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Growth Performance, Carcass and Organ Characteristics of Broiler Finishers Fed Dietary Acidifiers

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Abstract: ***Four (4) weeks feeding trial was conducted using one hundred and twenty; twenty eight-days-old Agritech broiler strain, to evaluate the effect of acidifiers on growth performance, organ and carcass characteristics. Four dietary treatments were formulated, using thirty birds per treatment in a completely randomized design (CRD) experiment. Each treatment was replicated three times with ten birds per replicate; consisting of T_1 (control), T_2 (hydrated lime), T_3 (citric acid) and T_4 (hydrated lime + citric acid). The result showed that final body weight, daily weight gain and daily feed intake were significantly ($P<0.05$) affected by the dietary treatments, except feed conversion ratio which was not significantly ($P>0.05$) influenced by the diets. The carcass and organ characteristics were significantly ($P<0.05$) affected by across the dietary treatments except on percentage liver weight ($P>0.05$). However, the result indicated that combined effect of two acidifiers were better than single effect of an acidifier. Acidifier unlike antibiotics poses no risk of microbial resistance for both livestock and human. It is therefore concluded that combination of the two acidifiers are better and should be used for optimum performance of broiler finishers.***

Keywords: Growth, carcass, organ, acidifiers, antibiotics and broilers.

1. Introduction

The ban on the use of antibiotics in livestock production due to the health consequences on both human and animal; due to its contribution to the development of anti-microbial resistant bacteria, which is seen as a major threat to public health and the possibility of residue of drugs in the animals which has negative effects on its products (Oyekunle and Owonikoko, 2012)[25], can never be overemphasized. To stimulate growth, various approaches such as genetic improvement by selective breeding, effective application of immunoprophylactic measures and better health cover with low cost growth promoting agents, must be employed. Growth promoters are substances that are added to balanced ratio to attain maximum genetic potential of the host, with regards to growth as well as improvement in feed conversation (Dhama *et al*., 2014)[10]. The following growth promoters are used in broilers industry to maximize performance in broilers; antibiotics, probiotics, prebiotics, exogenous enzymes, antioxidants etc. (Allen, 1999; Walker and Duffy, 1998; Dhama *et al*, 2007)[2, 35, 11]. Herbal material and extracts have also been used to maximize growth, these include *garcinia kola*, *Allium sativum*, *Azadirachta indica* etc (Dhama *et al*., 2013)[9]. Recent studies have shown that suitable alternative to antibiotics are; probiotics, prebiotics, acidifiers, extracts of plants, copper as well as zinc (Han and Thacker, 2010; Jones *et al*., 2010; Thacker 2013)[17, 19, 34].

Acidifiers have been used to improve performance, to reduce the level of pathogen in the crop/proventriculus of birds, to regulate gut microflora, to increase food digestion, improve growth and to slow passage of food in the gut (Cornelsion *et al*., 2015; Philipsen, 2006; Desai *et al*., 2007; Samanta *et al*., 2010)[7, 28, 8, 29].Therefore, the purpose of the study was to evaluate the effect of dietary acidifiers(hydrated lime and citric acid) on the performance, organ and carcass characteristics of broiler finishers.

2. Materials and Methods

Study location

The study was carried out at the poultry unit of the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture and Natural Resource Management, Enugu State University of Science and Technology, Agbani, Enugu State.

3. Experimental Design

One hundred and twenty (120) four weeks old Agritech broiler strain of mixed sexes with strong vigor selected from a pool of one hundred and seventy (170) birds were used for the study. The birds were divided into four groups and randomly assigned to four acidifier dietary treatments in a completely randomized design (CRD) experiment. Each treatment group consisted of thirty (30) birds, which was replicated three times with ten (10) birds per replicate. The birds were fed four (4) different diets identified as T_1, T_2, T_3 and T_4. Treatment group T_1 (0% acidifier) served as control, T_2 (contained 0.1% hydrated lime). T_3 (0.1% citric acid) and diet T_4 (contained 0.05% hydrated lime + 0.05% citric acid).

