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Research Article

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 level. A total number of 300 day-old Anak broiler chicks were used to determine the response of broiler chicks to diets supplemented with probiotics (*B. cereus*) and prebiotics (Mannose). The three hundred day-old 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 at 250ppm *B. cereus* + 500ppm MOS to 1.05 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 1,650g in birds fed 250ppm *B. cereus* + 500ppm MOS to 2,080g in birds fed 750ppm *B. cereus* + 500ppm MOS, while eviscerated weight ranged from 1063.3g at 5ooppm MOS to 1396.7g at 750ppm *B. cereus* + 500ppm MOS. The same trend was observed for dressing percentage, neck, gizzard whole 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 stage.

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 [1]. Also, there's concern that therapeutic treatment of human's might be jeopardized due to the appearance of resistant bacteria [2]. Also, scientific evidence suggests that the massive use of these compounds has led to increased problem of antibiotics resistance [3-5] and presence of antibiotics residues in feed and environment [6,7] compromises human and animal health [8].

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 [9]. 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.* [10] 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 [11]. 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 [12-16]. Whereas, some did not observe improvement when probiotics are used [17,18].

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 [19], and pigs [20]. 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 [21].

Materials and Methods

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 extensively. They were reared for starter and finisher phases respectively. All recommended vaccinations 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 7th 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 was excised and weighed. The weights were expressed as a percentage of the live weight.

Statistical analysis

All data collected was subjected to analysis of variance (ANOVA) in a completely randomized design (CRD) using SAS (1999) while significant (P<0.05) different means were compared using Duncan's Multiple Range Test [22].

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. Most of the parameters were not affected by the additives inclusion, except initial weight and feed conversion ratio. Feed conversion ratio decreased significantly ($p < 0.05$) across the dietary treatments implying improved performance on birds fed diets supplemented with combination of *B. cereus* and Mannose at 500ppm manose +750ppm *B. cereus*. Improved performance recorded for finishing broilers fed the dietary treatments supplemented with *B. cereus* and mannose is in accordance with the report of Mairoka., *et al*. [23]. Probiotics produces enzymes that improve feed intake, digestion and feed conversion ratio in broilers. This agrees with Chiang and Hsieh [24] 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 showed a higher values on birds fed combination of *B. cereus* and mannose treatment. 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 [25] which reported that prebiotics + probiotics had significant positive effect (P<0.05) on broilers. It also supported the report of Chapman and Hill [26] that birds fed on probiotic and prebiotic gave higher values for live weights and eviscerated weight. However result obtained on organ weights (Gizzard whole and liver) showed significant ($p< 0.005$) different, this contradicted result obtained by 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.

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)	11.97	11.97	11.97	11.97
Crude Protein (%)	22.89	22.89	22.89	22.89
Crude Fibre (%)	3.42	3.42	3.42	3.42
Ether Exract (%)	3.72	3.72	3.72	3.72
Ca (%)	2.25	2.25	2.25	2.25
AV Phos (%)	0.56	0.56	0.56	0.56
Lysine (%)	1.10	1.10	1.10	1.10
Methionine (%)	0.62	0.62	0.62	0.62

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

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.

Parameters	500ppm mannose	500ppm mannose + 250ppm *B. cereus*	500ppm mannose + 500ppm *B. cereus*	500ppm mannose + 750ppm *B. cereus*	SEM
Initial weight (g)	460.00^{a}	425.00^{ab}	395.33^{b}	423.33^{ab}	10.31
Final weight (g)	1256.67	1186.67	1186.68	1293.33	23.14
Total weight Gain (g)	796.67	761.67	794.34	870.00	10.77
Total feed intake(g)	920.33	923.33	921.67	921.67	2.31
FCR	1.15^{ab}	1.21^{a}	1.16^{ab}	1.05^{b}	0.02

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

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

Parameters	500ppm Mannose (T_1)	T1 + 250ppm *B. Cereus*	T + 500ppm *B. cereus*	T1 + 750ppm *B. cereus*	SEM
Final weight(g)	1750^{ab}	1650^{b}	1770^{ab}	2080^{a}	50.00
Plucked weight(g)	2463.8	2453.3	2491.7	2488.3	26.04
Eviscerated weight(g)	1063.3^{b}	1316.7^{ab}	1225.0^{ab}	1396.7^{a}	54.57
Dress weight(g)	938.3	1173.3	1173.3	1245.0	51.36
Dressing(%)	469.17^{b}	586.67^{ab}	541.67^{ab}	622.50^{a}	25.36
Cut parts (% of live weight)					
Head	2.7424	2.1304	2.5436	2.6869	0.08
Legs	4.7727	3.9875	4.7168	4.7081	0.98
Neck	3.3249^{ab}	2.8856^{b}	3.0283^{b}	3.7771^{a}	0.97
Wing	9.468^{ab}	6.908^{b}	8.017^{ab}	9.989^{a}	1.69
Drumstick	8.6229	8.2431	8.5893	8.3927	1.78
Thigh	8.003	7.525	9.063	9.433	0.98
Crop	2.655	2.970	2.255	2.135	0.09
Back	11.229	12.292	10.180	12.196	0.42
Breast	12.2306^{b}	13.4800^{b}	15.9368^{a}	12.7055^{b}	0.63
Organ weights (% of live weight)					
Gizzard whole	19.338^{a}	10.510^{b}	20.768^{a}	20.000^{a}	1.03
Gizzard	3.0471	3.4814	3.6874	3.5056	0.99
Gizzard empty	1.9293	2.2079	2.2712	2.0201	0.98
Proventiculus	0.6094	0.5469	0.6590	0.6457	0.01
Kidney	0.4057	0.0000	0.0000	1.1111	0.01
Abdominal fat	0.2037	0.0000	0.0980	0.2234	0.01
Liver	2.7239^{b}	3.1021^{ab}	3.9209^{a}	2.6424^{b}	0.98

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

^{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 offers good alternative to antibiotics in terms of growth performance and meat qualities.

