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Response of broiler chickens fed diets containing single and combined levels of Mycofix® and Biotronic® SE

***[1]Kehinde, H.W., [2]Sekoni, A. A., [1]Olugbemi, T. S. and [1]Onimisi, P. A.**

Animal Science Department, Ahmadu Bello University, Zaria, Nigeria, [2]National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria

Corresponding Author: yebokenny@gmail.com Phone No.: +234 8066245044

Target Audience: Poultry Farmers, Feed millers Researchers

Abstract

A feeding trial was conducted to evaluate the response of Ross broiler chicks fed diets containing single and combined levels of Mycofix® and Biotronic ® SE. A total of 396 Ross day old broiler chicks were allotted to six (6) dietary treatments in a completely randomized design. Each treatment had three replicates of 22 chicks each. Treatment one was the positive control diet without Mycofix® and Biotronic® SE while treatments 2, 3, 4, 5 and 6 (negative control) consisted of 400g Mycofix®, 500g Biotronic® SE, 200gMycofix® + 200 Biotronic® SE, 400g Mycofix® + 400g Biotronic® SE and 100g Oxyteracycline / 100 kg feed respectively. Feed and water were given to the birds ad libitum for the seven weeks period of the trial. Performance parameters measured were final body weight, weight gain, feed intake, feed conversion ratio, carcass evaluation, nutrient digestibility and villi morphometrics. Data collected were subjected to Analysis of Variance, while significant differences among treatment means were compared using Duncan test of significance. The results of the starter phase showed no significant (P>0.05) differences in most of the parameters measured. Birds on the negative control diet showed a significantly (P< 0.05) higher feed intake (1920.44g) compared to the other treatment groups. At the finisher phase, birds in the negative control treatment group had significantly (P<0.05) higher final weight (2999.0g), weight gain (1811.20 g), average daily weight gain (64.89 g), better feed conversion ratio (1.63) and least feed cost per kilogram gain (₦142.91). Nutrient digestibility in birds on single and combined levels of Mycofix® and Biotronic® SE had a significant (P<0.05) effect on dry matter digestibility. Results of villi morphometrics of sections of the jejunum showed that birds on combined 400g Mycofix® + 500g Biotronic® SE had significantly (P< 0.05) higher villi crypt. Villi roundness in the positive or negative control group was significantly (P< 0.05) higher than the other treatment groups. It can be concluded that the use of Mycofix® and Biotronic® SE either singly or in combination had no adverse effect on the growth parameters measured as well as improved the growth of broiler chickens, The birds performed comparable to those on antibiotic treatment in most of the parameters measured. It is recommended that the combined use of Mycofix® and Biotronic® SE at 400g/ 100kg feed can be employed as a replacement for antibiotics as growth promoters.

Key words: Mycofix®, Biotronic® SE, growth performance, villi morphometrics

Description of Problem

Mycotoxins are a historical problem in poultry and were first recognized in the 1960s as the cause of 'Turkey X disease' in England which resulted in the death of 100,000 turkey poults and many ducks, chickens and pheasants (1).Mycotoxins are highly toxic secondary metabolic products of moulds on

almost all agricultural commoditiesworldwide (2). They occur under natural conditions in feed. Several studies proved that economic losses occur at all levels of food and production, including crop and animal production, processing and distribution chain (2, 3).Surveys of mycotoxin levels in poultry feeds often reveal the presence of a number of different toxins; most samples in a recent survey contained at least 10 contaminants. Contamination of feeds with mycotoxins is a worldwide problem, with the most important in poultry being those produced by the genera, *Fusarium, Aspergillus and Penicillium* (4).

Mycotoxin binders or adsorbents are substances that bind to mycotoxins and prevent their absorption through the gut and into the blood circulation (5).The addition of mycotoxin binders to poultry diets has been considered the most promising dietary approach to reduce the effects of mycotoxins in combating contamination of poultry feed (6). The theory is that the binder decontaminates mycotoxins in the feed by binding them strongly enough to prevent toxic interactions with the consuming animal and to prevent mycotoxin absorption across the digestive tract.