Table 1: Percentage composition of Experimental diets

Treatments				
Ingredients	**T1**	**T2**	**T3**	**T4**
Maize	7.00	7.00	7.00	7.00
Cassava Chips	40.00	40.00	40.00	40.00
Wheat offal	10.00	9.90	9.90	9.90
PKC	9.00	9.00	9.00	9.00
Groundnut Cake	10.00	10.00	10.00	10.00
Soybean meal	1.50	1.50	1.50	1.50
Fish meal	5.00	5.00	5.00	5.00
Bone meal	1.50	1.50	1.50	1.50
Calcium carbonate	1.50	1.50	1.50	1.50
Common salt	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Vit/Min. Premix	0.25	0.25	0.25	0.25
Acidifier	(0.00%)	(0.1% H.L.)	(0.1% C.A.)	(0.05% H.L+ 0.05% C.A.)
Calculated value				
Crude Protein (%)	20.00	20.00	20.00	20.00
Energy (kcal ME)	3000.00	3000.00	3000.00	3000.00

PKC = Palm kernel cake, H.L. = Hydrated Lime, C.A. Citric acid

Management of Experimental Animals

The birds were reared in a deep litter system. Feed and water were provided *ad libitum*, while routine vaccination and veterinary attention were provided as at when due. The experiment lasted for twenty eight (28) days. Feed intake was recorded every day while the birds were weighed weekly. On the twenty eight (28) days of the experiment, three (3) broilers per treatment (one per replicate) were randomly picked and slaughter for carcass and organ studies.

Statistical Analysis

Data obtained from the response variables were subjected to one way analysis of variance (ANOVA) according to the procedure of Steel and Torrie (1980)[32]. Where significant treatment effects were detected from the analysis of variance, means were compared using Duncan's New multiple Range Test as described by Obi (1990)[22].

4. Results and Discussion

The results of the performance of broiler finishers fed dietary Acidifiers were as presented in Table 2. The result showed that final body weight, daily weight gain and daily feed intake were significantly (P<0.05) affected by the dietary treatments. However, initial body weight and feed conversion ratio were not (P>0.05) influenced by the dietary treatments.

Table 2: Performance of Broiler Finishers fed different dietary Acidifiers

Treatments					
Parameter	**T_1 (0%)**	**T_2 (0.1%)**	**T_3 (0.1%)**	**T_4 (0.05+0.05)**	**Sig.**
Initial body weight (g)	917.89	918.49	917.96	918.20	**NS**
Final body Weight (g)	2024.00^c	2274.00^b	2296.00^b	2413.00^a	*
Daily weight gain (g)	39.50^c	39.50^c	48.41^b	49.21^b	*
Daily feed intake(g)	109.00^b	115.00^a	117.00^a	120.00^a	*
Feed conversion ratio	2.76	2.37	2.37	2.25	**NS**

a, b, c, mean within row with different superscript differs significantly (P<0.05)

The effect of the different dietary acidifiers on final body weight shows that T_4 (2413.00g) was the highest followed by T_3 (2296.00g), T_2 (2274.00g) and T_1 (2024.00g) respectively. Weight gain statistically differed significantly (P<0.05) between the treatment group. The positive effect of the acidifier was because of the stimulating role on enzymatic secretion; mainly on synthesis of gastric and pancreatic lipase (Tellez *et al*., 2001; Patterson and Burkholder, 2003; Choudharic *et al*., 2008)[33, 27, 6]. The higher weight gain could be said to be due to the reduction of the growth depressing metabolites produced by microorganism in the gut (Feighner and Daskevicz, 1987; Knarrebog *et al*., 2004; Huyghebaert *et al*., 2011)[14, 20.18]. Other researchers also attributed the higher weight gain in favour of the treatment group with acidifiers to the prevention of exponential multiplication of common pathogenic bacteria (E. coli, Salmonella *spp*, Streptococcus *spp*, etc) due to the alteration of the pH in the gut (George *et al*., 1982; Brennan *et al*., 2003)[15, 4].

