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Prebiotics and probiotics as alternatives to usage of antibiotics and coccidiostat for broiler chickens

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Abstract

This study evaluated growth performance and nutrient digestibility of broiler chickens fed diets supplemented with prebiotics and probiotics as alternatives to antibiotics and coccidiostats. Three hundred and ninety-six (396), 7 days old Arbor Acres broiler chicks were randomly distributed into 9 treatments groups of 4 replicates each of 11 birds. Experimental diets were as follows: corn soybean meal-based diet was the Basal Diet (BD) which served as the control. Control = BD + Medicated Water "MW" (0.4g antibiotics plus 0.5g coccidiostat/L), T1 = BD + 0.5g probiotics/kg, T2 = BD + 2g prebiotics/kg, T3 = BD + 0.5g probiotics + 2g prebiotics/kg, T4 = BD + 1g probiotics + 4g prebiotics/kg, T5 = BD + 0.5g probiotics/kg + MW, T6 = BD + 2g prebiotics/kg + MW, T7 = BD + 0.5g probiotics + 2g prebiotics/kg + MW, T8 = BD + 1g probiotics + 4g prebiotics/kg + MW. All data collected were subjected to One Way and 2x2x2 factorial ANOVA at p≤0.050. The results showed that broiler starters in T3 (634.10, 25.17g), and those in T6 (670.35, 27.18g) significantly produced higher final body weight (FBW, P=0.0002), average daily weight gain (ADG, P=0.0003) than other groups. The best (P=0.002) FCR was noticed in starters in T6 (1.73) or T2 (1.71). Broiler finishers in T3 had the heaviest FBW (2464.50g, P=0.016), ADG (54.44g, P=0.010). Chickens in T2 had the highest (P<0.0001) digestibility in dry matter (96.27%), crude fibre (96.27%), ash (93.99%) and nitrogen free extract (99.80% in T4) with ether extract (86.01% in T3). It is concluded that supplementation of synbiotics of 0.5g probiotics and 2g/kg prebiotics as well as 2g prebiotics produced maximum FBW, ADG and optimum nutrient digestibility. It is therefore recommended that these two supplements at their dosage are best for optimum growth performance.

Keywords: Broiler, Probiotics, Prebiotics, Coccidiostat, Antibiotics, Growth Performance, Nutrient Digestibility

Introduction

Poultry products are one of the main sources of animal protein around the world (Nkukwana, 2018; Govoni *et al*. 2021). The growing demand for eggs and poultry meat have significantly increased in recent years across the continent (Mesa-Pineda *et al*., 2021). This growth is crucial makes the production of sustainable and safe protein a top priority (Singh *et al*., 2019). Digestive tract infections such as necrotic enteritis (NE) and coccidiosis-induced NE are among the top enteric infectious diseases in chickens which have led to severe economic losses (Salem and Attia, 2021).

Necrotic enteritis caused by *Clostridium perfringens* (CP) is an extensive bacterial disease of poultry which causes significant economic loss by damaging the intestinal mucosa and also leads to sudden death, with mortality rates up to 50% (Lee *et al*., 2011). Coccidiosis in poultry is characterized by dysentery, enteritis, diarrhea, which are usually bloody with certain *Eimeria* *species*, emaciation, lower feed conversion rate, delayed sexual maturity, drooping wings, poor growth and low production (Awais *et al*., 2012) with high morbidity (due to acute, bloody enteritis) and mortality rates (Abbas *et al*., 2012).

The control measure against this parasite has been through anticoccidial drugs, vaccines and strict management practice (Godwin and Morgan, 2015). The indiscriminate use of anticoccidial drugs in feed and water has led to serious drug resistance problems (Usman *et al.* 2011). The antibiotic resistance and regulatory pressures stress the urgent need to explore alternative strategies for maintaining intestinal functionality against NE and coccidiosis in chickens for improved productivity. Probiotics and prebiotics have been proposed as a solution to the intestinal problems of poultry. Probiotics are valuable gut microbe species that can colonize the gut, and prebiotics is indigestible oligosaccharides that can be utilized by the useful gut microbes (Wenk *et. al.,* 2000; Murate *et al*., 2015). They are also known as microorganisms that can alter the host health by colonizing the host GIT and providing a more balanced microbiota (Wenk *et al*., 2000; Khan and Naz, 2013; Murate *et al*., 2015).

