REPRODUCTIVE RESPONSE OF HYLA RABBIT DOE GROUPS TO SUPPLEMENTATION WITH ASCORBIC ACID UNDER TROPICAL CONDITIONS

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ABSTRACT
Reproductive performance of Hyla rabbit does with the effect of dietary supplementation of ascorbic acid (vitamin C) was studied under sub-humid tropical environment. A total of 81 rabbit does comprising of 35 multiparous pure New Zealand White (Parents) and 46 primiparous F1 progenies of the parents (31 pure New Zealand White and 15 cross Californian x New Zealand White F1) were used for the study. Ascorbic acid (AA) was included in the diets of the rabbits at levels of 0 (control), 200, 300 and 400 mg AA/kg feed. The hormonal response, doe and litter performance as well as doe and kit mortality were determined weekly for 14 weeks with a 2-week adjustment period. Ascorbic acid did not significantly ($P>0.05$) improve progesterone and estradiol concentrations as well as doe and litter size and weight parameters. However, there was numerical increase in the pregnancy and kindling rates in the rabbit does supplemented at 200 mg/kg level. Ascorbic acid did not significantly reduce doe and kit mortality. Based on these findings, ascorbic acid might be supplemented at 200 mg/kg level in order to reduce the adverse effect of high ambient temperature and improve reproductive and productive performance of rabbits in the tropics.

Keywords: Reproductive performance, Hyla rabbit, Ascorbic acid.

Description of Problem

Hyla rabbits, among the important exotic populations imported into Nigeria, are bigger in size than the local breeds and disease-resistant. They have rapid growth rate, great adaptability to different environmental factors and high genetic selection traits (1). Yamani (2) reported that the rabbits are meat breed and highly productive with more than 96% post-weaning survival rate. Vitamin C is a potent antioxidant whose effects have been demonstrated in many experiments *in vitro.* Ascorbic acid is one of the main natural antioxidants found in biological systems and feeds. In order to alleviate heat stress in rabbits, ascorbic acid is one of the most widely studied vitamins employed. Feed-grade ascorbic acid added to the diet of rabbits promoted growth, reproduction and counteracted infections by pathogenic bacteria and viruses (3).

Materials and Methods

Location of experimental site

The study was conducted in the Rabbitry of the Rabbit Research Unit, National Animal Production Research Institute (NAPRI), Shika, Zaria. Shika is geographically situated on latitude 11° 12′42′′N of the equator and longitude 7°33′14′′E with an altitude of 691m above sea level (4). The area falls within the Northern Guinea Savannah zone of Nigeria having an average annual rainfall of 1100 mm, which starts from April to September. Over the experimental period from January to April, the minimum and maximum ambient temperature and relative humidity in the morning ranged from 17.0 to 36.1°C and 15 to 41% while in the afternoon, the minimum and maximum ambient temperature and relative humidity ranged from 23.4 to 46.6°C and 15 to 39% respectively.

Experimental animals and management

A total of 81 rabbit does comprising of 35 multiparous pure New Zealand White (NZW: Parents), and 46 F1 progeny made up of primiparous purebred New Zealand White (NZW X NZW) and crossbred (Californian X NZW) does, progenies of the parent does, were used in this study. The rabbits having an average initial

weight of 4.0 kg were obtained from the flock of rabbits in the Rabbit Breeding Project, NAPRI, Shika. The animals were weighed and randomly allotted to four dietary ascorbic acid levels in a 4x2 factorial arrangement in a completely randomized design. The factors were four levels of ascorbic acid (0, 200, 300 and 400 mg/kg feed) and two doe groups (parent, F1 does).

Mating of the does

Hand-mating (the female does were carried to the buck' cages) was adopted. The does were taken to the bucks early in the morning by 8.00a.m. and evening by 4.00p.m to ensure good courtship and adequate service. The does were returned to their cages after mating.

