EFFECTS OF BITTER ORANGE JUICE AND AVILYTE® AS ALTERNATIVE SOURCES TO ANTIBIOTICS ON EGG QUALITIES OF LAYING HENS

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ABSTRACT
For sustainability and increased productivity of the poultry enterprise, utilization of substances with growth promoting effects can act as an alternative to antibiotics, acting as a key component to effective disease control. A ten week experiment was carried out to assess the efficacies of alternatives to antibiotics on egg quality traits of commercial layers. In a Completely Randomised Design, a hundred and forty-four commercial layer birds were randomly allotted into four treatments and replicated thrice with 12 birds per replicate at the Institute of Agricultural Research and Training, Apata Ibadan. The birds were offered a formulated layers basal diet with 2601 metabolizable energy, 16% crude protein and 3.32% crude fibre. Enrofloxacin, bitter orange juice and Avilyte® were administered via water. T1 had Enrofloxacin (10 ml to 20litres of water), T2 had Avilyte® (10 g to 20 litres of water), T3 had bitter orange juice (500mls to 20litres of water) and T4 were given ordinary water. Data were collected for internal and external egg quality parameters and subjected to Anova of SAS (2016) and means where significant were separated using Duncan multiple range test. Results on internal egg parameters revealed that there was no significant difference ($p>0.05$) across the treatments except for albumen diameter which was significantly ($p<0.05$) highest in T1 (9.80 cm) and lowest in T4 (8.78 cm). Egg number which is an external egg parameter was significantly ($p<0.05$) highest in T3. The egg weight was significantly ($p<0.05$) impacted by the treatments with range values of 57.25 g (T3) – 63.58 g (T4). The egg shape index was between 75.74 and 77.42 in T3 and T4 respectively, ($p>0.05$). The study concluded base on external egg quality parameters that Avilyte® and bitter orange juice can serve as alternatives to antibiotics.
Keywords: Antibiotics, Avilyte®, Bitter orange, Blood parameters, Laying birds.

INTRODUCTION

The popularity of poultry birds in Nigeria is noteworthy and can be attributed to the numerous benefits associated with poultry production and other activities entrenched in its value chain. Poultry birds are good sources of protein in form of eggs or meat, and its production is relatively cost effective, thus, making it possible for low-income farmers to start up the business (Heise *et al.*, 2015). More so, the return on poultry investment is relatively high compared to other livestock production and the high level of acceptability of the poultry products across diverse ethnic backgrounds and religious beliefs broadens the market and makes the business very viable. In addition to the benefits created by poultry, Aboki *et al.* (2013) remarked that poultry eggs are more affordable for low-income earners compared to other sources of protein. At present, poultry farming is one of the most profitable businesses and poultry products are among the highest consumed products worldwide but a lot of essential antibiotics are employed during poultry production in several countries. Antibiotics as growth promoter have long been included in the diet to prevent some specific intestinal pathogen, stabilize the intestinal microbial flora and improve the general performance of livestock (Miles *et al.,* 2006*)*. The biological basis of using antibiotics as growth promoter in poultry production is that it stimulates appetite, increases feed intake, reduce microbial load in gastro intestinal tract, inhibit sub-clinical infection, increase nutrient utilization and ultimately improve the performance.

However, search for alternatives to antibiotics is inevitable due to misuse of antibiotics, that led to the development of antimicrobial resistance; thus, strict regulations on the use of antibiotics in poultry diet in some climes was established. Avilyte®, a probiotic, provides essential electrolytes for broilers and layers to support maximum performance in challenging conditions and also increasing dietary electrolyte balance values of the birds by supplementation of Sodium and Potassium which improves average daily weight gain of chickens. Avilyte® is composed of Citric Acid, Potassium Chloride, Mineral salt, Vitamins E, A and Niacin Supplements, Vitamin D_3 Supplement, Dried Bifidobacterium longum Fermentation Product, Dried Lactobacillus acidophilus Fermentation Product, Dried Bacillus

subtilis Fermentation Product, Calcium Pantothenate, Menadione Sodium Bisulfite Complex. Bitter orange juice has citric acid; a natural acidifier, an array of phytochemicals with antimicrobial attributes and ascorbic acid; an antistress. Therefore, this study was undertaken to assess the effect of different alternatives to antibiotics on the internal and external egg quality characteristics of laying chickens.

