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Effect of dietary vitamin E on growth performance of rabbit bucks

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Target Audience: *Rabbit farmers, Physiologists, Additive suppliers*

Abstract

Growth performance, haematology and serum chemistry of rabbit bucks fed vitamin E was evaluated using 40 crossbred rabbit bucks 7-9 weeks of age weighing 650-800 g. The study involved allocating the bucks to four dietary groups at different inclusion levels of vitamin E/kg feed (00 mg/kg, 20 mg/kg, 40 mg/kg and 60 mg/kg for treatments 1,2,3 and 4 respectively) in a completely randomized design (CRD). The bucks were randomly allocated to four treatments of ten bucks/treatment. Feed and water were provided ad-libitum for sixteen weeks. Other routine management practices were provided as needed. Growth performance, haematology and serum chemistry of the bucks were monitored. Results revealed a significant (P<0.05) difference in final weight gain, average daily feed intake, average daily weight gain, feed conversion ratio, packed cell volume, haemoglobin, red blood cell and in some serum biochemical parameters across treatments. There were indications (white blood cell and lymphocyte levels) that the immune system of the bucks in the treatment group were improved more than the control, though this effect is not significant (P>0.05). Bucks in the treatment group performed better than bucks in the control group in all the parameters measured. Hence, including vitamin E to rabbit bucks' diet to as low as 20 mg/kg and as much *as 60mg/kg feed can lead to appreciable improvement in growth, haematology and serum biochemical profile of rabbit bucks.*

Keywords: *Rabbit, bucks, vitamin E, growth.*

Description of Problem

Animal protein consumption is very essential for meeting protein requirement of man. The average daily protein intake per adult is still less than 35g per adult per day (1). Rabbit (*Oryctolagus cuniculus*) production is a viable option for increased dietary protein intake, due to their prolificacy, early maturity, fast growth rate, high genetic selection potential, high feed conversion efficiency and economic utilization of space (2). However, performance of rabbits in the tropics have been generally on the decline due to several unfavourable environmental factors (3). The daily body weight gains of rabbits in the tropics vary from 8-13g which is low compared to 42g in temperate region (4). Supplementing rabbit diets with antioxidants may help to mitigate some biochemical and biophysical factors affecting optimum rabbit production in the tropics. One effective antioxidant that is cheap and readily available is vitamin E (tocopherol) which is the only significant lipid-soluble antioxidant present in animal blood. Dietary vitamin E functions as antioxidant by preventing lipid peroxidation and limiting agents that break oxidative chain reactions, usually by scavenging for reactive oxygen species (ROS) to prevent cellular damage, thus increasing growth (5). Vitamin E is also involved in the control of enzyme activity to stabilize biological cell membrane (6). Vitamin E is essential for such body functions as growth, tissue integrity, reproduction, disease prevention and improved biological systems (7). This study aimed at evaluating the growth performance, haematology and serum biochemical effect of

vitamin E supplementation in rabbit production.

Materials and Methods

Experimental site: The study was conducted at the National Animal Production Research Institute (NAPRI), Shika, Zaria. Shika lies within the Northern guinea savannah Zone of Nigeria and located on latitude 11^0 12'N and longitude 7^0 33' E with an altitude of 691 m above sea level. Annual rainfall range is between 1100-1200 mm, while mean temperature is about 24.4 ^{0}C (14.5-39.3 ^{0}C), with the lowest temperature occurring during the early dry season (November-January), while, the highest temperatures are experienced during late dry season between February-April. (8)

Experimental design and management: A total of 40 crossbred rabbit bucks (7-9 weeks of age weighing 650-800 g) were used in this study. The rabbits were purchased from National Veterinary Research Institute Vom Jos, Plateau State. The animals were weighed (weight balance-hena :20kg- The big boss, China) at the onset of the experiment and allocated to four dietary groups at different inclusion levels of vitamin E/kg feed (00 mg/kg, 20 mg/kg, 40 mg/kg and 60 mg/kg for treatments 1,2,3 and 4 respectively) in a completely randomized design (CRD). The bucks were randomly allocated to four treatments of ten bucks/treatment, each buck serving as a replicate. The rabbits were housed in metal cages measuring 60x60 cm in dimension, raised in a well ventilated house. Each cage was equipped with two round bottom earthen pot for feeding and for providing drinking water. The rabbits were fed 100g of concentrate daily and water was given *ad libitum*. All animals were kept, monitored and treated in accordance with standard routine management practices. Feed intake (FI) and body weight (BW) were recorded weekly in grams throughout the experimental period (16 weeks).