Prebiotics are innovative approach to coccidiosis management and their mechanism of action is mainly based on the multiplication and activation of specialized probiotic bacteria (Gadde *et al*., 2017). Although, there were reports on synbiotics usage of prebiotics and probiotics, that prebiotics as additives can stimulate the commensal flora and enhance the beneficial effects of probiotics within the host. However, much attention had been given to sole use of probiotics and prebiotics as feed additives whereas their use on the challenges associated with necrotic enteritis and coccidiosis has not attracted much attention. Could there be synergistic action if both probiotics and prebiotics are used as synbiotics for prevention of necrotic enteritis and Eimeria infection in poultry raised on litter? This study was aimed to understand optimal dosages, management practices, and regulatory framework of prebiotics and probiotics as viable alternatives to conventional antibiotics for managing necrotic enteritis and coccidiosis in broiler chickens raised on litter. The study therefore, evaluated the influence of graded levels of prebiotics and probiotics on performance, and blood profile of broiler chickens as alternatives to antibiotics and coccidiostats usage.

Materials and Methods

Experimental Site: The experiment was carried out at the Broiler Unit, Teaching and Research Farm, Ladoke Akintola University of Technology, Ogbomoso, Oyo Sate, Nigeria. Ogbomoso is located in the derived savanna zone that lies on longitude 4°16'18" East of greenish meridian and latitude 8°10'10" North of equator (Google Earth Map, 2025).

Source of Test Ingredients: Rossbind® (prebiotics) and Rosszyme® plus (probiotics) were obtained from Solvic Agro Farm International Limited, 2, Soji odiyeye street, opposite Oniwolu House, Ikorodu, Lagos State, Nigeria. The two materials were manufactured in Rossari Biotech Limited, Mumbai, India.

Information on the Test ingredients: Rosszyme® contained the following enzymes and probiotics per kg, 125,000CMCU/g cellulase, 1000u/g pectinase, 3000u/g glucanase, 10,000u/g mannanase 75,000u/g xylanase, 80,000u/g protease, 10,000u/g amylase, 3000u/g lipase, 2200FTU/g phytase, $3x10^9$CFU/g *Bacillus subtilis*, $5x10^9$CFU/g *Lactobacillus acidophilus*, $3x10^8$CFU/g *Saccharomyces cerevisiae*, $5x10^7$ *Saccharomyces boulardii*. One kilogram (kg) of Rossbind® (prebiotic) contained 50g manna oligosaccharide, 10g choline chloride, 30g activated charcoal, 40kg copper sulphate, 50g extract of *Azadirachta indica* and HSCAS (carrier at q.s ad)

Formulation of experimental diet: Nine experimental diets were formulated for the study. A corn soybean meal-based diet (basal diet) without test materials but supplied with antibiotics and coccidiostat in drinking water was the control. The basal diet was supplemented with probiotics (Rosszyme®) at 0.5 and 1 g/kg and prebiotics (Rossbind®) at 2 and 4g per kg diet as appropriate to each treatment group (Tables 3.1).