A functional and healthy gut is the cornerstone for optimum performances of birds. When the gut function and health are impaired, digestion and absorption of nutrients are affected thus the health and performance of birds will be compromised (7).

Acidifiers' constitute an important component of modern feeding strategies without antibiotics. Acidifiers are added to the poultry feed in a solid form as this fights mould development in the feed and reduces the pH in the birds' gastro intestinal tract (8).Dietary acidifiers also improve nutrient digestion and protect the GIT from pathogenic bacteria invasion and proliferation by reducing the pH in the GIT, which checks the growth and proliferation of pathogenic organisms (9). The study;s objectives therefore aimed at, looking at effect of single and combined levels of including Mycofix®, and Biotronic®,SE in diets of broiler chickens on growth characteristics and villi morphometrics. The study also evaluated the synergy in the combine use of Mycofix®, and Biotronic®,SE in diets of broiler chickens in improving growth.

Materials and Methods

Experimental site and location

The experiment was carried out at the poultry unit of the Department of Animal Science Teaching and Research farm, Faculty of Agriculture, Ahmadu Bello University, Samaru, Zaria. The site is located in the Guinea Savannah Zone of Nigeria, Latitude 11^{o} 9' 46'' N and Longitude 7^{o}37'45''E at an altitude of 610m above sea level. The temperature ranges between 26-40^{o}C depending on the season while the relative humidity during the dry and wet seasons are 21 and 72% respectively. The wet period in Zaria is between May and October with annual rainfall of about1500mm (10).

Source of Experimental birds / Mycofix®,Biotronic® SE and Oxytetracycline

Ross breed of broiler chicks purchased from a reputable hatchery located in South Western Nigeria were used for the trials. Mycofix®, Biotronic®SE and Oxytretracycline were purchased from a commercial dealer in poultry products in Kaduna metropolis, Kaduna, State.Manufacturer doses for Mycofix® is 2-3kg/ton for starter and finisher phases, Biotronic®SE 3 – 4kg / ton at starter phase and 2 -3 kg/ton at finisher phase and Oxytetracycline 100g/100kg feed

Experimental diets

Six experimental diets were formulated at both Broiler starter and finisher phases to meet the nutrient requirement of broiler chickens.

Treatment one was the control diet without Mycofix®, Biotronic® SE and Oxytetracycline, treatment 2, had 400g Mycofix®/100kg feed, treatment 3 had 500g Biotronic® SE/100kg feed, Treatment four was a combination of 200g Mycofix®and 250g Biotronic® SE. Treatment 5 was a combination of 400g of Mycofix®and 400g Biotronic® SE. Treatment 6 consisted of 100g Oxytetracycline. The composition of ingredients and estimated nutrient content of diets are shown in Tables 1and 2.

Table 1: Ingredient composition of experimental broiler starter diets supplemented with levels of Biotronic®SE and Mycofix® singly and in combination (0 – 4 weeks)

	T1	T2	T3	T4	T5	T6
Maize	56.00	56.00	56.00	56.00	56.00	56.00
Soya bean cake	29.70	29.70	29.70	29.70	29.70	29.70
Groundnut cake	10.00	10.00	10.00	10.00	10.00	10.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Vitamin premix*A	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis						
ME Kcal/kg (%)	2902	2902	2902	2902	2902	2902
Crude protein (%)	23.19	23.19	23.19	23.19	23.19	23.19
Crude fibre (%)	3.59	3.59	3.59	3.59	3.59	3.59
Ether extract (%)	3.16	3.16	3.16	3.16	3.16	3.16
Calcium (%)	1.32	1.32	1.32	1.32	1.32	1.32
Phosphorous (%)	0.87	0.87	0.87	0.87	0.87	0.87
Lysine (%)	1.46	1.46	1.46	1.46	1.46	1.46
Methionine (%)	0.56	0.56	0.56	0.56	0.56	0.56
Cost/ kg diet(₦)	83.82	84.06	84.13	84.24	84.36	91.32