Monitoring of pregnancy

Pregnancy was determined using ultrasonographic examination of the does' uteri transcutaneously on day 9 post coitum using a realtime ultrasound machine (Scanner 200 Vet/Pie Medical) equipped with a 5 MHz sector transducer. The probe was positioned externally against the abdominal wall while the does were restrained at dorsal recumbency in a restraining device to view their uteri. Prior to the scanning, the does' abdominal region was shaven and ultrasound gel was applied at the site of examination. The non-pregnant does after the examination were immediately rebred.

Blood sampling and collection

Blood sample was collected from six rabbits in each experimental group in the morning (10.00a.m.) from the ear veins (Feldman *et al.*, 2000) into sample bottles without anti-coagulant, Ethylene Diamine Tetra Acetic Acid (EDTA) to analyze for progesterone and estradiol concentrations. The blood sample was refrigerated at 4°C and the serum decanted 24 hours after collection and stored at -20°C until analyzed. The blood assay was done in the Department of Chemical Pathology Laboratory, Ahmadu Bello University Teaching Hospital, Zaria.

Measurement of Reproductive Performance

The reproductive performances of the does recorded were hormonal responses and doe and kits' performance.

Hormonal assay/profile

Hormonal assays were run to determine the progesterone and oestradiol concentrations in a 4x3x2 factorial arrangement. The profile of these hormones was determined using Enzyme-Linked immunosorbent Assay test kits obtained from Accu-Bind Diagnostics, USA.

Measurement of doe and kit performance

Parameters considered in this study include pregnancy rate, kindling rate, doe mortality, litter weight alive at birth, weekly litter weight, litter weight at weaning, stillbirth, weekly kit mortality and total kit mortality. Ascorbic acid levels (0, 200, 300 and 400) mg/kg were considered. The pregnancy rate was determined by dividing the total number of does used by the total number of pregnant does expressed in percentage while the kindling rate was determined by dividing the total number of pregnant does by total number of does that kindled expressed in percentage.

Litter weight alive at birth was determined by weighing the kits immediately after kindling while weekly litter weight was determined once every week. All the weights were measured using a very sensitive weighing balance scale (in grams). Doe mortality was determined by dividing the total number of dead does by total number of does used expressed in percentage. Stillbirth was determined by dividing the total number of dead kittens at birth by total number of kittens born expressed in percentage while weekly kit mortality up to weaning was determined by dividing the weekly number of kits dead by total kits alive every week expressed in percentage.

Statistical analysis

Data obtained were subjected to analysis of variance using General Linear Method (GLM) while the significant differences between means were separated using pairwise-difference method (P-DIFF: 5).

RESULTS AND DISCUSSIONS

Table 1 presents the effect of ascorbic acid levels on oestradiol and progesterone concentrations. The Table indicated that ascorbic acid had no significant ($P>0.05$) effect on the concentrations of the two hormones. The non-significant and non-consistent increase in both oestradiol and progesterone concentrations obtained in this study for ascorbic acid supplemented does agrees with the findings of Byrd *et al.* (6) who reported that

ascorbic acid was associated with steroid biosynthesis; uterine oestrogen binding in mammalian species and increase in progesterone biosynthesis. Table 2 presents the effect of ascorbic acid level on doe performance and litter size of the does. The Table indicated that ascorbic acid had no significant (P>0.05) effect on all the measured litter size. The ascorbic acid supplemented does with non-significantly less pregnancy and kindling rates obtained in this study could be ascribed to the adverse effect of high temperature or heat stress (7). Table 3 presents the effect of AA levels on litter weight parameters of the does. AA had no (P>0.05) significant effect on all the measured litter weight parameters.