Outlay of Experimental Diets

Control = Basal diet + Medicated water (antibiotics, 0.4g Doxystimore20/20® plus coccidiostat, 0.5g GaliCox®/L)
T1 = Basal diet supplemented with 0.5g probiotics/kg
T2 = Basal diet supplemented with 2g prebiotics/kg
T3 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg
T4 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg
T5 = Basal diet supplemented with 0.5g probiotics/kg + Medicated water
T6 = Basal diet supplemented with 2g prebiotics/kg + Medicated water
T7 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg + Medicated water
T8 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg + Medicated water

Table 1: Ingredients composition for broiler starter and finisher diets

Ingredient	Starter	Finisher
Maize	57.00	48.00
Soya bean meal	30.00	26.00
Fish meal (72%)	4.00	3.00
Maize offal	5.00	15.00
Bone meal	2.00	2.00
Wheat offal	-	4.25
Limestone	1.00	1.00
Lysine	0.25	-
Methionine	0.25	0.25
Premix	0.25	0.25
Salt	0.25	0.25
Total	**100**	**100**
Calculated Analysis		
ME (kcal/kg)	3241.48	3045.82
Crude Protein (%)	22.57	21.09
Crude Fibre (%)	3.73	4.84
Lysine (%)	1.53	1.44
Methionine (%)	0.58	0.58
Calcium (%)	1.40	1.33
Av. Phosphorus (%)	0.66	0.61

Av. Phosphorus = Available Phosphorus ME = Metabolizable Energy

Experimental Animals and Management: Three hundred and ninety-six (396) day old broiler chicks of Arbor Acres strain were purchased from a reputable hatchery in Oyo state. The birds were randomly distributed into nine (9) treatments groups of four (4) replicates each. A treatment group contained eleven (11) birds per replicate. Feed and water were supplied *ad libitum*. All the necessary medication and vaccination were done as at when due. The study consisted of two phases, starter and finisher phases with each lasting for three and four weeks respectively.

Data Collection

Data were collected on growth performance and nutrient digestibility of the experimental birds.

Growth Performance

On the day of the arrival day old broiler chicks were weighed to determine the initial body weight and they were fed a pre-experimental diet for seven days prior to the study. The body weight of the experimental birds was determined on a weekly basis. The growth phases were partitioned into starter and finisher of three (3) and four (4) weeks each. The body weight (BW) of experimental birds at 3rd and 7th week of the study were the finial body weight for the starter and finisher phases, respectively. Experimental diets and clean drinking water were supplied to the birds *ad libitum* and the remnant of the feed recorded.

Nutrient Digestibility:

On the 43rd day of the study, two birds per replicate were selected and transferred to the metabolic cage for the assessment of nutrient utilization of the experimental diets. The birds were offered 70% of daily feed allowance for five (5) days. The birds were left to acclimatize for two (2) days while faecal samples were collected for three (3) days. The collected faecal samples were oven dried until the weight remain constant and they were then transferred to laboratory for determination of the proximate composition.

Experimental Design

A completely randomized design was adopted for the study. A 2x2x2 factorial arrangement of drugs (0 and 0.5g/L), probiotics (0.5 and 1.0g/kg) and prebiotics (2 and 4g/kg) was used for the estimation of main and interaction effects on measured parameters.

Chemical Analysis

The proximate composition of the experimental diets and faecal samples was done using AOAC (2023).

Data Analysis

Data collected were subjected to One-way and 2x2x2 Factorial ANOVA using SAS (2000). Significant means were separated by Duncan multiple range test of the statistical package. A probability of 5% was considered significant (P<0.05).

Results and Discussion

The growth performance of broiler starters fed diets supplemented with probiotics and prebiotics between day 7th to 28th based on the age of the experimental birds is shown in Table 1. The supplementation of 2g prebiotics along with medication yielded maximum final body weight (670.35g/bird, P=0.0003), average daily gain (27.18g/bird, P=0.0002) and most efficient FCR (P=0.002) in the starter phase. The interaction effect of prebiotics and drug demonstrated significant effects on FBW (P=0.038) and ADG (P=0.045). This finding was consistent with the observation of Abdel-Raheem and Abd-Allah (2011) who reported that cumulative feed intake increased for birds fed a diet with 2 g prebiotics (mannan-oligosaccharides) in the starter phase. The dietary inclusion of 1g probiotics and 4g prebiotics without medication led to the highest (P=0.004) ADG at starter phase. This observation in this study agreed with the finding of Abdel-Raheem and Abd-Allah (2011) who reported that feed intake was improved by the supplementation of probiotics and prebiotics. The main effect of prebiotics (P=0.011) and probiotics (P=0.049) significantly affected FCR of starter broilers. It could be suggested that 2g prebiotics significantly improved FCR whereas the 0.5g probiotics impaired the FCR of the starters.