[A]Biomix Broiler starter premix provide per kg f diet Vit. A, 10,000 I.u; Vit D_3, 2000 I.U; Vit E 23mg; Vit. K, 2mg; Calcium, Pantothenate,7.5mgnB12, 0.015mg; Folic acid, 0.75mg; Choline Chloride, 300mg; Vit B_1 1,8mg, Vit. B_2, 5mg; Vit B_6, 3mg; Manganese, 40m g; Iron, 20mg; Copper, m3g; Iodine, 1mg; Cobalt, 0.2mg; Selenium, 0.2mg' Zinc, 50mg Myco.: Mycofix®, Bio: Biotronic®SE, Oxyte: Oxytetracycline. T1:postive control, T2: 400g Myco, T3: 500g Bio, T4: 200gMyco + 250gBio, T5; 400gMyco +400g Bio, T6: Negative control 100g Oxt

Table 2: Ingredient composition of experimental broiler finisher diets supplemented with levels of Biotronic®SE and Mycofix® singly and in combination (5 – 7 weeks)

Ingredients	T1	T2	T3	T4	T5	T6
Maize	58.00	58.00	58.00	58.00	58.00	58.00
Soya bean cake	20.00	20.00	20.00	20.00	20.00	20.00
Groundnut cake	13.00	13.00	13.00	13.00	13.00	13.00
Maize offal	4.65	4.65	4.65	4.65	4.65	4.65
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Limestone	0.50	0.50	0.50	0.50	0.50	0.50
Common salt	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Vitamin premix[A]	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis						
ME Kcal/kg	2929	2929	2929	2929	2929	2929
Crude protein	20.54	20.54	20.54	20.54	20.54	20.54
Crude fibre	4.11	4.11	4.11	4.11	4.11	4.11
Ether extract	3.35	3.35	3.35	3.35	3.35	3.35
Calcium	1.32	1.32	1.32	1.32	1.32	1.32
Phosphorous	0.85	0.85	0.85	0.85	0.85	0.85
Lysine	1.27	1.27	1.27	1.27	1.27	1.27
Methionine	0.50	0.50	0.50	0.50	0.50	0.50
Cost/ kg diet(₦)	79.44	79.68	79.68	76.68	79.92	86.90

[A]Biomix Broiler Finisher premix provides per kg f diet Vit.A, 10,000 I.u; Vit D_3, 2000 I.U; Vit E 23mg; Vit. K, 2mg; Calcium, Pantothenate, 7.5mg B12, 0.015mg; Folic acid, 0.75mg; Choline Chloride, 300mg; Vit B_1 1,8mg, Vit. B_2, 5mg; Vit B_6, 3mg; anganese, 40mg; Iron, 20mg; Copper, m3g; Iodine, 1mg; Cobalt, 0.2mg; Selenium, 0.2mg' Zinc, 30mg Myco = Mycofix®, Bio = Biotronic®SE, Oxyte = OxytetracyclineT1-Basal diet (Positive control) T2 - Basal diet +400g Mycofix® T3- Basal diet + 500g Biotronic®ST4 - Basal diet + 200g Mycofix® + 250g Biotronic®ST5- Basal diet + 400g Mycofix® + 500g Biotronic®SET6 - Basal diet + 100g Oxytetracycline (Negative control)

Experimental design and management of birds

A total of 396 unsexed day-old broiler chicks were used for the study. The chicks were randomly allocated based on an initial average weight of 43.11g,to six isonitrogenous and isocaloric diets, each treatment with three replicates containing 22 birds per replicate in a completely randomized design (CRD). The birds were reared on a deep litter system with feed and water provided *ad libitum* during the 7 weeks experimental period. The diets were formulated to meet the nutrient requirement of broiler chickens (11). After four weeks of starter phase, the birds were randomized and adjusted for weights within treatments, using a uniform average weight (1179.33g for the next three weeks which constituted the finisher phase and fed the finisher diets..Twenty birds were used per replicate. Vaccines against Newcastle and Gumboro diseases were administered following the vaccination schedule of the Veterinary Teaching Hospital of Ahmadu Bello University, Zaria.

