EFFECT OF ULTRA-DIETARY VITAMIN AD AND E ON CARCASS CHARACTERISTICS OF FINISHER BROILER CHICKENS

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ABSTRACT
Effect of ultra-dietary vitamin AD (iu) and E (mg) supplementation on physical and chemical characteristics of broiler meat was assessed using 72 unsexed four-week-old broilers randomly assigned to eight experimental diets. Diet 1 was the control without any vitamin supplementation while diets 2, 3, 4, 5, 6, 7 and 8 were supplemented with 200E + 1000D3; 4000A, 200E + 2000D3; 8000A, 200E + 3000D3; 12000A, 1000D3; 4000A, 2000D3; 8000A, 3000D3; 12000A and 200E, respectively. The diets were fed to 72 finisher Arbor Acres plus broilers for 10 days after which the birds (3 birds per replicate) were slaughtered and dissected. Carcass performance traits, primal cuts, external offal, organ weights and meat quality characteristics were significantly improved ($p<0.05$) for birds fed vitamin AD and E supplemented feed. Sensory evaluation for birds fed supplemented diets were statistically similar ($p>0.05$) to the control. It implies that supplementation of broiler feed with vitamin AD and E may improve carcass characteristics and meat quality of broilers. However, further experiments with longer period should be conducted to confirm the optimum period of supplementation.

Keywords Vitamins, carcass characteristics, broiler chickens, meat quality characteristics, sensory evaluation

INTRODUCTION

The meat quality is used to describe the overall meat characteristics including its physical, chemical, morphological, biochemical, microbial, sensory, technological, hygienic, nutritional and culinary properties (Jassim *et al*., 2011). In general, consumers judge meat quality from its appearance, texture, juiciness, water-holding capacity, firmness, tenderness, odour and flavour. According to Nasir *et al*. (2017) those meat features are among the most important factors that influence the initial and final judgment by consumers. A number of factors affect poultry meat quality, with genetics, pre-slaughter handling, transportation, post-mortem processes, etc. being the most important. Over the past few years, meat production and market have undergone several negative events that have impaired the image of this essential food products from the consumer's standpoint thereby causing reduction in meat consumption. Nevertheless, chickens and turkeys are today marketed in about half the time and at about twice the body weight compared to 50 years ago. These improvements are mainly due to the high heritability of body weight and body composition during breeding which has put more stress on the growing bird and some believe it has resulted in histological and biochemical modifications of the muscle tissue. Massimiliano and Claudio (2012) evidenced that fast-growing strains exhibit a high incidence of spontaneous or idiopathic myopathies (e.g. deep pectoral muscle disease) and an increased susceptibility to stress-induced myopathies which may have great implications for meat quality and incidence of abnormal conditions such as pale, soft and exudative (PSE)-like meat. However, Janghan *et al*. (2023) indicated that manipulating the nutrient composition of poultry diet may offset the negative effects of genetic predisposition and poultry handling on poultry meat quality. The objective of this study therefore was to assess the effects of ultrra-dietary vitamin AD and E on the poultry meat quality attributes.

MATERIALS AND METHODS

The study was carried out at the Poultry Unit, Teaching and Research Farm, University of Ibadan, located at Latitude $7^{0}26'35.1''$N and Longitude $3^{0}53'32.3''$E. 72 unsexed four-week-old broiler finisher's birds were used for the study. Prior to the collection of the birds, the pen had been cleaned and disinfected. Fresh litter (wood shaving) was uniformly spread on the floor of the pen, which was partitioned into eight sections to accommodate the birds. Thereafter, the birds were randomly assigned to eight treatments consisting of nine (9) birds per treatment. Each treatment comprised a replicate of (3) birds each. Five feeding days adaptation was conducted and thereafter, the experiment lasted ten days. The birds in each replicate were fed in the feeders with a specified weight every day. Feed and water were supplied *ad libitum* by refilling the troughs.