The best FCR (1.71) was observed in the starters fed 2g prebiotics (T2) without medication. Additionally, their counterparts fed 2g prebiotics with medication closely follow (1.73). Rehman *et al.* (2020), indicated that dietary supplementation of prebiotics (mannan-oligosaccharides) improved weight gain and feed conversion ratio (FCR). Likewise, Piray *et al.* (2007) and Bozkurt *et al.* (2009), reported that dietary prebiotic supplementation from the first day of age until 42 days of age improved feed consumption. Salehimanesh *et al.* (2016) reported that feeding with prebiotics significantly improved feed conversion ratio in broilers over the prebiotic-free ones.

In addition, the chicks fed 0.5g probiotics had the most impaired (P=0.002) FCR at the starter phase and the lowest FBW and ADG in the present study. Awad *et al.* (2009) reported that the body weight significantly increased during the 35 days of the experiment by the addition of synbiotics with probiotics achieved similar body weight with the control. The lowest FBW and ADG of broiler starters offered 0.5g probiotics in this study might be related to several factors such as breed of birds and probiotic strain, sex, and dose rate as suggested by Bedford (2000).

The growth performance of broiler finishers fed diets supplemented with probiotics and prebiotics between 29th to 56th day old age of the experimental birds is shown in Table 2. The synbiotics supplementation of probiotics and prebiotics in finisher diets in T3, T7, T8 significantly improved the FBW (P=0.016) and ADG (P=0.010) in this study. The finishers fed diets supplemented with 0.5g probiotics and 2g prebiotics without medication (T3) had the highest FBW (2464.50g/bird) and ADG (54.44g/bird). This finding was in line with the observations of Rauf *et. al*. (2024) who reported that the synbiotics group displayed increased growth performance. The final body weight and average daily gain of broiler finishers offered sole or combination of probiotics and prebiotics irrespective of medication were significantly better than the control. This also agreed with the observation of Dizaji *et. al.* (2012) who showed that the control group gained less weight than the synbiotics-treated group.

The ADG and FCR for broiler finishers were not significantly affected by the dietary supplements. Sarangi *et. al.* (2016) revealed that FCR was not affected by the supplementation of synbiotics. The sole inclusion of 0.5g probiotics in finisher diet in T1 led to increased FBW and ADG, contrary to earlier finding at the starter phase. This is compensatory growth that the birds in this group experienced. Allahdoa *et al*. (2018) reported that the inclusion of a probiotic in the diet during the growing or finishing periods positively affected body weight gain, feed intake, and feed conversion. Rosen (1995), also reported that supplementing broiler diet with bacitracin probiotic led to increase in live weight from 1.5 to 2.6 kg over weeks 5 to 8 of the growth period. Chickens fed 0.5g probiotics and 2g prebiotics without drug (T3) had the highest FBW (2464.50g/bird, P=0.016) and ADG (54.44g/bird, P=0.010). Dietary supplementation of prebiotics and probiotics (synbiotics) irrespective of medication significantly improved final body weight (P=0.016) relative to the control group. This observation was in line with the assertion of Song *et al.,* (2022) that synbiotics of probiotics and prebiotics enhanced animal growth while inhibiting harmful bacteria, offer a productive substitute for in-feed antibiotics. The lowest mortality (P=0.0007) was observed in broiler finishers offered 2g prebiotics without medication (T2) and those offered 0.5g probiotics and 2g prebiotics along with medication (T7). This observation in this study agreed with reports of Pelicano *et al.* (2005) that mortality percentage was decreased by synbiotics supplementation and the finding of Lowry *et al.* (2005) that using prebiotic in the diet for broilers challenged with salmonella had decreased mortality rate and economic loss. The interaction effect of probiotics with drug (P=0.035) significantly demonstrated influence on the mortality rate of the birds. This suggested the probiotics strain used in the study may have contributed to the high mortality (12.88%) observed in 0.5g probiotics fed group (T1).

