Nigerian J. Anim. Sci. 2023, 25 (2): 102-109

Response of pullet chickens to probiotic and antibiotic-supplemented diets

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***Target Audience:** Poultry farmers, Animal nutritionists, Feed millers, Researchers.*

Abstract

Poultry production is an important way of ensuring food security, especially in Africa where food insecurity is still a challenge. Profitable commercial poultry production usually adopts intensive system of production, which involves the use of antibiotics for disease control and prevention and growth promotion. However, with the knowledge that antibiotics leave residues in meat has raised concern about its continuous use. In this study, the effect of commercial probiotics, antibiotic and diet without antibiotic on pullet chicken production was examined. Two hundred and fifty-five one-day old chicks were randomly allotted to five treatments in a completely randomized design. The experimental diets were as follows: Treatment 1; Basal diet (BD) alone: Treatment 2; BD + 4-Bac extra (probiotic). Treatment 3; BD + Salmo-nil dry (probiotic). Treatment 4; BD + Biovet Yc (probiotic). Treatment 5; BD + Oxytectracycline. The probiotics and the antibiotics were added to the feed as recommended by the manufacturer as follows: 4-Bac Extra (0.5g/ kg); Salmo-nil dry (2g/ kg); Biovet Yc (0.5g/kg) and antibiotics, Oxytectracycline (0.25g/kg). The study lasted for eight weeks. Growth performance and dry matter digestibility were not significantly (p>0.05) different across treatments. Crude protein digestibility was significantly (p<0.05) higher for birds fed with commercial probiotics (Biovet Yc and 4 Bac-extra) while birds fed diets containing Salmonil dry group (89.90) and antibiotics, Neoceryl plus group (91.68) compared with the control group (89.90). the study concludes that strict adherence to adequate biosecurity may prevent the use of synthetic antibiotics in poultry production.

***Key words**: antibiotics, biosecurity, pullet, chickens, residue*

Description of Problem

The impact of food crisis in Africa calls for increased production in food in spite of the current challenges. Poultry products are major sources of animal protein in Nigeria and the poultry industry has been contributing towards sufficient consumption of animal protein. In order to meet the current demand, farmers rely greatly on intensive poultry farming system, which is accompanied with the use of vaccines, vitamins, minerals and mostly, antibiotics. Approximately 80% of all food producing-animals receive medication for part or most of their lives [1]. Antibiotics are included in animal feeds to improve growth rate, feed efficiency, for diseases prophylaxis and disease therapy [2]. Although using antibiotics has value in terms of production, unfortunately edible poultry tissues might be contaminated with harmful concentration of drug residues [3].

Misuse of antibiotics has been proved to be harmful to humans because it makes them resistant to certain types of drugs of different disease and makes it harder to fight off infections [4]. In United States of America alone, more than 2 million people were diagnosed with antibiotics resistant infections and 23,000 people die yearly due to resistant infections [5]. The search for alternative(s) to antibiotics as growth promoter led to probiotics as an option [6]. Probiotics are microorganisms that are believed to provide health benefits to livestock [7]. They are currently used to name ingested -microorganisms associated with benefits for human and animals [8]. Most probiotics' products utilise one or multiple types of bacteria which include the strains of *Bifidobacterium, Enterococcus, Lactobacillus, bacillus, Pedicoccus* and *Streptococcus*, while some products contain viable yeast and other fungi in addition to bacteria [9].

Two common brands of probiotics and an acidifier are being utilized by farmers in Lagos area in place of antibiotics. Are the products effective as replacement for antibiotics? Which of them is better, considering the finishing cost? The objective of this study is therefore to assess the efficacy of the common brands of probiotics and acidifier used in place of feed-based antibiotics in the locality.