Table 1: Composition of the experimental diet

Ingredients	1	2	3	4	5	6	7	8
Maize	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
Soyabean meal	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
Palm oil	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Wheatoffals	17.73	17.73	17.73	17.73	17.73	17.73	17.73	17.73
Oyster shell	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Dicalcium phosphate	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lasalocid	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Broiler premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Vit E (mg)	-	200	200	200	-	-	-	200
Vit AD (IU)	-	1000	2000	3000	1000	2000	3000	-

CP-22.94, ME-3147, Premix-Vitamin A-12,000,000iu, Vitamin D_3-3,000,000iu, Vitamin E-20,000mg, Vitamin K-2000mg, Pantothenic acid-10,000mg, Folic acid-1,000mg, Biotin-100mg, Choline chloride-300,000mg, Manganese-80,000mg, Zinc-60,000mg, Iron-40,000mg, Copper-80,000mg, Iodine-800mg, Selenium-200mg, Cobalt-300mg, Antioxidant-100,000mg

Table 2: Carcass and organ weights of broiler chickens fed ultra-dietary vitamin AD and E supplemented feed

Parameter	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	SEM
Carcass Traits									
Live weight	$1.30^{b}\pm0.02$	$1.51^{ab}\pm0.02$	$1.43^{ab}\pm0.25$	$1.50^{ab}\pm0.10$	$1.39^{b}\pm0.17$	$1.47^{ab}\pm0.06$	$1.63^{a}\pm0.10$	$1.42^{ab}\pm0.10$	0.07
Bled weight	$1.26^{b}\pm0.03$	$1.41^{ab}\pm0.02$	$1.47^{ab}\pm0.10$	$1.36^{b}\pm0.16$	$1.41^{ab}\pm0.02$	$1.60^{a}\pm0.04$	$1.60^{a}\pm0.04$	$1.37^{b}\pm0.10$	0.07
Defeathered weight	$1.05^{a}\pm0.05$	$1.34^{b}\pm0.02$	$1.27^{b}\pm0.07$	$1.33^{b}\pm0.03$	$1.26^{b}\pm0.13$	$1.34^{b}\pm0.04$	$1.53^{b}\pm0.03$	$1.22^{b}\pm0.04$	0.04
Eviscerated weight	$0.89^{c}\pm0.05$	$1.14^{b}\pm0.02$	$1.07^{b}\pm0.10$	$1.12^{b}\pm0.03$	$1.06^{b}\pm0.11$	$1.13^{b}\pm0.05$	$1.28^{a}\pm0.05$	$1.03^{b}\pm0.04$	0.04
Primal Cuts									
Wing	$7.66^{e}\pm0.10$	$8.42^{c}\pm0.06$	$8.45^{bc}\pm0.08$	$8.47^{bc}\pm0.13$	$8.54^{bc}\pm0.06$	$8.60^{b}\pm0.07$	$8.89^{a}\pm0.05$	$7.88^{d}\pm0.07$	0.04
Back	$11.43^{d}\pm0.04$	$12.22^{b}\pm0.11$	$12.47^{a}\pm0.05$	$12.51^{a}\pm0.04$	$12.50^{a}\pm0.03$	$12.51^{a}\pm0.05$	$12.51^{a}\pm0.12$	$12.02^{c}\pm0.07$	0.04
Breast	$16.40^{e}\pm0.13$	$17.28^{d}\pm0.06$	$17.22^{d}\pm0.11$	$17.39^{dc}\pm0.17$	$17.57^{bc}\pm0.07$	$17.66^{b}\pm0.16$	$18.18^{a}\pm0.05$	$17.71^{b}\pm0.09$	0.06
Thigh	$9.00^{e}\pm0.10$	$9.34^{d}\pm0.09$	$9.35^{d}\pm0.03$	$9.51^{c}\pm0.01$	$9.65^{b}\pm0.06$	$9.74^{b}\pm0.03$	$9.90^{a}\pm0.06$	$9.27^{d}\pm0.04$	0.04
Drumstick	$8.10^{d}\pm0.07$	$9.39^{d}\pm0.18$	$9.40^{b}\pm0.08$	$9.49^{b}\pm0.04$	$9.53^{b}\pm0.04$	$9.50^{b}\pm0.04$	$9.79^{a}\pm0.05$	$8.70^{c}\pm0.04$	0.05
Dressing percentage	68.66±3.42	75.24±1.71	77.07±5.40	75.17±5.70	76.47±5.53	76.86±5.55	78.87±2.24	72.67±3.03	4.41
External and Internal Offals									
Head	$2.71^{f}\pm0.02$	$3.59^{c}\pm0.03$	$3.66^{bc}\pm0.09$	$3.76^{ab}\pm0.08$	$3.46^{d}\pm0.04$	$3.86^{a}\pm0.05$	$3.85^{a}\pm0.06$	$3.07^{e}\pm0.14$	0.04
Neck	$4.30^{b}\pm0.23$	$4.70^{a}\pm0.08$	$4.70^{a}\pm0.03$	$4.71^{a}\pm0.04$	$4.72^{a}\pm0.03$	$4.72^{a}\pm0.06$	$4.75^{a}\pm0.04$	$4.61^{a}\pm0.04$	0.05
Shank	$5.10^{e}\pm0.16$	$5.23^{de}\pm0.04$	$5.36^{cd}\pm0.03$	$5.48^{c}\pm0.03$	$6.07^{ab}\pm0.11$	$6.07^{ab}\pm0.07$	$6.21^{a}\pm0.10$	$5.99^{b}\pm0.04$	0.05
Spleen	0.09±0.03	0.11±0.02	0.10±0.01	0.11±0.02	0.11±0.02	0.11±0.02	0.11±0.01	0.10±0.01	0.01
Gizzard	$1.83^{d}\pm0.08$	$2.12^{b}\pm0.08$	$2.00^{c}\pm0.07$	$2.00^{c}\pm0.08$	$2.01^{c}\pm0.03$	$2.08^{bc}\pm0.04$	$2.31^{a}\pm0.03$	$1.98^{c}\pm0.03$	0.03
Abdomin.fat	$3.00^{e}\pm0.13$	$3.10^{de}\pm0.07$	$3.27^{c}\pm0.12$	$3.24^{cd}\pm0.07$	$3.70^{ab}\pm0.06$	$3.73^{ab}\pm0.08$	$3.82^{a}\pm0.06$	$3.60^{b}\pm0.02$	0.05
Liver	$1.43^{d}\pm0.05$	$1.68^{b}\pm0.07$	$1.68^{b}\pm0.02$	$1.68^{b}\pm0.06$	$1.69^{b}\pm0.04$	$1.72^{b}\pm0.03$	$1.87^{a}\pm0.04$	$1.57^{c}\pm0.08$	0.03
Heart	$0.32^{c}\pm0.03$	$0.42^{a}\pm0.02$	$0.42^{a}\pm0.02$	$0.42^{a}\pm0.02$	$0.42^{a}\pm0.02$	$0.42^{a}\pm0.01$	$0.40^{ab}\pm0.03$	$0.36^{bc}\pm0.03$	0.01
Kidney	0.76±0.04	0.80±0.02	0.79±0.02	0.79±0.06	0.80±0.03	0.82±0.04	0.80±0.06	0.80±0.02	0.02
Intestine	$8.66^{b}\pm0.11$	$9.80^{a}\pm0.10$	$9.89^{a}\pm0.17$	$9.98^{a}\pm0.06$	$9.78^{a}\pm0.07$	$9.76^{a}\pm0.09$	$9.09^{ab}\pm1.14$	$8.78^{b}\pm0.08$	0.24