Data collection / Parameters measured

Growth Performance

Initial average body weight of the day-old chicks was taken per replicate and subsequently feed intake and body weights of the birds were recorded weekly in both starter and finisher phases. Body weight gain was calculated as the difference between the final and the initial weight, feed intake was calculated as the difference between the initial feed given and the leftover. Feed / gain ratio was calculated as a ratio between feed intake and weight gain and mortality was recorded as it occurred

Nutrient Digestibility Trial

On the 49thday of the feeding trial, six (6) birds having representative average weights of the group were selected from each treatment and kept in individual metal cages for total excreta collection. The birds were allowed a period of three days to adjust to the cage environment. Thereafter, one kilogram each of the experimental feed was weighed for each bird and given daily for 5 days with water. Trays were placed under each cage to enable daily excreta collection. Total excreta was collected for five consecutive days, weighed and oven-dried at 65 ^{0}C for 24 hours. The total feed consumed was calculated as a difference of the leftover from the initial feed weighed per bird. The dried excreta were then assayed for their nutrient contents using methods described by (12) at the Biochemical Laboratory of the Department of Animal Science, Ahmadu Bello University Zaria. Nutrient digestibility was determined for crude fibre, crude protein, ether extract, ash and nitrogen free extract using the formula below:

$$\% \text{ Apparent Digestibility} = \frac{\text{Nutrient in feed} - \text{Nutrient in faeces}}{\text{Nutrient in feed}} \times 100$$

Where; Nutrient intake (g) = Feed intake x Nutrient in feed; Nutrient output (g) = Feacal output x Nutrient in faeces.

Quantitative Assessment of Gut Morphology

A portion of the jejenum approximately 6cm long was cut from the intestines of six birds per treatment. Each sample was fixed in 10% formal saline for 24 hours. Gross sections of the jejunum were processed with the aid of an automated tissue processor at the Histology Laboratory, Faculty of Human Medicine, Ahmadu Bello University Zaria for Histo-Morphological assessment. Sections of the processed tissues were cut using a rotator microtome at 8µ and each sample was prepared on a slide. The photomicrographs were taken at a magnification of x40 using MD9000 Amscope digital camera. Ten readings per sample were taken for villi area, villi height, villi width, villi perimeter, villi roundness and villi crypts were measured using a digimizer image analyzer software. Villi height was measured from the basal region (which starts at a higher portion of crypts, until villi tip), perimeter was measured around the border where the microvilli are located as described by (13).

Carcass Analysis

At the end of the 7th week, six chickens were randomly selected from each treatment, which represented the average weight of the group for carcass evaluation. The selected birds were fasted of feed overnight, weighed and slaughtered by severing the jugular vein to bleed. The birds were then scalded in hot water to remove their feathers. Live weight was taken before slaughtering, the dressed weight, cut parts (breast, thigh, drum stick, back and wings) were measured and expressed as percent dressed weight while dressing percentage was calculated as live weight divided by dressed weight multiplied by 100.

The organs were measured and expressed as percentages of their live weights.

Statistical analysis

Data generated from the studies were subjected to the analysis of variance (ANOVA) using the General Linear Model (GLM) procedure Statistical Analysis Systems (14). Significant differences among treatment means were separated using Duncan's Multiple Range Test in SAS, version 9 package. Model used for the study is shown as:

$$\mathbf{Y}_{ij} = \boldsymbol{\mu} + \mathbf{t}_i + \mathbf{e}_{ij}$$

Where:

$\mathbf{Y}_{ij}$= Dependent variable

$\boldsymbol{\mu}$= Overall mean

$\mathbf{t}_i$= i^{th} Effect of treatment

$\mathbf{e}_{ij}$ = Random error

Results and discussion

Growth Study of broiler starter chicks fed diets containing varying levels of single and combined Mycofix® and Biotronic®SE

The effect of single and combined Mycofix® and Biotronic® SE on the performance of broilers chicks is presented on table 3. The results showed no significant ($P>0.05$) differences in most of the parameters measured (final weight, weight gain and FCR) Feed intake and average daily feed intake however, was significantly ($P<0.05$) higher in birds on Oxytretacycline treatment compared to the other groups and the control.