The nutrient digestibility of broiler chickens fed diets supplemented with probiotics and prebiotics is shown in Table 4. Broiler chickens fed 2g prebiotic without medication (T2) had the highest (P<0.0001) digestibility in dry matter, crude fibre and ash as well as those fed synbiotics supplementation of probiotics and prebiotics demonstrated better impact on the nutrient digestibility. Elangia *et al.* (2023) reported that supplementation of probiotics, prebiotics, and combinations of probiotics with prebiotics had no influence on ileal digestibility of dry matter (DM), organic matter (OM), crude fibre (CF), and nitrogen-free extract (NFE). The increased nutrient digestibility for prebiotics and synbiotics groups in the present study could be influenced by dosage of the prebiotics, specific bacteria used in the probiotics, and the intricate relationship between probiotics and prebiotics as suggested by Mountzouris *et al.* (2010).

The inclusion of 2g prebiotics as sole supplement as well as 0.5g probiotics and 2g prebiotics (synbiotics) showed optimal nutrient digestibility in this study. Tuohy *et al.* (2003) reported that an increase in the nutrient digestibility in broilers supplemented with an oligosaccharide diet was due to an improvement in gut health. Yun *et al*., (2017), declared that the addition of synbiotics in broiler diets significantly improved nutrient digestibility. The increase in digestibility was attributed to the intake of live microorganisms that modulated the gut environment and enhanced gut barrier function via fortification of the beneficial members of the intestinal microflora, the competitive exclusion of pathogens, and the stimulation of the immune system (Mountzouris *et al*., 2010). Furthermore, interaction effect of probiotics and drug significantly influenced digestibility of dry matter (P=0.027), ash (P=0.002) and ether extract (P=0.001). The main and interaction effects did not significantly affect crude protein digestibility of broiler chickens.

Table 2: Growth performance of broiler starters fed diets supplemented with probiotics and prebiotics (g/bird)

Parameters	Control	T1	T2	T3	T4	T5	T6	T7	T8	P-value	SEM
Final Body Weight	551.44^{cd}	513.33^{d}	627.19^{ab}	634.10^{ab}	615.27^{ab}	594.33^{bc}	670.35^{a}	629.38^{ab}	609.93^{abc}	0.0002	19.30
Initial Body Weight	99.09	96.54	97.81	99.18	98.59	99.23	99.55	99.14	94.77	0.123	4.50
Average Daily Gain (g/b/d)	21.54^{cd}	19.85^{d}	25.21^{ab}	25.17^{ab}	24.60^{ab}	23.58^{bc}	27.18^{a}	25.25^{ab}	24.53^{ab}	0.0003	0.93
Daily intake (g/b/d)	43.72^{bcd}	43.25^{cd}	42.77^{d}	47.01^{ab}	48.62^{a}	46.75^{ab}	46.47^{abc}	46.90^{ab}	44.73^{bcd}	0.004	1.03
FCR	2.04^{ab}	2.19^{a}	1.71^{c}	1.85^{bc}	1.90^{bc}	1.99^{ab}	1.73^{c}	1.90^{bc}	1.83^{bc}	0.002	0.07

Main and Interaction Effects

	Initial Body Weight	**Final Body Weight**	**Av. Daily Gain**	**Feed Intake**	**FCR**
Drug	0.988	0.037	0.039	0.363	0.109
Prebiotics	0.322	0.0005	0.0007	0.071	0.011
Probiotics	0.707	0.390	0.382	0.034	0.049
Prebiotics x Drug	0.290	0.038	0.045	0.098	0.111
Probiotics x Drug	0.489	0.231	0.253	0.079	0.799