Means with different superscripts on the row are significantly different ($p<0.05$)

Table 3: Meat characteristics of broiler chickens fed ultra-dietary vitamin AD and E supplemented feed

Parameter	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	SEM
Thermal shortening	$26.00^{e}\pm1.00$	$31.00^{c}\pm1.00$	$33.00^{b}\pm1.00$	$29.00^{d}\pm1.00$	$26.00^{e}\pm1.00$	$33.00^{b}\pm1.00$	$32.00^{bc}\pm1.00$	$39.00^{a}\pm1.00$	0.58
Cooking loss (%) _ _	$46.35^{a}\pm0.03$	$33.08^{e}\pm0.01$	$36.1^{c}\pm0.10$	$29.98^{g}\pm0.04$	$31.35^{f}\pm0.03$	$37.56^{b}\pm0.03$	$33.46^{d}\pm0.03$	$28.08^{h}\pm0.01$	0.08
Shear force _(Kg)	$3.43^{a}\pm0.03$	$3.46^{a}\pm0.03$	$3.30^{ab}\pm0.01$	$3.05^{b}\pm0.05$	$3.53^{a}\pm0.03$	$3.24^{ab}\pm0.03$	$3.23^{ab}\pm0.03$	$3.49^{a}\pm0.05$	0.10
WHC (%)	$57.80^{b}\pm0.20$	$51.90^{f}\pm0.30$	$58.46^{a}\pm0.07$	$52.20^{f}\pm1.20$	$50.97^{g}\pm0.03$	$56.25^{c}\pm0.03$	$53.59^{d}\pm0.03$	$52.60^{e}\pm0.17$	0.10
Sensory Evaluation									
Tenderness	6.00	6.50	6.50	6.60	5.60	6.00	5.00	7.00	0.26
Juiciness	5.60	6.60	6.60	6.40	5.60	5.60	4.80	6.40	0.23
Flavour	3.60	4.20	3.20	4.80	4.60	3.80	5.00	5.00	0.39
Colour	4.80	4.00	3.80	4.60	4.00	5.00	5.00	4.60	0.23
Aroma	6.20	6.40	5.00	6.40	6.00	5.80	6.00	5.60	0.38