From literature reviews, there have been combinations of organic acid, probiotics and antibiotics but there is a paucity of information on use of toxin binders and organic acid singly and in combination with antibiotics in a study. However, the use of toxin binder in ameliorating the effect of toxins present in feed are well documented (15). In the present study, the observed non significant effect in the single and combined use of Mycofix® and Biotronic® SE as feed additives may be associated with other factors. With a good environmental condition, well-nourished, healthy chicks did not positively respond to growth promoters when they were housed under clean conditions at moderate stocking density. The two additives used singly and in combination at different levels with the antibiotic group did not improve growth performance above the control diet. Several researchers reported that when chicks were housed in a clean environment, growth promoters such as probiotic, organic acid or antibiotic may not have a pronounced effect on performance (16).

Table 3: Growth performance of broiler chicks on levels of single and combined Mycofix® and Biotronic ® SE

Parameters	T1	T2	T3	T4	T5	T6	SEM
Initial weight (g/bird)	43.12	43.11	43.11	43.12	43.10	43.12	0.01
Final weight (g/bird)	1096.67	1158.33	1133.33	1100.00	1191.67	1241.67	36.36
Weight gain (g/bird)	1053.55	1115.23	1090.22	1056.88	1148.56	1198.55	36.36
Av. daily wt gain (g/bird)	37.63	39.83	38.94	37.75	41.02	42.81	1.30
Total feed intake (g/bird)	1775.01^{b}	1801.08^{b}	1799.43^{b}	1800.92^{b}	1813.18^{b}	1920.44^{a}	24.27
Av daily feed intake (g/bird)	63.39^{b}	64.32^{b}	64.27^{b}	64.32^{b}	64.76^{b}	68.59^{a}	0.87
Feed conversion ratio	1.62	1.60	1.68	1.67	1.57	1.59	0.04
Feed cost /gain (₦/kg gain)	135.84	134.81	14	139.56	132.26	145.31	3.18
Mortality Percentage (%)	0.20	0.00	0.00.	0.00	0.00	0.00	0.02

^{ab}Means with different subscripts along the same rows show significant difference, SEM = standard error mean, Myco = Mycofix, Bio = Biotronic, Oxyt = Oxytetracycline, Av = average, wt = weight. T1:postive control, T2: 400g Myco, T3: 500g Bio, T4: 200gMyco + 250gBio, T5; 400gMyco +400g Bio, T6: Negative control 100g Oxt

Growth Study of broiler finisher chickens fed diets containing single and combined levels of Mycofix® and Biotronic® SE

Table 4 shows the results of growth performance of broiler finisher chickens fed levels of single and combined Mycofix® and Biotronic® SE. The result shows non - significant (P>0.05) differences for final live weight, body weight gain, average daily weight gain and feed conversion ratio, in the control (positive) and the other treatment groups. However, birds fed Oxytetracycline had a significantly (P<0.05) higher in final live weight, weight gain, average daily weight gain and had the best feed conversion ratio compared to the rest groups.

The superior performance of the Oxytetracycline group at the finisher phase compared with all the other treatments showed that antibiotic increased feed efficiency and growth rate which could be attributed to its anti-microbial effect. This result can be compared with the findings of (17) who reported that the highest weight gain was achieved by virginiamycin (P<0.05), when Sangrovit® herbal extract was used at 35g/ton of diet, Primalac® a probiotic was used at 0.1 % of diet, Termin-8® an organic acid was added at 0.2 % of diet and Virginiamycin an antibiotic was used at 15ppm of diet as additives in broiler diets.

