in EU have prompted researchers to think about alternatives to antibiotics (Diarra and Malouin, 2014). The aim of these alternatives is to reduce mortality rate, a good level of animal yield while preserving environment and consumer health. There are so many therapeutics alternatives that can substitute antibiotics use. Examples of these include: essential oils, enzymes, phytobiotics, prebiotics and probiotics. Alternatives used in the present studies are probiotics and prebiotics.

Probiotics by Gong *et al* (2002) can be defined as health – promoting bacteria inhabiting the gastrointestinal tract of humans and animals. The major probiotics include Lactobaccillus, saccharomyces, Baccillus, streptococcus and Aspergillius (Tannock, 2001). Use of probiotics for carcass and meat quality improvement have been questioned and unclear results have been shown. Some authors reported advantages of probiotics administration (Burkett et *al*., 1977, Jensen and Jensen, 1992., Maruta, 1993., Correa *et al*., 2000, Vargas *et al*., 2002). Some researchers, however, did not observe improvement when probiotics are used (Owings *et al*., 1990, Quadrose *et al*., 2001).
Prebiotics are dietary components that are not digested by the host, but they benefit the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the GIT, predominantly those that produce SCFA. Dietary supplementation of prebiotics has been shown to stimulate these unculturable bacteria in humans (Rastall *et al*., 2005), and pigs (Konstantivoc *et al*., 2003). The commonly used prebiotics that are derived from the plants are carbohydrate sources and they cannot be easily broken down by the Chickens but can easily be utilized by the Microflora of the intestinal tract, oligosaccahrides, polysaccharides and lactose are non-digestible carbohydrate sources typically used in poultry as the foundation for prebiotics and probiotics application on chickens (Hajati and Rezael, 2010).

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the poultry unit of the Agricultural Department, Federal College of Education, Abeokuta.The area falls within the rainforest vegetation zone of south western Nigeria on latitude 7°11'39.015" and longitude 3°27'12.2112" with an altitude of 76 meters above sea levels. The climate is humid within a mean annual rainfall of 1037mm. The annual mean temperature and humidity is 34.7% and 82% respectively.

Management of experimental birds

A total of 300-day-old broiler chicks of commercial strain (Anak 2000) were purchased from a commercial hatchery in Abeokuta. The house and equipment used were thoroughly washed and disinfected before the arrival of the chicks. The birds were raised intensively. The birds were initially raised together for four (4) weeks before being alloted to 4 dietary treatments for the finishing phase (week 4 - 8). All recommended vac-

cinations were administered and all the management protocols were strictly applied.

Dietary treatments

Bacillus cereus and MOS were used as test ingredients in this experiment. Mannose oligosaccharides (MOS) was supplied (Allteck, Inc Kenturkey, USA) while *Baccilus cereus* was supplied by a commercial company (Simbiyotek Biological Product Inc.). A standard basal diet was formulated for the starter and finisher phases of the study. A total of 300 day old broiler chickens were randomly allotted to 4 treatment groups of 75 birds. Each treatment group was replicated thrice with 25 birds per replicate. The 4 dietary treatments consisted of the following: Diet 1, 2, 3 and 4 contained 500ppm MOS, 250 B. cereus + 500ppm MOS, 500 B. cereus + 500ppm MOS and 750 B. cereus + 500ppm MOS, respectively.

Data Collection

Growth Parameters

- **Weight gain:** Birds in each replicate were weighed at the beginning of the experiment and subsequent weighing was carried out on weekly basis. All weighing was done on a five-star weighing scale. Weight gain was determined by the difference in the body weights of two consecutive weighing for each replicate group.
- **Feed intake:** Known quantity of feed was supplied to each replicate group at the beginning of each week and the left over at the end of each week was subtracted from the amount supplied. The difference was taken to be the feed consumed by the replicate group.
- **Feed Conversion ratio**

Feed conversion ratio was determined by calculating

$$\frac{\text{Amount of feed consumed (g)}}{\text{Weight gain (g)}}$$

- **Carcass characteristics determination**

At the end of the experiment, a bird per replicate whose weight is a representative of the average weight of each replicate was selected, weighed, slaughtered, scalded, eviscerated and the dressed weights determined. Cut parts such as head, neck, shank, thigh, drumstick, back and breast weight and visceral organs such as gizzard, liver, heart and kidney were excised and weighed. The weights were expressed as a percentage of the live weight.