Materials and Methods

This study was carried out at the Poultry Unit of the Department of Animal Production, Lagos State University of Science and Technology, Ikorodu, Lagos State, Nigeria. A total number of two hundred- and fifty-five-day-old chicks were collected from a reputable hatchery and were randomly allotted into five treatments. Each of the treatments was replicated thrice in a completely randomized design. Birds were reared on floor pens and fed *ad-libitum* throughout the study. All the routine management practices were strictly followed. A basal diet (BD) was prepared (as control) while three (3) common brands of probiotics were added to other treatments as additive. The fifth treatment diet contained BD + antibiotic. The experimental diets were as follows: Treatment 1; Basal diet (BD) alone: Treatment 2; BD + 4-Bac extra (probiotic). Treatment 3; BD + Salmo-nil dry (probiotic). Treatment 4; BD + Biovet Yc (probiotic). Treatment 5; BD + *Oxytectracycline*. The probiotics and the antibiotics were added to the feed as recommended by the manufacturer as follows: 4-Bac Extra (0.5g/ kg); Salmo-nil dry (2g/ kg); Biovet Yc (0.5g/kg) and antibiotics, Oxytectracycline (0.25g/kg). The corresponding active ingredients of the additives were; *Lactobacillus acidophilus*, Calcium acetate, *Saccharomyces cerevisiae* and *Oxytetracycline*. Data were collected on the, weight gain and feed intake (FI). At the end of the 7th week, four birds were randomly selected from each replicate to a clean and disinfected metabolic cage with polythene bag attached to the beneath of the cage. They were allowed three days for acclimatization followed by four-day collection period. A known weight of feed was fed to the birds during the trial. The collected faecal samples were dried and ground before taken to the laboratory for analysis. Differences were considered at $p < 0.05$ and means were separated using Duncan's multiple range [10]. The experimental composition and proximate analysis of the experimental diet are presented in Table 1.

Result and Discussion

Growth performance characteristics of pullet chickens (0-8 weeks) fed commercial probiotic and antibiotic-supplemented diets are presented in Table 2. The results of the study revealed that growth performance was not significantly ($p>0.05$) different across treatments for all the parameters measured. Table 3 shows apparent nutrient digestibility of pullet chickens (0-8 weeks) fed commercial probiotic and antibiotic-supplemented diets. Dry matter digestibility values were not significantly different across treatments. The numerical values obtained for the diets were 60.85, 69.50, 68.20, 75.07, and 70.26 respectively for the control, 4 Bac-extra, Salmonil dry, Biovet Yc and Neoceryl plus groups. Crude protein digestibility was significantly ($p<0.05$) higher for birds fed with commercial probiotics (Biovet Yc and 4 Bac-extra) while birds fed diets containing Salmonil dry group (89.90) and antibiotics, Neoceryl plus group (91.68) compared with the control group (89.90). Ether extract digestibility values for commercial probiotics and antibiotic were statistically ($p>0.05$) similar to the control group. 4 Bac-extra (97.51), Biovet Yc (97.83) and Neocerl plus group (98.00) were statistically similar. The value obtained for Salmonil dry group (95.24) was significantly ($p<0.05$) lower than the value obtained for Neoceryl plus (98.00) and other probiotic groups.

Table 1: Composition of experimental diet and proximate analysis

Feed ingredients	Quantity (kg)
Maize	50.00
Groundnut cake meal	29.60
Soybean meal	5.00
Fish meal	1.00
Wheat offal	9.00
Oyster shell	2.50
Bone	2.00
Salt	0.25
Methionine	0.30
Lysine	0.10
Vitamin-premix	0.25
Determined proximate analysis	
Dry matter (%)	91.49
Ether extract (%)	7.76
Crude protein (%)	17.58
Ash (%)	11.00
Crude fibre (%)	5.75
Nitrogen free extract (%)	49.40
Energy (Kcal/kg)	2,804.12

Table 2: Performance characteristics of pullet chickens fed probiotic and antibiotic-supplemented diets

Parameters	Control	4 Bac-extra	Salmonil dry	Biovet Yc	Neoceryl plus	SEM
Initial weight, g	43.52	44.69	44.40	43.48	44.44	0.06
Final weight, g	606.33	663.33	682.00	666.67	613.33	13.73
Total feed intake, g	2208.77	2094.35	2054.16	1976.98	2003.95	122.10
Body weight gain, g	562.81	618.64	637.60	623.19	568.89	11.23
ADFI, g	39.44	37.40	36.68	35.30	35.78	0.83
ADG, g	9.99	11.05	11.39	11.13	10.27	0.28
PER	1.48	1.54	1.60	1.69	1.56	0.03

ADFI = average daily feed intake, ADG = average daily gain, PER=protein efficiency ratio, SEM = standard error of mean

Crude fibre digestibility was statistically similar (p>0.05) for probiotic-supplemented diets and the control group as well as for antibiotic-supplemented diets and the control group. 4 Bac-extra (83.00) was also similar to Biovet Yc (78.02) group. A similar trend was observed for Salmonil dry (77.60) and Neoceryl plus (80.00) group. Economic analysis of pullet chickens fed commercial probiotics and antibiotic-supplemented diets is shown in Figure 1. Return on feed (₦) was higher for commercial probiotic-supplemented diets, 357.65 (Biovet Yc group) and 330.12 (4 Bac-extra group), while the least value was obtained by the control group (272.63). Biovet Yc group (₦ 275.98) obtained the highest value of profit, followed by Neoceryl plus group (₦ 267.45), while Salmonil dry group obtained the least profit (₦ 249.00). However, for feed efficiency, g/kg, Biovet Yc group (315.22) obtained the highest value, followed by Salmonil dry group (310.39), while the least was obtained by control group (254.81).