MATERIALS AND METHODS

The study was carried out at the Bora Poultry Unit of the Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, Ibadan for ten weeks. In a completely randomized design, a hundred and forty-four commercial layer chickens were tagged and randomly allotted into four treatments with three replicate each of 12 birds per replicate. The treatments are:
T1 – Enrofloxacin (10mls in 20litres of water) -Positive control
T2 - Avilyte® (10g to 20litres of water),
T3 - Bitter orange juice (B.O), - 500mls to 20litres of water
T4 - Water (Negative control).
The birds were fed twice daily with the recommended requirement and quantity as described by NRC (1994). The treatments were administered via water for five days each every four weeks. Birds were allowed *ad libitum* access to clean water after the completion of the respective medications. Collection and weighing of the eggs were done everyday and eggs with mean weight close to that of replicate group per batch were selected for internal and external egg quality parameters in the last fourteen days of the experimental period across the treatments.
Data generated were subjected to analysis of variance (ANOVA) appropriate for complete randomized design using the General Linear Model procedures of SAS (2002). Statistical significance was assessed at $P < 0.05$ (95% confidence) using Duncan's Multiple Range Test.

Table 1: Composition of the Experimental Diet (Basal Diet)

Ingredients (%)	T1(Enrofloxacin)	T2(Avilyte®)	T3(B.O.)	T4
Maize	55.00	55.00	55.00	55.00
Soyabean meal	21.00	21.00	21.00	21.00
Wheat offal	10.00	10.00	10.00	10.00
Limestone	10.20	10.20	10.20	10.20
Bone meal	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Layers Premix	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated values				
Metabolizable energy Kcal/kg	2601	2601	2601	2601
Crude protein (%)	16.0	16.0	16.0	16.0
Crude fibre (%)	3.32	3.32	3.32	3.32

- Vitamin A: 10,00IUg,Vitamin D3: 2,000,000IU, Vitamin E: 12,000mg, Vitamin K3: 2000mg, Vitamin B1: 1500mg, Viatamin B2: 5000mg, Vitamin B6 : 1500mg, Viatamin B12: 10mg, Niacin: 15,000mg, Calpan : 5000mg, Folic acid: 600mg,Biotin: 25mg. Anitoxidant: 100,000mg, Choline chloride: 150,000, Manganese: 80,000mg, Iron: 40,000, Zinc: 60,000, Copper: 8,000mg, Iodine: 1000mg,Cobalt: 250mg, Ssselenium: 150mgInclude.

RESULTS AND DISCUSSION

The effect of different alternatives sources to antibiotics on internal egg qualities is shown in Table 2. The albumen weight was not significantly ($P>0.05$) influenced by alternative sources to antibiotics among the treatments. The albumen weights among treatment groups were 36.42, 35.67, 33.42 and 37.54 in T1, T2, T3 and T4, respectively. There was no significant ($p>0.05$) difference in the albumen height, yolk weight, yolk height, yolk diameter among the treatments. Yolk index was T1(0,24), T2(0.22), T3(0.21) and T4(0.23) respectively with no significant ($P>0.05$) difference among the treatments. Alternative sources to antibiotics used in this study did not significantly ($P>0.05$) affect

yolk weight: Albumen ratio. Although, Haugh unit was highest in birds on T2 (43.58) that was administered avilyte in water, it was not significantly different from other treatments. However, the albumen diameter was significantly (P<0.05) different among the treatments, T1 (9.80) was significantly (P<0.05) different from T2 (9.02), T3 (9.27) and T4 (8.783) while birds in T3 had statistically similar value with those on T2. This result obtained in this study is similar to the work of Balcon-Pacheco *et al.* (2022) who reported significant differences in albumen diameter across the treatment groups when young layers were fed probiotic *Bifidobacterium animalis* supplemented diet.

Table 2: Effects of different alternative sources to antibiotics on the egg internal quality

Parameters	T1 (Enrofloxacin)	T2 (Avilyte®)	T3 (Bitter orange)	T4 (Water)	SEM	P-value
Albumen weight (g)	36.42	35.67	33.42	37.54	0.76	0.283
Albumen height (cm)	0.33	0.35	0.39	0.42	0.02	0.456
Yolk weight (g)	16.08	16.13	16.14	16.50	0.18	0.866
Yolk height (cm)	1.06	0.98	0.95	1.01	0.02	0.451
Yolk diameter (cm)	4.36	4.45	4.51	4.43	0.04	0.644
Yolk index	0.24	0.22	0.21	0.23	0.01	0.401
Yolk: Albumen ratio	0.46	0.46	0.49	0.45	0.01	0.598
Haugh Unit	36.50	43.58	36.81	37.18	1.38	0.214
Albumen diameter (cm)	9.80^{a}	9.02^{bc}	9.27^{b}	8.78^{c}	0.12	0.001

SEM, standard error of mean. a, b, c means with different superscripts on the same row denote significant difference (P<0.05).