Table 4: Growth Performance of broiler chickens on levels of single and combined Mycofix® and Biotronic ® SE

Parameter	T1	T2	T3	T4	T5	T6	SEM
Initial weight(g/bir)	1179.33	1179.67	1179.67	1179.00	1179.55	1179.00	0.54
Final weight (g/bird)	2568.63[b]	2529.41[b]	2637.25[b]	2637.25[b]	2589.46[b]	2990.20[a]	58.17
Weight gain (g/bird)	1389.29[b]	1349.75[b]	1457.59[b]	1458.24[b]	1410.13[b]	1811.20[a]	58.31
Av. daily wt gain (g/bird)	49.21[b]	48.21[b]	52.06[b]	52.08	50.36[b]	64.89[a]	2.08
Total feed intake (g/bird)	2841.18	2644.12	3005.88	2832.35	2750.25	2955.88	67.22
Av daily feed intake (g/bird)	135.29	125.91	143.14	134.87	130.96	140.76	3.20
Feed conversion ratio	2.04[b]	1.96[b]	2.07[b]	1.95[b]	1.98[b]	1.63[a]	0.06
Feed cost /gain ((₦/kg gain)	162.41	156.51	164.62	155.93	155.88	141.91	4.93
Mortality (%)	0.05	0.00	0.00	0.00	0.00	0.00	0.02

[ab]Means with different subscripts along the same rows show significant difference, SEM = Standard error mean, Myco = Mycofix, Bio. = Biotronic, Oxyt = Oxytetracycline, Av = average, wt = weight T1-Basal diet (Positive control) T2 - Basal diet +400g Mycofix® T3- Basal diet + 500g Biotronic®ST4 - Basal diet + 200g Mycofix® + 250g Biotronic®ST5- Basal diet + 400g Mycofix® + 500g Biotronic®SET6 - Basal diet + 100g Oxytetracycline (Negative control)

Single and combined levels of Biotronic® SE and Mycofix® on apparent nutrient digestibility of broiler finisher chickens

The effect of single and combined levels of Biotronic® SE and Mycofix ®diets on nutrient digestibility of broiler finisher chickens is presented on table 5. The dry matter, crude protein, crude fibre, ether extract and ash differed significantly (P<0.05) among various treatment groups. Dry matter results for treatment 2 (400g Mycofix) and the control were significantly (P<0.05) different from treatments 3, 4, 5 and 6 which were similar in values that is 84.92, 85.00, 84.66 and 84.66% respectively. Digestibility values for crude protein were similar for birds on control, 400g Mycofix®, 400g Biotronic® SE, 200g Mycofix and 200g Biotronic® SE and 400g Mycofix® and 400g Biotronic® SE but significantly (P<0.05) different from 100g Oxytetracycline. Control had a better digestibility value for ether extract which was significantly (P<0.05) different from other treatment groups. Ash values were better in control, 400 Mycofix®, 400g Biotronic® SE and T6 compared with the rest.

The improved digestibility results obtained with birds on 400g Biotronic ®SE indicated the positive effect of organic acid on nutrient utilization. It has been documented that dietary supplementation of organic acids can improve the retention of protein and other nutrients. Broiler chickens fed diets containing various inclusion levels of dietary organic acids generally had greater retention of dry matter (DM) and protein than those fed control diets (18. 19).

(20) reported that there was 1.3% increase in DM and 2.1% increase in crude protein over the control when citric acid 20 g/kg was included in broiler diets.. (21) reported 4.4% and 2.9% increase respectively for DM and CP over the control when 40g/kg citric acid was included in broiler diets. According to (22), the positive effect of organic acids on digestion was related to a slower passage of feed in the intestinal tract, a better absorption of the necessary nutrients and less wet droppings.