Blood collection and analysis: Blood sample was collected using 1 ml syringe from the ear vein of the bucks into EDTA treated tubes for haematological analysis. Blood was sampled from five rabbit bucks per treatment at the beginning and at the end of the study to monitor the haematological changes. Blood samples were transferred to a 2 ml test-tube and allowed to clot at room temperature for serum collection. Centrifugation took place three (3) hours after blood collection and serum harvested. Haematological indices and serum chemistry were determined according to the methods described by Turffrey (9). Data generated were subjected to Analysis of Variance (ANOVA) using the General Linear Model (GLM) procedure of SAS (10). Significant means between treatment groups were separated using Dunnett's test (11).

Results and Discussion

Table 1 shows the percentage composition of the experimental diet while the performance of rabbits bucks fed different levels of vitamin E is shown on Table 2. Bucks on 0, 20, 40 and 60 mg/kg vitamin E recorded 1805.00, 1970.00, 1792.50, 1403.30 g final body weight respectively and these weights differed significantly ($P<0.05$). These differences are based on the principle that dietary vitamin E scavenges for reactive oxygen species (ROS), prevents cellular damage and improves growth (5). This observation is in line with the report of (12) who observed that dietary vitamin E addition in rabbits' diet resulted in higher body weight and feed conversion efficiency in rabbits. However, the highest final body weight (1970 g) recorded in this study contrasted with the values obtained by Eiben *et al.* (13) and Marai *et al*. (14) who recorded 2100.27g and 2231.57 g in rabbits fed with 20 and 50 mg vitamin E / kg diet respectively.

The observed differences might be attributed to variations in age, sex, breed and other environmental factors. So, it can be suggested that supplementing rabbit bucks' diet with dietary vitamin E to as low as 20 mg/kg could enhance growth performance up to 1970 g. The haematological parameters of rabbit bucks fed vitamin E supplementation at different inclusion levels is presented in Table 3. Packed cell volume, haemoglobin and red blood cell count differed significantly ($P<0.05$) with better haematological indices in the treatment group. This is understandable as dietary vitamin E is known to improve erythropoietic factors, thus, improving the concentrations of packed cell volume, haemoglobin and red blood cell (7). This result is similar to the findings of Abdel-Khalek *et al*. (15) who reported an increased packed cell volume, haemoglobin and red blood cells in both pregnant and lactating rabbit does on 20 mg dietary vitamin E /kg DM. However, in disagreement with this finding, Shaibu (16) recorded no significant difference in packed cell volume, haemoglobin and red blood cell in rabbit does on 40 mg vitamin E /kg feed. This may be accounted for due to differences in the sex of rabbits used in the two studies. Also, Shinde *et al*. (17) reported that supplementing animal diets with vitamin E and selenium independently and simultaneously could improve their immune responses and this observation validated the findings obtained in this study as they were cases of increased lymphocytes and white blood cells among the treatment groups, although these changes were not significant. Table 4 shows the effect of vitamin E on serum biochemical profile of rabbit bucks fed different levels of vitamin E. There were no significant differences ($P>0.05$) in glucose, total protein, albumin, aspartate transaminase, alanine transaminase and alkaline phosphatase concentrations across treatments while globulin, glutathione peroxidase and vitamin E concentration of the bucks differed significantly ($P<0.05$) across treatments. Bucks in the treatment groups had higher serum globulin, glutathione peroxidase and vitamin E concentrations. Dietary vitamin E is a chief source of antioxidant in animals and widely known to control enzyme activities (6), hence an increase in serum globulin, glutathione peroxidase and vitamin E among treatment group. This result is in agreement with the findings of (18) who recorded higher values of serum globulin, glutathione peroxidase and vitamin E for sheep on 450 mg vit. E/kg feed than the control. Soliman *et al*. (19) also reported that ewes treated with vitamin E (50 mg/kg feed) at late gestation and during suckling period had significant increase in plasma total protein and globulin with no significant change in plasma albumin when compared to untreated ewes. Also, (20) reported increase in plasma vitamin E and erythrocyte glutathione peroxidase activity in rabbit bucks fed 40mg vitamin E/kg feed which is in agreement with this result. Based on these observations, it can be suggested that Vitamin E supplementation in rabbit bucks' diets to as low as 20mg and as much as 60mg/kg feed could improve weight gain and immunity in rabbit bucks.

Conclusion and Application

1. Dietary inclusion of vitamin E at 20 mg/kg feed in rabbit diet decreased total feed intake and improved average daily gain, hence, recommended for increase in growth performance.
2. 40mg vitamin E/kg feed is recommended for increased packed cell volume, serum globulin and glutathione peroxidase in rabbit bucks.
3. For increase in white blood cell, lymphocyte and serum vitamin E concentrations in rabbit bucks, 20-60mg vitamin E/kg feed is recommended.