Means with different superscripts on the row are significantly different ($p<0.05$)

RESULTS AND DISCUSSION

Table2 showed that the birds in T_1 differ significantly ($P<0.05$) from those in T_7, while there was no significant difference ($P>0.05$) when compared with those in T_2, T_3, T_4, T_5 and T_6. Similarly values for T_2, T_3, T_4, T_5 and T_6 were statistically similar ($P>0.05$) to T_1. For live weight, it is expected that there is no significant difference. The reason for this may be that the diets fed were of good quality. Good quality feed allows animals to perform close to their genetic potential (Acarmovic, 2001). However, the response recorded for birds on T_7 suggested a synergistic effect on body weight. The bled weight followed a normal curve trend which supports the statement by Ogunwole (2012) that birds with higher pre-slaughter weights are expected to produce higher bled weights. Similarly, eviscerated weight followed a normal trend which suggested a synergistic effect of the combination of vitamin AD and E. A negligible response observed in dressing percentage could be because feeding period was not long enough to affect it significantly. Also, for the weight of primal cuts of broilers such as breast, thighs, drumsticks, wings and back. T_7 birds gave the highest values for primal cuts. These values were significantly different from values obtained from birds in T_1. Similarly, T_2, T_3, T_4, T_5, T_6 and T_8 birds differ significantly from T_1 birds. This result indicates that vitamin AD and E supplementation affect primal cuts of broiler chickens significantly, when fed independently or in combination. This is in in contrast with Manca *et al.* (2022) which observed that combination of vitamins did not affect primal cuts significantly. Although their study was carried out with vitamin E and C. Furthermore in table2, the relative weight of external offals in groups containing vitamin D supplementation, whether singly or in combination differed from the basal diet. According to Colet *et al*. (2015) the bone strength increased as vitamin D supplementation levels increased. This could be due to higher levels of vitamin D supplementation, which must have stimulated calcium absorption and thus increase in bone density. However, for relative organ weight, liver and heart weights are significantly higher for birds fed experimental diets. This could be partly supported by Vaneila *et al.* (2024) who observed that vitamin A levels improved these relative weight characteristics of the organs. Improved feeding which could have resulted from vitamin supplementation of the feed may be due to the important role of the liver in vitamin metabolism.

Table3 revealed that thermal shortening in the breast meat of animals fed experimental diets were significantly ($P<0.05$) lower than that of basal diet, with breast meat from animals fed only vitamin E supplemented-diet producing the lowest thermal shortening. In this study, thermal shortening occurred in all treatments. Similarly, results have shown that T_8 produces breast meat with the lowest cooking loss. Post mortem changes cause the water content within the myofibrils in the narrow channels between the filaments to change as meat shrinks with the tissue matrix, resulting in cooking loss with heat (Frontisck *et al*. 2019) Generally, a reduction in the cooking loss as the weight increases is in harmony with the observation of Olusegun *et al* (2020) who reported that as slaughter weight increases, cooking loss and thermal shortening decreased while water-holding capacity and shear force values increased. Furthermore, this experiment showed that animals fed with vitamin supplemented feed showed lower shear force values compared to animals in T_1 with T_4 animals showing the lowest shear force value for breast meat. This observation disagrees with the earlier report, however, this could be as a result of the synergistic effect of vitamin AD and E combined at these levels. Although there was no significant difference (P>0.05) in the tenderness of the breast meat of the animals fed supplemented diets when compared with those in T_1 which could have been due to a comparatively short period of supplementation, T_8 demonstrated the highest score.This result agrees with Manca *et al*. (2022) which reported that the addition of dietary vitamin E resulted in better sensory quality of fresh and stored breast meat when fed along with vitamin C and selenium.

CONCLUSION

This study established that ultra-dietary vitamin AD and E might improve carcass characteristics and meat quality of broilers if the diet is supplemented with these additives few days before slaughtering.

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