Table 5: Single and combine levels of Biotronic® SE and Mycofix® diets on apparent nutrient digestibility broiler finisher chickens

Parameters	T1	T2	T3	T4	T5	T6	SEM
Dry matter (%)	70.44[c]	75.70[b]	84.92[a]	85.00[a]	84.66[a]	82.66[a]	1.49
Crude protein (%)	81.40[a]	82.52[a]	81.38[a]	83.52[a]	85.13[a]	77.42[b]	1.42
Crude fibre (%)	77.44[a]	76.07[a]	75.57[a]	65.38[b]	60.61[b]	74.20[a]	2.46
Ether extract (%)	93.01[a]	85.16[b]	88.17[b]	82.39[b]	86.64[b]	85.84[b]	1.96
Ash (%)	84.99[a]	84.16[a]	85.03[a]	77.63[b]	75.78[b]	84.16[a]	1.42
NFE (%)	59.16	48.74	54.41	48.09	43.41	49.17	3.86

[abc] = Means with different superscripts along same rows show significant differences, SEM = Standard Error of Means, NFE = Nitrogen free extract, Oxyt = Oxytetracycline T1-Basal diet (Positive control) T2 - Basal diet +400g Mycofix® T3- Basal diet + 500g Biotronic®ST4 - Basal diet + 200g Mycofix® + 250g Biotronic®ST5- Basal diet + 400g Mycofix® + 500g Biotronic®SET6 - Basal diet + 100g Oxytetracycline (Negative control)

Villi morphometrics of sections of jejunum ofbroiler finisher chickens fed single and combined levels onMycofix® and Biotronic® SE diets

Table 6 presents results of the effect of single and combined levels ofMycofix® and Biotronic® SE diets on villi morphometrics of section of the jejunum of broiler finisher chickens. The results showed significant ($P<0.05$) differences in terms of villi roundness and crypt across treatments. No influence of the applied treatments was observed for villi area, perimeter, height and width across treatments.

The villus crypt is regarded as the villus factory, and deeper crypts indicate fast tissue turnover to permit renewal of the villus as needed in response to normal sloughing or inflammation from pathogens or their toxins and high demands for tissue (23).

There was a significant increase ($P<0.05$) in the intestinal crypt of birds fed 400g Mycofix® and 400g Biotronic ®SE, compared with control, and the other treatment groups. (24) reported that decreased crypts depth may lead to poor nutrient absorption, increased secretion in the gastrointestinal tract and lower performance.

Conversely, (25) reported that crypts of jejunum were significantly deeper in birds fed the formic acid diet (1.0%) than birds fed the antibiotic diets (266 vs. 186 µm, respectively; $P<0.05$) in the same experiment. Thus, formic acid supplementation increased both the villus height and crypt depth.Short-chain fatty acids have been demonstrated to stimulate the proliferation of normal crypt cells, enhancing healthy tissue turnover and maintenance. This reduction in the muscularis thickness was helpful in improving the digestion and absorption of nutrients as reported by (26) that the thickening of mucous layer on the intestinal mucosa contributed to the reduced digestive efficiency and nutrient absorption.

Table 6: Villi Morphometrics of sections of Jejunum broiler finisher chickens

Parameters	T1	T2	T3	T4	T5	T6	SEM
Villi Area (µm)	52876	41205	40379	73664	63575	36051	12372.34
Villi Perimeter (µm)	2375	2920	5944	4925	3678	3185	1670.34
Villi Height (µm)	675.50	664.80	723.30	1124.40	767.80	546.30	320.35
Villi Width (µm)	172.93	187.94	205.75	269.43	217.38	237.20	34.30
Villi Roundness (µm)	0.16[a]	0.06[b]	0.06[b]	0.05[b]	0.08[b]	0.07[b]	0.03
Villi Crypt (µm)	643.16[b]	627.97[b]	696.50[b]	643.16[b]	895.05[a]	555.46[b]	112.39

SEM = Standard error mean; Oxyt = Oxytetracycline; Myco = Mycofix® = Bio:= Biotronic T1-Basal diet (Positive control) T2 - Basal diet +400g Mycofix® T3- Basal diet + 500g Biotronic®ST4 - Basal diet + 200g Mycofix® + 250g Biotronic®ST5- Basal diet + 400g Mycofix® + 500g Biotronic®SET6 - Basal diet + 100g Oxytetracycline (Negative control)