^{abcd} Means along the same row with different superscripts are significantly different (P<0.05)
Control = Basal diet + Medicated water (antibiotics, 0.4g Doxystimore20/20®, or coccidiostat, 0.5g GaliCox®/L)
T1 = Basal diet supplemented with 0.5g probiotics/kg; T5 = Basal diet supplemented with 0.5g probiotics/kg + Medicated water; T2 = Basal diet supplemented with 2g prebiotics/kg; T6 = Basal diet supplemented with 2g prebiotics/kg + Medicated water; T3 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg; T7 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg + Medicated water; T4 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg; T8 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg + Medicated water

Table 3: Growth performance of broiler finishers fed diets supplemented with probiotics and prebiotics (g/bird)

Parameters	Control	T1	T2	T3	T4	T5	T6	T7	T8	P-value	SEM
Final Body Weight	1937.80^{c}	2341.70^{ab}	2235.40^{ab}	2464.50^{a}	2072.50^{bc}	2187.50^{abc}	2274.30^{ab}	2351.70^{ab}	2362.10^{ab}	0.016	94.21
Initial Body Weight	551.44^{cd}	513.33^{d}	627.19^{ab}	634.10^{ab}	615.27^{ab}	594.33^{bc}	670.35^{a}	629.38^{ab}	609.93^{abc}	0.0002	4.50
Average Daily Gain (g/b/d)	39.61^{d}	52.24^{ab}	45.95^{abcd}	54.44^{a}	41.63^{d}	45.52^{cd}	47.30^{abcd}	49.21^{abc}	50.06^{abc}	0.010	2.65
Daily intake (g/b/d)	96.59	112.21	95.39	97.50	93.98	101.20	99.99	100.29	98.11	0.424	5.19
FCR	2.47	2.16	2.22	1.80	2.26	2.24	2.13	2.04	1.96	0.487	0.20
Mortality (%)	8.33^{bcd}	12.88^{ab}	3.79^{d}	5.30^{d}	11.36^{abc}	15.91^{a}	11.36^{abc}	4.55^{d}	6.82^{cd}	0.0007	1.87

Main and Interaction Effects

	Initial Body Weight	Final Body Weight	Weight Gain	Feed Intake	FCR	Mortality
Drug	0.037	0.509	0.797	0.990	0.665	0.335
Prebiotics	0.0005	0.133	0.276	0.166	0.147	<0.0001
Probiotics	0.390	0.110	0.061	0.827	0.184	0.167
Prebiotics x Drug	0.038	0.825	0.781	0.219	0.681	0.319
Probiotics x Drug	0.231	0.419	0.225	0.870	0.397	0.035

^{abcd} Means along the same row with different superscripts are significantly different ($P<0.05$)
Control = Basal diet + Medicated water (antibiotics, 0.4g Doxystimore20/20®, or coccidiostat, 0.5g GaliCox®/L)
T1 = Basal diet supplemented with 0.5g probiotics/kg; T5 = Basal diet supplemented with 0.5g probiotics/kg + Medicated water; T2 = Basal diet supplemented with 2g prebiotics/kg; T6 = Basal diet supplemented with 2g prebiotics/kg + Medicated water
T3 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg; T7 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg + Medicated water; T4 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg; T8 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg + Medicated water

Table 4: Nutrient digestibility of broiler chickens fed diets supplemented with probiotics and prebiotics (%)