The daily feed intake for the experimental birds were; T_4 (120.00g), T_3 (117.00g), T_2 (115.00g) and T_1 (109.00g). Daily feed intake for T_1 significantly differs (P<0.05) from other treatment groups with T_4 recording the highest value

of daily feed intake. This could be attributed to the combined effects of the acidifiers. However, it could be observed that there were better performances in all the treatment diets with acidifier because acidifiers reduce the pH of feed, improve the hygienic condition and improve palatability which ultimately increase feed intake (Cave, 1984)[5] and body weight.

The feed conversion ratio for T_4 was 2.25 and 2.37 for both T_2 and T_3, while that of the control T_1 was 2.76. This shows that feed conversion or nutrient utilization was at the lowest in T_1 which was the control but much better in T_4. The better feed conversion ratio for the groups with acidifiers was due to the lowering of the pH of the digestive organ which led to better digestion, absorption and utilization of nutrients (Seema and Johri, 1992; Bengmark, 1989; Dhama *et al.*, 2011)[30, 3, 12]. Acidifiers modified intestinal microflora and helped to improve bird's performance; health statue as well as reduced the microbial use of nutrients (Snyder and Wostmann, 1987)[31]. The lowering of the pH, optimized the activity of proteases and beneficial bacteria (Partanen and Morz, 1999; Nava *et al*., 2009; Overland *et al*., 2000)[26, 21, 24], and enhanced feed conversion by broiler birds.

The result of the dietary acidifiers on the carcass and organ characteristics is shown in Table 3. The result showed that live weight, dressed weight, dressing percent and percentage gizzard weight were significantly ($P<0.05$) affected by the dietary treatments, except percent liver weight ($P>0.05$).

Table3: Carcass and organ characteristic of broiler finishers fed different dietary acidifiers

Treatments					
Parameters	**T_1 (0%)**	**T_2 (0.1%)**	**T_3 (0.1%)**	**T_4 (0.05+0.05)**	**Sig.**
Live weight (g)	1998.00^c	2236.00^b	2280.00^b	2396.00^a	**
Dressed weight (g)	1279.00^c	1512.00^b	1556.00^b	1677.00^a	**
Dressing (%)	64.01^b	67.62^a	68.24^a	70.00^a	**
Gizzard (%)	1.49^b	1.52^a	1.54^a	1.58^a	**
Heart (%)	0.44	0.50	0.57	0.60	NS
Liver (%)	1.45	0.43	0.43	0.47	NS

a, b, c, means within rows with different superscript differ significantly ($p<0.05$)

Carcass yield expressed in gram live body weight and dressed weight were significantly ($P<0.05$) affected. This is in contrary to the observation of (Abu *et al*., 2013)[1] who found no significant effect on the live weight of broiler fed dietary acidifier. The final live weights obtained in this study were higher than the values 1.78, 1.74, 1.53 and 1.71 in dietary acidifier 1, 2, 3 and 4, respectively, recorded by (Abu *et al*. 2013) and(1448.4, 1291.0, 1487.6 and1574.1) for birds on diets A, B, C and D respectively, reported by (Ogunwole *et al.* 2011)[23].The higher percentage live weight of T_4 (1677), T_3 (1556), T_2 (1512) over the control T_1 (1279) was because of the growth promoting effect of acidifies which improved the rate of utilization of cell nutrient especially protein which resulted in better dressing percentage. The values obtained in gizzard weight were significantly affected ($P<0.05$) by the diets. However, were lower than the values reported by (Ogunwole *et al.* 2011)[23] in broiler fed acidified diets. The heart and liver of the various treatment group; though varied numerically but did not differ significantly ($P>0.05$). This is in agreement with (Ogunwole *et al.* 2011)[23] who also reported no significant difference ($P>0.05$) in liver weight and heart weight of broilers treated with dietary acidifiers. The growth enhancing properties of hydrated lime and citric acid is an effective alternative to feed antibiotics in animal feed production. Moreover, unlike antibiotics it has no risk of microbial resistance. It is therefore recommended that hydrated lime and citric acid should be included in combined doses of 0.05% for optimum performance.

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