Bibliography

1. Menten JFM. "Probióticos, Prebióticos e Aditivos Fitogênicos na Nutrição de Aves". In: II Simpósio sobre Ingredientes na Alimentação Animal CBNA (2002): 251-275.

2. Dale N. "Probiotics paraacres". *Agricultural professional* 10.2 (1992): 88-89.

3. Diarra MS., *et al*. "Impact of feed supplementation with antimicrobial agents on growth performance of broiler chickens, clostridium perfringens and enterococcus counts, and antibiotic resistance phenotypes and distribution of antimicrobial resistance determinants in Escherichia Coli isolates". *Applied Environment and Microbiology* 73 (2007): 6566e76.

4. Forgetta V., *et al*. "Pathogenic and multidrug-resistant Escherichia fergusonii from broiler chicken". *Poultry Science* 91 (2012): 512e25.

5. Furtula V., *et al*. "Veterinary pharmaceuticals and antibiotic resistance of Escherichia Coli isolates in poultry litter from commercial farms and controlled feeding trials". *Poultry Science* 89 (2010): 180e8.

6. Carvalho IT and Santos L. "Antibiotics in the aquatic environments: a review of the European scenario". *Environment International* 94 (2016): 736e57.

7. Gonzalez Ronquillo M., *et al*. "Antibiotic and synthetic growth promoters in animal diets: review of impact and analytical methods". *Food Control* 72 (2017): 255e67.

8. Diarra MS., *et al*. "Distribution of antimicrobial resistance and virulence genes in enterococcus spp. and characterization of isolates from broiler chickens". *Applied Environment and Microbiology* 76 (2010): 8033e43.

9. Diarra MS and Malouin F. "Antibiotics in canadian poultry productions and anticipated alternatives". *Frontier in Microbiology* 5 (2014): 282.

10. Gong J., *et al*. "Diversity and phylogenetic analysis of bacteria in the mucosa of chicken ceca and comparison with bacteria in the cecal lumen". *FEMS in Microbiology Letter* 208 (2002): 1-7.

11. Tannock GW. Probiotics and prebiotics: Scientific aspects. Caister Academic press: the 12th European Symposium on poultry Nutrition, Veldhoven, The Neitherlands: WPSA Dutch Branch (2001): 193-201.

12. Burkett RF., *et al*. "Supplementing market broiler diets with Lactobacillus and live yeast cultures". Animal Science Agricultural Research Report. Oklahoma State University and USDA. USA. (1977).

13. Jensen JF and Jensen MM. "The effect of using growth promoting Bacillus strains in poultry feed". In: World's Poultry Congress, 18, 1992, Amsterdam. Proc. Amsterdam: WPSA 3 (1992): 398-402.

14. Maruta K. "Probióticos e seus benefícios". In: Conferência APINCO de Ciência e Tecnologia Avícolas; Santos, São Paulo. Brasil (1993): 203-219.

15. Corrêa GSS., *et al*. "Desempenho de frangos de corte alimentados com diferentes promotores de crescimento". In: Reunião Anual da SBZ, 2000, Viçosa. Anais. Viçosa (2000): 37.

16. Vargas Jr JG., *et al*. "Características de carcaça de frango de corte, submetidos a rações contendo probióticos, prebióticos e antibióticos". In: XXXIX Reunião Anual da SBZ, 2002, Recife. Anais ...Recife (2002)

17. Owings WJ., *et al*. "Influence of dietary supplementation with Streptococcus faecium M - 74 on broiler body weight, feed conversion, carcass characteristics, and intestinal microbial colonization". *Poultry Science* 69 (1990): 1257-1264.

18. Quadros ARB., *et al*. "Características qualitativas da carne de suínos alimentados com rações contendo ou não probióticos". In: XXXVIII Reunião Anual da SBZ, 2001, Piracicaba. Anais. Piracicaba (2001): 794-795.

19. Rastall RA., *et al*. "Modulation of the microbial ecology of the human colon by probiotics, prebiotics and synbiotics to enhance human health: an overview of enabling science and potential applications". *FEMS Microbiology Ecology* 52 (2005): 145-152.

20. Konstantinov SR., *et al*. "Effect of fermentable carbohydrates on piglet faecal bacterial communities as revealed by denaturing gradient gel electrophoresis analysis of 16S ribosomal DNA". *FEMS Microbiology Ecology* 43 (2003): 225-235.

21. Hajati H and M Rezeai. "The application of prebiotics in poultry production". *International Journal of Poultry Science* 9.3 (2010): 298-304.

22. Duncan DB. Multiple Range and Multiple F-test Biometric 11-1-24 (1995).

23. Maiorka A., *et al*. "Utilization of prebiotics, probiotics, or symbiotics in broiler chicken diets". *Revista Brasileira de Ciência Avícola* 3 (2001): 75-82.

24. Chiang SH and WM Hsieh. "Effect of direct-fed microorganisms on broiler growth performance and litter ammonia level". *Asian-Australasian Journal of Animal Sciences* 8.2 (1995): 159-162.

25. Watkins BA and Kratzer FH. "Drinking water treatment with commercial preparation of a concentrated Lactobacillus Culture for broiler Chickens". *Poultry Science* 63 (1984): 1671-1673.

26. Chapman HD., *et al*. "Sustainable coccidiosis control in poultry production: The role of live vaccines. *International Journal for Parasitology* 32 (2002): 617-629.

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