EFFECT OF ACETIC ACID ON BROILER CHICKS GROWTH PERFORMANCE

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ABSTRACT
This study was conduct to investigate the effect of drinking water supplemented with different dosage of acetic acid (AA) at varied frequency of administration on growth performance of broiler chickens at the early growth phase. 300 Arbor acre broiler chicks were assigned to 6 groups in a completely randomized design experiment with a 2 by 3 factorial arrangement and 5 replicates of 10 chicks each. The 6 groups were; T1 and T4 (0ml/L AA/Enrofloxacin group), T2 (5ml/L AA twice weekly), T3 (5ml/L AA thrice weekly), T5 (10ml/L AA twice weekly), T6 (10ml/L AA thrice weekly. The AA administration began on the 2nd day of the chicks' life and was included in the drinking water on selected days. Growth performance was evaluated on parameters like weight gain, feed intake, water intake and Feed Conversion Ratio. The data collected were subjected to One-way Analysis of Variance via a General Linear Model procedure using Minitab 17 and means were separated using Tukey's test of the same statistical software. There was no significant difference ($p>0.05$) among all the 6 groups but when considering the main effect of AA dosage and the frequency of administration, only the dosage had significant effect ($p<0.05$) on the final weight and water intake of the birds, as the highest values were obtained in the 10ml/L AA group and both AA groups respectively. Results from this study shows that inclusion of AA in drinking water of broilers at the early growth phase is a promising alternative to antibiotics growth promoter.
Keywords: Broiler chicks, Acetic acid, Enrofloxacin, Antibiotic growth promoter, Growth performance

INTRODUCTION
The global threat of antibiotic resistance and the ineffectiveness of antibiotics treatment has led to the ban of non-therapeutic use of antibiotics in animal production in many parts of the world (Castanon, 2007; Cogliani *et al*., 2011). This has led researchers to test the efficacy of organic alternatives (such as acidifiers (organic acids), prebiotics, probiotics, synbiotics, enzymes, phytogenic, microflora enhancers, immunostimulants, antimicrobial peptides, bacteriophages and metals) in maintaining or improve poultry health and performance (Gadde *et al*., 2017).
Organic acids are widely distributed in nature as normal constituents of animal or plant tissues and some of them [specifically short-chain fatty acid (SCFA)] are produced in the hind gut of livestock and humans through microbial fermentation of carbohydrates and they can also be administered in the feed or drinking (Huyghebaert *et al*., 2011). AA is one of such SCFA. SCFA improves gut health by serving as a direct energy source for the growth of epithelial cells which are responsible for most digestive, absorptive and secretory processes in the GIT (Gadde *et al*., 2017). Generally, organic acids showcase specific antimicrobial properties via pH-reduction effects at the moment of digestion thus inhibiting some pathogenic bacteria proliferation, trophic effects on the gastrointestinal tract (GIT) mucosa, and increase of pancreatic secretion (Dibner & Buttin, 2002; Van Immerseel *et al*. 2006). In young chicks, SCFA production in the gut is insufficient and acidifiers may be used to compensate for this. Various studies have shown that organic acids can be used to enhance growth performance. In spite of this, using organic acids to

improve performance lacks consistency and this is attributable to various factors such as inclusion rates, the source of the organic acids, and the buffering capacity of other dietary ingredients (Dibner and Buttin, 2002; Kim *et al*., 2015). Hence, this research which aims to examine the effect of AA in drinking water of broiler chicks (at varying inclusion rate and frequency of administration) on the growth performance.

MATERIALS AND METHODS

This study was carried out at the Teaching and Research Farm Unit of the Directorate of University Farms, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. 300 broiler chicks of Arbor acre strain obtained from reputable hatchery were brooded on a deep litter system for two weeks after initially weighing and allotting them into six treatments, namely; T1 and T4 (Control/Enrofloxacin group for the 5ml/L AA and 10ml/L AA groups respectively), T2 (5ml/L AA twice weekly), T3 (5ml/L AA thrice weekly), T5 (10ml/L AA twice weekly), T6 (10ml/L AA thrice weekly) using a Completely Randomized Design in a 2 by 3 factorial arrangement. A total of 50 chicks were assigned into each treatment which was made up of 5 replicates with 10 chicks each. The feed and water were supplied *ad libitum*. The commercial starter diet used for all treatment contained 2800Kcal/KgME and 21% crude protein. The AA administration began for the required treatments on the second day of the chicks' life and was included in the drinking water on selected days while antibiotics containing 20% Enrofloxacin & bromhexine hydrochloride solution was administered into the drinking water of birds in the control groups following the standard medication schedule. All other medication and vaccination schedules were strictly adhered to as applicable. To monitor the ambient temperature and relative humidity of the brooding house, hygrometers were suspended about the level of the birds in addition to the physical observation of the birds. Data were collected for feed and water intake (daily), weekly weight, weight gain and consequently the Feed Conversion Ratio were calculated while statistical analysis of all data generated were done by subjecting the data to One-way analysis of variance using the general linear model procedure of MINITAB 17 and means were separated using Tukey's test of the same statistical package.