HU= 100 * log (h - $1.7w^{0.37}$ + 7.6) where HU = Haugh unit, h = observed height of the albumen in millimeters and w = weight of egg in grams

Effects of different alternative sources to antibiotics on external egg qualities is shown in Table 3. The egg number were significantly (P<0.05) higher in birds administered different alternative sources to antibiotics in T2 (292.67), T3 (283.00) and T4 (276.67) compared to T1 (155.33) administered enrofloxacin. This corroborates the work of Abou-Elkhair *et al*. (2018) who reported significant difference across the treatment when laying hens were fed diets containing phytogenic feed additives. Egg weight was significantly (P<0.05) different across the treatment. Birds in T1 (62.08 g) and T4 (63.58 g) were significantly (P<0.05) different from T3 (57.25 g) while birds on T3 was not significantly (P>0.05) different from T2 (60.83 g). Egg length was not significantly (P>0.05) different among the treatments, likewise, egg width. The egg width ranged between 43.17 mm in T3 treated with bitter orange juice in water to 44.51 mm in T4 with water only. Also, shell weight was not significant (P>0.05) different among the treatments. The shell thickness in T2 (0.34 mm) and T4 (0.37 mm) were significantly different from T1 (0.28 mm) and T3 (0.30 mm).

Table 3: Effect of different alternative sources to antibiotics on eggs external quality

Parameters	T1 (Enrofloxacin)	T2 (Avilyte®)	T3 (Bitter orange)	T4 (Water)	SEM	P-value
Egg number (eggs)	155.33^{b}	292.67^{a}	283.00^{a}	276.67^{a}	17.77	0.0002
Egg weight (g)	62.08^{a}	60.83^{ab}	57.25^{b}	63.58^{a}	0.90	0.0436
Egg length (mm)	57.97	57.39	57.39	57.56	0.27	0.8897
Egg width (mm)	43.80	44.01	43.17	44.51	0.21	0.1431
Shell weight (g)	7.26	8.17	7.75	8.54	0.22	0.2160
Shell thickness(mm)	0.28^{b}	0.34^{a}	0.30^{b}	0.37^{a}	0.01	0.0031
Egg shape index	76.08	76.78	75.74	77.42	0.54	0.7551

a, b, means with different superscripts on the same row denote significant (P<0.05) different.

SEM - Standard Error of Means

Conclusions

The use of bitter orange (*Citrus aurantium*) and Avilyte® as alternatives to antibiotics has shown potentials through the results of egg quality most especially in egg number. Therefore, Avilyte® at

10g to 20litres of water and Bitter orange juice at 500mls to 20litres of water is recommended for use in laying birds as alternative to antibiotics.

REFERENCES

Aboki, E., Jongur, A. A. and Onu, J. I. 2013. Productivity and technical efficiency of family poultry production in Kurmi local government area of Taraba State, *Nigeria Journal of Agriculture and Sustainability*, 4(1): 52-66.

Abou-Elkhair, R., Selim, S., Hussein, E., 2018. Effect of supplementing layer hen diet with phytogenic feed additives on laying performance, egg quality, egg lipid peroxidation and blood biochemical constituents. *Animal Nutrition (4),* Pp. 394-400.

Balcon-Pacheco Cristina D., Coronel-Gomez Fabiola D., Ozuna Cesar, Jimenez-Femandez Maribel, Angel-Ssahagun Cesar, Elena Franco Franco Robles. 2022. Effect of probiotic *Bifidobacterium animalis* as an alternative to growth-promoting antibiotics on performance, egg quality and health parameters in young laying hens. *J. Researchsquare* 12:1–15.

Heise, H., Crisan, A. and Theuvsen, L. 2015. The Poultry market in Nigeria: Market Structures and Potential for Investment in the Market. *International Food and Agribusiness Management Review,* Volume 18, Special Issue A.: 197-222.

Miles, L., Newton, A. C., DeFries, R. S., Ravilious, C., May, I., Blyth, S., Kapos, V. and Gordon, J. E, 2006. A global overview of the conservation status of tropical dry forests. *J Biogeogr* 33:491–505.

National Research Council, 1994. Nutrient Requirements for poultry**.**

Statistical Analysis System, 2002.