- **Statistical analysis**

All data collected were subjected to analysis of variance (ANOVA) in a completely randomized design (CRD) using SAS (2002) while significant ($P<0.05$) different means were compared using Duncan's Multiple Range Test (Duncan, 1995).

Table 1: **Gross composition of Experimental Diets fed to the broiler finishers (4-8weeks) (g/kg)**

Additives supplemented	**500ppm MOS**	**250ppm B. cereus+ 500ppm MOS**	**500ppm B. cereus+ 500ppm MOS**	**750ppm B. cereus+ 500ppm MOS**
Maize	470.00	470.00	470.00	470.00
Soyabean meal	260.00	260.00	260.00	260.00
Vegetable oil	45.00	45.00	45.00	45.00
Fish meal	15.00	15.00	15.00	15.00
Wheat offal	150.00	150.00	150.00	150.00
Oyster shell	30.00	30.00	30.00	30.00
Bone meal	20.00	20.00	20.00	20.00
Salt	2.50	2.50	2.50	2.50
Methionine	2.50	2.50	2.50	2.50
Lysine	2.50	2.50	2.50	2.50
**Premix*	2.50	2.50	2.50	2.50
Total	1000	1000	1000	1000
Calculated Analysis				
M.E (MJKg)	14.17	14.17	14.17	14.17
Crude Protein (%)	18.95	18.95	18.95	18.95
Crude Fibre (%)	4.39	4.39	4.39	4.39
Ether Exract (%)	8.06	8.06	8.06	8.06
Ca (%)	1.86	1.86	1.86	1.86
Available Phosphorus (%)	0.66	0.66	0.66	0.66
Lysine (%)	1.26	1.26	1.26	1.26
Methionine (%)	0.54	0.54	0.54	0.54

Vitamin and mineral premix contained the following per kg diet: *Vit;4,000,000Iu, Vit D:80000, VitB12:25mg, Niacin:6000mg, Vit E40000, Vit k3 800mg, VitB3 1000mg, Vit B26000mg, Vit B6:5000mg panthotenic Acid:20000, Folics Acid:200mg, Biotine 8mg, Maganese:30000, Iron8000mg, Zinc:2000mg, Copper: nill, Cobalt: 80mg, Iodine:400mg, Selenium:40mg, Choline:80000mg*

RESULT AND DISCUSSION

Influence of diets supplemented with combination of *B.cereus* and mannose on growth performance of finishing broilers is found on Table 2. Total weight gain, final weight and feed conversion ratio recorded for the birds were significantly ($p<0.05$) affected by the supplements. Feed conversion ratio decreased significantly ($p < 0.05$) across the dietary treatments with increase in *B. cereus.* This implies improved performance of birds with increase in the quantity of *B. cereus* (probiotics) combined with the mannose (prebiotics). This is in accordance with the report of Mairoka *et al.* (2001) who reported an improved performance for finishing broilers fed the dietary treatments supplemented with prebiotics and probiotics. Probiotics produces enzymes that improve feed intake, digestion and feed conversion ratio in broilers. This agrees with Chiang and Hsieh (2005) who stated that dietary probiotics surpressed the growth of bacteria and produces enzyme which increases the feed intake and is responsible for the increased weight gain in the birds fed probiotics.