Carcass Characteristics of Broiler Finisher Chickens

The results of carcass characteristics of broiler finisher chickens fed diets containing single and combined levels of Mycofix® and Biotronic® SE are presented in table.7. Birds on Oxytetracycline were significantly (P<0.05) higher than the rest treatment groups in terms of live weight and carcass weight. There were no statistical differences observed for dressing percentage in all the treatments. Results of cut parts showed that birds on Oxytetracyline had a significantly (P <0.05) higher breast cut value compared with the rest treatments. Birds on 400g Biotronic® SE had a significantly (P < 0.05) higher drum stick value than the rest treatment groups. The better carcass yield observed in the Oxytetracycline fed group could be attributed to the higher weight of birds in the group compared with the other treatments and control. The use of antibiotics as growth promoters has the ability to improve weight gain as well as carcass yield of birds have been reported (27). The heavier breast and thigh could be as result of a better dressing percentage observed for the treatment.

Table 7: Carcass characteristics of broiler chickens on single and combined levels of Mycofix® and Biotronic® SE

Parameters	T1	T2	T3	T4	T5	T6	SEM
Live weight (g/bird)	2561.67[b]	2519.62[b]	2601.83[b]	2681.64[b]	2752.83[b]	3004.83[a]	72.75
Carcass weight (g)	1921.67[b]	1817.33[b]	1851.17[b]	1890.83[b]	1931.83[b]	2158.17[a]	76.23
Dressing percentage %	71.83	70.45	71.12	70.12	72.01	75.11	1.71
Cut parts expressed as percentage of carcass weight (%)							
Back	11.70	12.91	12.72	12.41	11.77	12.54	0.62
Breast	22.76[b]	22.83[b]	23.46[b]	23.23[b]	25.30[b]	28.73[a]	0.94
Thigh	10.46	11.95	12.64	11.28	13.05	13.01	0.74
Drum stick	9.00[b]	9.20[b]	10.75[a]	9.31[b]	8.48[b]	8.84[b]	0.47
Wings	6.53	6.80	7.06	6.97	6.47	7.13	0.42
Organs expressed as percentage of live weight (%)							
Heart	0.66	0.62	0.62	0.56	0.55	0.66	0.06
Full gizzard	3.90	4.29	4.12	4.26	3.88	3.77	0.29
Empty gizzard	2.60	2.82	2.74	2.83	2.64	2.47	0.20
Liver	2.56	3.13	2.95	2.78	3.05	2.43	0.31
Lungs	1.20	0.87	0.79	0.69	0.73	0.63	0.71
Kidneys	0.77	0.85	0.83	0.86	0.82	0.71	0.06
Spleen	0.12	0.15	0.19	0.13	0.18	0.12	0.06
Abdominal fat	1.57	1.78	1.93	1.74	1.96	2.45	0.30

[ab]Means with different superscripts along same rows show significant difference, SEM = Standard error mean, Bio = Biotronic® SE, Oxyt = Oxytetracycline ,Myco = Mycofix® T1-Basal diet (Positive control) T2 - Basal diet +400g Mycofix® T3- Basal diet + 500g Biotronic®ST4 - Basal diet + 200g Mycofix® + 250g Biotronic®SE, T5- Basal diet + 400g Mycofix® + 500g Biotronic®SET6 - Basal diet + 100g Oxytetracycline (Negative control)

Conclusion and Applications

The study showed that

1. Single and combined levels of Mycofix®a toxin binder and Biotronic®SE an acidifier did not significantly improve growth of broiler chickens.
2. The inclusion levels of Mycofix® and Biotronic® SE ….however, worked in synergy with each other even at high inclusion levels.
3. The inclusion of 400g Mycofix® + 400g Biotronic® SE significantly improved the villi crypt over the control and the other treatment groups.

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