Table 3: Apparent nutrient digestibility of pullet chickens fed probiotic and antibiotics-supplemented diets

Nutrients	Control	4 Bac-extra	Salmonil dry	Biovet Yc	Neoceryl plus	SEM
Crude protein	89.90^{b}	93.19^{a}	89.90^{b}	93.27^{a}	91.68^{b}	0.73
Dry matter	60.85	69.50	68.20	75.07	70.26	2.30
Ether extract	96.76^{ab}	97.51^{a}	95.24^{b}	97.83^{a}	98.00^{a}	0.50
Crude fibre	77.27^{ab}	83.00^{a}	77.60^{ab}	78.02^{a}	80.00^{a}	1.07

Different superscripts within rows indicate significant differences between treatments at p<0.05.

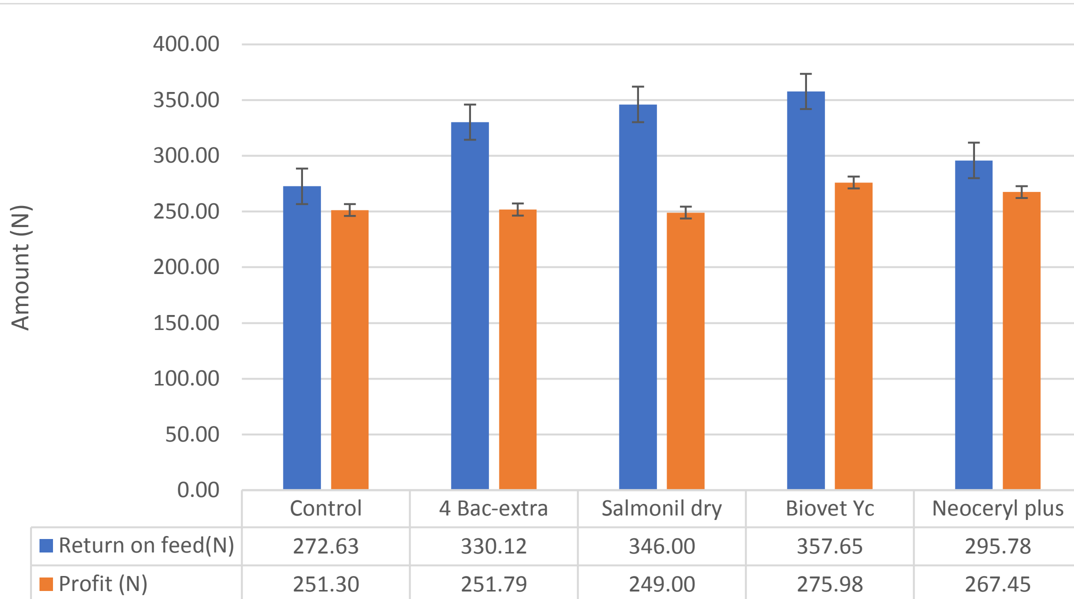

Figure 1: Economic anaysis of pullet chickens fed probiotic and antibiotic-supplemented diets

Probiotics are used in poultry feed for different purposes. Sometimes, they are used to improve intestinal tract of chickens. However, there were disparities in the results of the previous studies. Some researchers concluded that probiotics improved growth performance characteristics [11, 12] while some reported otherwise [13, 14]. Different probiotics, species of animals used and environmental factors might contribute to the disparity observed. The results of the present study agreed with the findings of [15] and [16].

The importance of antibiotics in farm animal production have been extensively documented. Antibiotics are chemicals which at low concentrations can inhibit or kill micro-organisms, including bacteria, fungi, protozoa, and parasites. Unfortunately, after administering antibiotics, their residues might contaminate meats, milk and eggs [17, 18], which has limited their use in recent times. Also, animal feeds are supplemented with antibiotics to serve as growth promoter to make the animals grow faster than they usually would have without a growth promoter. It has been reported that the ability of antibiotics to serve as growth promoter for animals and birds was discovered in the 1940s [19, 20]. The use of antibiotics as growth promoter thereafter became widely known and practised. For instance, it has been reported that out of the over 11 million Kg antibiotics used in animal agriculture annually in the United States of America alone, a substantial portion is used as growth promoters and not for the treatment of infections [20]. However, the fear of losing poultry flocks to infections has necessitated the continuous use of antibiotics in poultry production.