Parameters	Control	T1	T2	T3	T4	T5	T6	T7	T8	P-value	SEM
Dry Matter	89.71^{bc}	89.88^{bc}	93.04^{a}	88.22^{bcd}	87.22^{cd}	85.64^{d}	90.19^{b}	89.45^{bc}	80.15^{e}	<0.0001	0.88
Crude Protein	91.87	90.46	94.93	88.57	87.77	88.91	94.96	91.65	92.07	0.250	4.69
Crude Fibre	73.10^{f}	89.09^{d}	96.27^{a}	95.63^{ab}	90.78^{cd}	91.08^{cd}	92.92^{bc}	93.26^{abc}	84.41^{e}	<0.0001	1.05
Ether Extract	70.33^{ab}	67.86^{cd}	78.88^{ab}	86.01^{a}	59.88^{de}	75.39^{bc}	85.11^{a}	79.72^{ab}	52.87^{e}	<0.0001	2.77
Ash	90.64^{b}	88.81^{bc}	93.99^{a}	83.98^{d}	86.16^{cd}	90.25^{b}	93.60^{a}	90.30^{b}	64.03^{e}	<0.0001	0.95
Nitrogen Free Extract	90.78^{bcd}	93.23^{ab}	93.84^{ab}	92.01^{abc}	99.80^{a}	89.12^{d}	92.81^{ab}	92.45^{ab}	85.61^{e}	<0.0001	0.76

Main and Interaction Effects

	Dry Matter	Crude Protein	Crude Fibre	Ether Extract	Ash	NFE
Drug	<0.0001	0.559	<0.0001	0.605	<0.0001	<0.0001
Prebiotics	0.225	0.827	<0.0001	<0.0001	0.019	0.169
Probiotics	0.004	0.019	0.808	0.620	<0.0001	0.156
Prebiotics x Drug	0.004	0.239	0.002	0.0005	0.017	0.005
Probiotics x Drug	0.027	0.433	0.441	0.001	0.002	0.335

^{abcd} Means along the same row with different superscripts are significantly different ($P<0.05$)
Control = Basal diet + Medicated water (antibiotics, 0.4g Doxystimore20/20®, or coccidiostat, 0.5g GaliCox®/L)
T1 = Basal diet supplemented with 0.5g probiotics/kg; T5 = Basal diet supplemented with 0.5g probiotics/kg + Medicated water; T2 = Basal diet supplemented with 2g prebiotics/kg; T6 = Basal diet supplemented with 2g prebiotics/kg + Medicated water; T3 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg; T7 = Basal diet supplemented with 0.5g probiotics/kg + 2g prebiotics /kg + Medicated water; T4 = Basaldiet supplemented with 1g probiotics/kg + 4g prebiotics /kg; T8 = Basal diet supplemented with 1g probiotics/kg + 4g prebiotics /kg + Medicated water

Conclusion and Recommendation

The following can be concluded from the outcome of the study

1. Synbiotics supplementation of 0.5g probiotics and 2g prebiotics to broiler starters that had assess to medicated water of antibiotics and coccidiostat (T6) produced the heaviest final body weight (P=0.0002) and average daily gain (P=0.0003). The most efficient FCR was observed in those offered 2g prebiotics without medication (T2).
2. Synbiotics supplementation of 0.5g probiotics and 2g prebiotics to broiler finishers without medication (T3) produced the heaviest FBW (P=0.016) and ADG (P=0.010). Lower mortality rates were observed in broiler chickens fed 2g prebiotics without medication (T2, 3.78%) and their counterparts on the synbiotics supplementation of 0.5g probiotics and 2g prebiotics with (T7, 4.55%) or without medication (T3, 5.30%) than the control (8.33%).
3. Feeding of 2g prebiotics without medication (T2) to broiler chickens had the highest nutrient digestibility of dry matter, crude fibre and ash. Synbiotics usage of 0.5g probiotics and 2g prebiotics without (T3) or with medication (T7) had better nutrient digestibility than the control.

Recommendation

The supplementation of synbiotics of 0.5g probiotics and 2g/kg prebiotics as well as 2g/kg prebiotics are recommended as suitable alternatives to antibiotics and coccidiostat for optimum growth performance and efficient nutrient digestibility. However, the effective usage of probiotics, prebiotics and synbiotics as alternatives to antibiotics and coccidiostats in broiler production should be coupled with efficient management protocol and good biosecurity at the rearing site to avoid increased mortality.

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