Table 1. Percentage Composition of the Experimental Diet

Ingredients	Inclusion (kg)
Maize	16.00
Maize offal	43.00
Brewers dried grain	6.50
Groundnut seed cake	8.00
Soya cake	11.70
Rice offal	10.90
Limestone	1.20
Bone meal	2.00
Common salt	0.25
Vitamin/mineral premix	0.25
Lysine	0.10
Methionine	0.10
Calculated analysis	100
Protein	16.00
Metabolizable Energy/kcal	2701
Ether Extract	5.98
Crude fibre	11.28
Calcium	0.93
Available Phosphorus	0.32
Lysine	0.76
Methionine	0.30
Ash	3.22
Cysteine	0.22

***Biomix premix supplied per kg of diet: Vit.A, 10,000 iu; vit D_3, 2000 iu; vit E, 23 mg; vit.k, 2mg, vit B_1, 1.8; vit B_2, 5.5 mg; Niacin, 27.5mg; pantothenic acid,7.5mg; vit B_{12}, 0.015mg: Folic acid, 0.75mg; Biotin, 0.06mg; chloride, 300mg; cobalt, 0.2; Copper, 3mg; Iodine 1mg; Iron, 20 mg; Manganese, 40 mg; selenium, 0.2 mg; Zinc, 30 mg; Antioxidant, 1.25mg.(Manafactured by: Bio-organics Nutrient System Limited, Ibafo Ogun State, Nigeria)*

Table 2: Growth Performance of Rabbit Bucks fed Vitamin E Supplementation

Parameters	Inclusion Levels of Vitamin E (mg/kg diet)					
	0	20	40	60	SEM	P values
Initial weight (g)	766.30	750.00	700.00	650.00	110.96	0.3500
Final weight (g)	1805.00^{b}	1970.00^{a}	1792.50^{b}	1403.30^{c}	109.55	0.0411
Average daily feed intake (g)	87.86^{a}	73.52^{b}	85.88^{a}	86.73^{a}	2.53	0.0369
Average daily gain (g)	9.27^{b}	10.89^{a}	9.75^{b}	6.72^{c}	1.13	0.0327
Feed conversion ratio	9.47^{b}	7.35^{c}	8.80^{b}	12.90^{a}	1.04	0.0431

^{ab}: Means with different superscripts in the same row are significantly ($P<0.05$) different

Table 3: Haematological Parameters of Rabbit Bucks fed Vitamin E Supplementation

	Inclusion levels Vitamin E (mg/kg diet)					
Parameters	0	20	40	60	SEM	P values
Packed cell volume (%)	27.00^{c}	33.67^{b}	40.00^{a}	37.33^{ab}	1.43	0.0011
Haemoglobin (g/dl)	9.10^{c}	11.30^{b}	13.20^{a}	12.33^{ab}	0.46	0.0013
White blood cells (x10^{6})	7.07	7.00	7.93	6.67	1.72	0.7387
Red blood cells (x10^{9})	4.70^{b}	6.17^{a}	7.00^{a}	6.47^{a}	0.31	0.0042
Neutrophil (%)	15.67	15.00	8.67	13.67	2.45	0.2494
Lymphocytes (%)	74.67	82.00	88.33	81.33	3.08	0.0793
Monophils (%)	2.00	0.67	0.67	1.00	0.7	0.7907
Eosinophils (%)	2.00	0.00	1.33	0.00	0.53	0.0654
Basophils (%)	0.00	0.00	0.00	0.00	0.00	-

^{ab}: Means with different superscripts in the same row are significantly (P<0.05) difference

Table 4. Serum Biochemical Profile of Rabbit Bucks fed Vitamin E Supplementation

	Inclusion levels of Vitamin E (mg/kg diet)					
Parameters	0	20	40	60	SEM	P values
Glucose (mmol/l)	3.30	3.03	2.63	3.10	0.39	0.6315
Total Protein (g/dl)	65.67	68.00	65.33	60.00	3.76	0.4725
Albumin (g/l)	34.00	28.33	21.33	28.00	3.33	0.1115
Globulin (g/l)	31.67^{b}	39.67^{ab}	44.00^{a}	32.00^{b}	2.75	0.0215
Aspartate transaminase (IU/l)	22.67	20.00	49.33	25.00	8.01	0.0802
Alanine transaminase (IU/l)	26.00	18.33	38.00	23.00	7.54	0.3073
Alkaline Phosphatase (IU/l)	168.67	217.33	232.00	118.00	27.13	0.0607
Glutathione peroxidase (µmol/l)	3.95^{b}	8.94^{ab}	10.73^{a}	5.13^{ab}	1.74	0.0542
Vitamin E (mmol/l)	0.63^{c}	2.00^{c}	7.79^{b}	17.18^{a}	0.96	<0.0001

^{ab}: Means with different superscripts in the same row are significantly (P<0.05) different

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