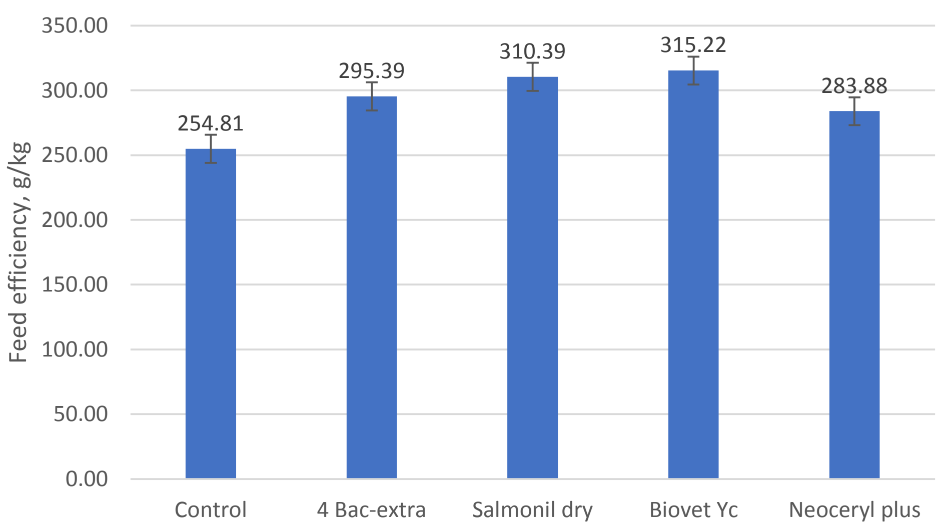

Figure 2: Feed efficiency of pullet chickens fed probiotic and antibiotic-supplemented diets

One of the most used antibiotics is tetracycline, which is a broad-spectrum antibiotic used to treat a variety of infections and is also used as a growth promoter in animals. It has been estimated that about 60% of an ingested dose of oxytetracycline is absorbed from the gastrointestinal tract and widely distributed in the body, especially kidney, bones, teeth and liver [21]. For years, tetracyclines have been used as an important class of antibiotics in food, animal health and production. They are used to prevent and control diseases as well as a growth promoter in both chicken and pig production [22]. In human food, the presence of antibiotics has been reported to result in tissue damage, hypersensitivity, gastrointestinal disturbance and neurological disorders [23]. People are more concerned about chemical and antibiotic residues in their foods than they used to be. Hence, the need to find alternatives to synthetic antibiotics in meat production whether for disease control and prevention or as a growth promoter.

The result of the present study showed that farmers might not be at a serious risk if they ensure adequate biosecurity in their farm as demonstrated in the present study. Growth performance was significantly different between the antibiotic-supplemented groups and control group where we maintained only strict biosecurity measures. It has been recommended that the withdrawal periods of antimicrobials should be respected in order to reduce the level of antimicrobial residues in meat samples to a minimum as well as to reinforce controls through regular sampling and analysis [24]. However, the authors also recommended further studies on the different types of antibiotics used in farm animal production. So, studies on antibiotics use in animal production and finding alternatives to synthetic antibiotics in farm animal production, especially poultry is an on-going search.

The present study ensured a strict biosecurity for the control group and compared the findings with the antibiotic or probiotic groups. The results of the study indicated that with adequate biosecurity, farmers may not need to rely heavily on the use of synthetic antibiotics. However, the authors suggested further studies in this regard to establish the comparison. Previous study reported that differently processed *Moringa oleifera* seed and leaf meal as a replacement for synthetic antibiotic did not influence feed conversion ratio [25]. However, 0.25g/kg of oxytetracycline and 0.25g/kg of raw *Moringa oleifera* seed meal improved body weight gain of broiler chickens when compare with no-antibiotic control.

Conclusion and Applications

1. Growth performance was not influenced by the use of probiotics and antibiotics.
2. The probiotics and antibiotics employed did not influence dry matter digestibility in pullet chickens.
3. Probiotics (except Salmonil dry) improved crude protein digestibility in experimental animals.

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