Table 1: Effect of Ascorbic Acid on Hormonal Response of Rabbit Does

	Ascorbic acid level (mg/kg feed)				
Parameters	0	200	300	400	LOS
Estradiol Concentration (pg/mL)	6.76±1.62	7.24±1.55	6.17±1.55	11.22±1.58	0.802
Progesterone Concentration (ng/mL)	0.74±1.66	0.71±1.58	0.55±1.58	0.76±1.62	0.959

LOS=Level of significance

Table 2: Effect of Ascorbic Acid Level on Doe Performance and Litter Size Parameters of Rabbit Does

	Ascorbic acid level (mg/kg)				
Parameters	0	200	300	400	LOS
Pregnancy rate (%)	66.00±15.00	76.00±10.00	57.00±10.00	52.00±10.00	0.391
Kindling rate (%)	55.00±15.00	61.00±11.00	43.00±11.00	50.00±10.00	0.703
Litter size at birth	5.33±1.10	5.70±0.75	7.58±0.81	6.92±0.78	0.316
Alive at birth	5.00±3.26	4.75±1.63	5.50±2.31	5.33±1.88	0.992
First week	5.00±3.09	4.75±1.55	5.00±2.19	5.33±1.79	0.995
Second week	4.00±2.87	4.75±1.43	5.00±2.03	4.67±1.66	0.993
Third week	4.00±2.87	4.25±1.43	5.00±2.03	4.33±1.66	0.988
Fourth week	2.00±2.50	3.75±1.25	5.00±1.77	4.33±1.44	0.789
At weaning	2.00±2.48	3.45±1.34	5.00±1.94	4.30±1.36	0.987

LOS=Level of significance

Table 3: Effect of Ascorbic Acid Level on Litter Weight Parameters of Rabbit Does

	Ascorbic acid level (mg/kg)				
Litter weight (g)	0	200	300	400	LOS
Alive at birth	630.00±311.55	527.50±155.78	685.00±220.30	743.33±179.88	0.826
First week	780.00±372.74	760.00±186.37	880.00±263.57	920.00±215.20	0.943
Second week	860.00±483.79	1055.00±241.90	1000.00±342.10	1126.67±279.32	0.966
Third week	1040.00±856.70	1290.00±428.35	1725.00±605.78	1440.00±494.62	0.906
Fourth week	800.00±1029.92	1395.00±514.96	2165.00±728.26	1933.33±594.62	0.665
At weaning	822.00±602.79	1005.50±301.40	1292.00±426.24	1232.67±348.02	0.880

LOS=Level of significance

The non-significant litter weight observed in rabbit does supplemented with ascorbic acid agrees with the findings of Yassein *et al.* (8) who reported higher kit weight gain in the ascorbic acid supplemented group (287.5 g) than the non-supplemented rabbit does (221.3 g). Sedki *et al.* (9) reported that ascorbic acid has a growth promoting action on growth traits and reproductive performance by enhancing the total antioxidant status of rabbits. Table 4 presents the effect of ascorbic acid levels on doe and kit mortality of the does. The Table

indicated that ascorbic acid had no significant (P>0.05) effect on all the mortality parameters measured. The non-significant and non-consistent lower doe and kit mortality observed in rabbit does supplemented with ascorbic acid could suggest that ascorbic acid ameliorated the adverse effect of heat stress which causes high mortality, increased disease incidence and immunosuppression effect in farm animals (10).

Table 4: Effect of Ascorbic Acid Level on Doe and Kit Mortality of Rabbit Does

	Ascorbic acid level (mg/kg)				
Parameters	0	200	300	400	LOS
Doe mortality (%)	18.00±9.00	9.00±8.00	22.0±8.00	12.00±7.00	0.637
Kit mortality (%)					
Stillbirth	12.07±7.48	12.47±5.11	11.03±5.54	14.30±5.29	0.923
First week	53.70±16.00	46.49±10.93	36.87±12.28	32.09±11.47	0.662
Second week	5.00±10.61	1.39±5.87	22.22±6.62	3.13±5.81	0.114
Third week	5.00±6.71	1.79±3.71	6.58±4.18	6.74±3.67	0.773
Total	63.88±15.30	55.48±10.45	58.15±11.74	45.37±10.97	0.759

LOS=Level of significance.

Conclusion and Application

Based on these findings, ascorbic acid might be supplemented at 200 mg/kg level in order to reduce the adverse effect of high ambient temperature and improve reproductive and productive performance of rabbits in the tropics.

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