Results presented in Table 3 showed that Eviscerated weight, neck and wing weight increased ($p<0.05$) in birds fed with combination of *B. cereus* and mannose treatments. The result shows that the values significantly increased ($P<0.05$) with increasing inclusion of *Bacillus cereus.* This is in agreement with the studies of Watkins and Kratzer (1984) which reported that prebiotics + probiotics had significant positive effect ($P<0.05$) on broiler chickens. It also supported the report of Chapman and Hill (2006) that birds fed on probiotic and prebiotic gave higher ($p<0.05$) values for live weights and eviscerated weight, although, the live weights of the birds in this current research were not significantly ($p>0.05$) affected. Result obtained on organ weights (Whole gizzard and liver) showed significant ($p<0.05$) differences. However, this contradicts the study of Behrouz *et al* (2012), who stated that weights of gizzard, liver and bursa of fabricus were not affected by addition of probiotics, prebiotics and antibiotics.

Table 2: Effect of prebiotic and probiotic (Mannose and *Bacillus cereus*) levels of inclusion on the performance characteristics of finishing broilers

Parameters	500ppm mannose	500ppm mannose + 250ppm *B. cereus*	500ppm mannose + 500ppm *B. cereus*	500ppm mannose + 750ppm *B. cereus*	SEM
Initial weight (g/bird)	1256.67	1186.67	1186.68	1293.33	23.14
Final weight (g/bird)	2463.80	2453.30	2491.70	2488.30	26.04
Total weight Gain (g/bird)	1207.13^{b}	1266.63^{ab}	1305.02^{a}	1189.97^{c}	26.62
Total feed intake (g/bird)	1388.20^{b}	1532.62^{a}	1513.82^{a}	1249.47^{c}	65.56
FCR	1.15^{ab}	1.21^{a}	1.16^{ab}	1.05^{b}	0.02

^{abc} Mean on the same row having different superscripts are significantly different ($P<0.05$)

Table 3: Carcass characteristics of finishing broiler fed prebiotic and probiotic

Parameters	500ppm Mannose (T_1)	T1 + 250ppm *B. Cereus*	T + 500ppm *B. cereus*	T1 + 750ppm *B. cereus*	SEM
Live weight (g/bird)	2463.80	2453.30	2491.70	2488.30	26.04
Plucked weight (g/bird)	1750.00^{ab}	1650.00^{b}	1770.00^{ab}	2080.00^{a}	50.00
Eviscerated weight (g/bird)	1063.30^{b}	1316.70^{ab}	1225.00^{ab}	1396.70^{a}	54.57
Dressed weight (g/bird)	938.30	1173.30	1173.30	1245.00	51.36
Cut parts (% of live weight)					
Head	2.74	2.13	2.54	2.69	0.08
Legs	4.7727	3.9875	4.7168	4.71	0.98
Neck	3.32^{ab}	2.89^{b}	3.03^{b}	3.78^{a}	0.97
Wing	9.47^{ab}	6.91^{b}	8.02^{ab}	9.99^{a}	1.69
Drumstick	8.62	8.24	8.59	8.39	1.78
Thigh	8.00	7.53	9.06	9.43	0.98
Crop	2.655	2.970	2.255	2.14	0.09
Back	11.23	12.29	10.18	12.20	0.42
Breast	12.23^{b}	13.48^{b}	15.94^{a}	12.71^{b}	0.63
Organ weights (% of live weight)					
Whole gizzard	19.34^{a}	10.51^{b}	20.77^{a}	20.00^{a}	1.03
Gizzard	3.05	3.48	3.69	3.51	0.99
Empty gizzard	1.93	2.21	2.27	2.02	0.98
Proventiculus	0.61	0.55	0.66	0.65	0.01
Kidney	0.41	0.00	0.00	1.11	0.01
Abdominal fat	0.20	0.00	0.10	0.22	0.01
Liver	2.72^{b}	3.10^{ab}	3.92^{a}	2.64^{b}	0.98

^{abc} Means on the same row having different superscripts are significantly different ($P<0.05$)

CONCLUSION

Result obtained in this study shows that combinations of probiotics and prebiotics act synergistically in finishing broilers by improving the performance of birds with better carcass qualities. In addition, their combinations offer good alternative to antibiotics in terms of growth performance and meat qualities.

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(Manuscript received: 21st February, 2020; accepted: 29th June, 2020).