RESULTS AND DISCUSSION

The effect of AA on growth performance parameters of broiler chicks are presented in Tables 1 and 2, with Table 1 showing the main effect of dosage and frequency of administration of AA at two weeks of age and Table 2 showing the interactive effect of dosage and frequency of administration at two weeks of age. Table 1 indicated that the frequency of administration did not significantly affect ($p>0.05$) all measured parameters while there was a significant difference ($p<0.05$) only in values obtained for the water intake and final weight with regard to the dosage of AA. Table 2 revealed that the two factors considered (dosage and frequency of administration) did not have a significant effect ($p>0.05$) on all growth indices measured.

Table 1: Main effect of AA on growth performance at the second week of experiment

	Dosage of AA					Frequency			
Parameter	**0ml/L**	**5ml/L**	**10ml/L**	**SEM**	**P-value**	**Twice/week**	**Thrice/ week**	**SEM**	**P-value**
Initial weight (g/bird)	119.3	122.6	123.6	2.00	0.30	119.6	124.1	2.83	0.05
Final weight (g/bird)	268.7^{b}	269.5^{b}	288.3^{a}	5.57	0.03	275.0	276.1	4.55	0.87
Average feed Intake (g/bird/week)	243.0	259.3	270.7	7.43	0.05	260.8	254.6	6.07	0.48
Average water Intake (l/bird/week)	0.46^{b}	0.52^{a}	0.54^{a}	0.01	<0.01	0.50	0.52	0.01	0.21
Average weekly weight gain (g/week)	148.9	146.9	164.7	5.93	0.09	155.4	151.6	4.84	0.59
Feed Conversion Ratio	1.64	1.79	1.67	0.08	0.33	1.70	1.70	0.06	0.96

^{a,b}Means in the same row not sharing common superscript are significantly different (P<0.05)
SEM: Standard Error of Mean

Table 2: Interactive effect of AA on growth performance at the second week of experiment

	5ml/L AA			10ml/L AA			SEM	P-value
Parameter	**0**	**Twice/ week**	**Thrice /week**	**0**	**Twice/ week**	**Thrice/ week**		
Initial weight (g/bird)	119.8	116.2	129.0	118.9	122.7	124.6	1.63	0.06
Final weight (g/bird)	269.0	265.0	274.0	268.4	290.9	285.8	7.88	0.66
Average feed Intake (g/bird/week)	243.0	264.6	254.0	243.0	274.7	266.8	10.51	0.87
Average water Intake (l/bird/week)	0.46	0.50	0.54	0.46	0.53	0.56	0.02	0.57
Average weekly weight gain (g/week)	149.2	148.8	145.0	148.6	168.1	161.2	8.38	0.93
Feed Conversion Ratio	1.63	1.80	1.78	1.64	1.65	0.69	0.11	0.97

^{a,b}Means in the same row not sharing common superscript are significantly different (P<0.05)
SEM: Standard Error of Mean

Organic acids such as AA, formic acid and butyric acid have been used in poultry diets for decades and seem to elicit a positive response in growth performance (Kopecky *et al*., 2010). According to this study, the growth performance of the chicks was not negatively compromised but rather positively enhanced (as reflected by the final weight at 2 weeks and the birds' water consumption) by the administration of AA via drinking water at 5ml/L (0.5%) and 10ml/L (1%)

dosage and at both frequencies of administration considered (twice or thrice weekly), thus indicating the potency of AA as a growth promoter and a beneficial alternative to antibiotic growth promoters. This result corroborates the findings of Rehman *et al*. (2016) in their study of dietary AA supplementation in which AA supplementation at 0.3% level was reported to improve bird's performance during 2-6 weeks of age.

The final weight at the end of the second week of the chicks' life was significantly higher in the 10ml/L AA group. This increase in the final weight may be attributed to the ability of AA to reduce microbial competition with the host for nutrients thus leading to an enhanced nutrient digestibility and absorption (Dibner and Buttin, 2002). This finding is in agreement with Abdelrazek *et al*. (2016) who also reported a significant increase in body weight of broilers when their drinking water was acidified with mixture of citric acid and AA. However, in contrast to our result, Islam *et al*. (2008) reported a reduced weight in birds on 0.5% AA when compared to the other groups (0% organic acid, 0.5% citric acid and 0.5% citric acid + 0.5% AA). A significantly higher water intake was also recorded in both 5ml/L AA group and 10ml/L AA group. The high water consumption by chicks may be due to the numerically higher feed intake which makes the birds require more water to aid their feed digestion process. Ali *et al*. (2020) in their study using single and mixture of organic acids as antibiotics alternative, found that water acidification did not affect birds' water consumption.

CONCLUSION AND RECOMMENDATION

The results of the present study have demonstrated the beneficial effects of AA (particularly at 10ml/L dosage) on growth parameters in broiler chicks and it could be suggested as a replacement for AGPs. However, further studies are needed to determine the maximum safe level of AA inclusion in drinking water of chicks.

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