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Feed restriction, vitamin e inclusion during pregnancy, effect on haematological parameters of gestating rabbit does

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ADDITIONAL KEYWORDS
Quantitative feed restriction.
Vitamin E.
Pregnant Rabbits and blood parameters.

SUMMARY

Blood parameters are good indices used in confirming health, physical status of animals and are of ecological significance in understanding the relationships between blood parameters and environment conditions. Thus this study aimed to examine whether feed restriction during pregnancy with or without vitamin E could have any detrimental effect or pose any danger to blood parameters of pregnant rabbits does. A total of Seventy five (75) rabbits consisting of sixty (60) 5 months old rabbit does of different breeds (Chinchilla, Dutch, New Zealand) with initial live weight of 1.7-2.0 kg were randomly allotted into 12 treatments of 5 replicates each during pregnancy period. The rabbit does were subjected to two levels of feed restriction (0% and 15%) at three different periods of gestation (15-19days, 20-24days and 25-29days) with or without vitamin E inclusion (0 and 300mg/kg). Data obtained on haematological indices were subjected to Analysis of Variance in a completely randomized design. Results obtained showed that Ad libitum feeding with vitamin E inclusion significantly ($p<0.05$) increased higher mean value for packed cell volume, haemoglobin, white blood cell count and Neutrophils levels of gestating rabbit does than the restricted group, this may be consider as a good indicator of increasing immunity efficiency. It may be concluded that feed restriction and periods of feed restriction with or without E inclusion does not have any detrimental effect on hematological parameters of gestating rabbit does as the values obtained in this study are within the ranges of blood values reported by authors for gestating rabbit does. The results shows that feed restriction did not resulted in levels above the recommended ranges of values reported by authors that have worked on gestating rabbit does. Which shows that feed restriction with or without vitamin E inclusion does not have any negative effect on gestating rabbit does.

Restricción alimenticia, inclusión de vitamina e durante la gestación, efecto sobre parámetros hematológicos de conejas gestantes

PALABRAS CLAVE ADICIONALES
Restricción cuantitativa de alimentación.
Vitamina E.
Conejas preñadas y parámetros sanguíneos.

RESUMEN

Los parámetros sanguíneos son buenos índices utilizados para confirmar la salud, el estado físico de los animales y son de importancia ecológica para comprender las relaciones entre los parámetros sanguíneos y las condiciones ambientales. Por lo tanto, este estudio tuvo como objetivo examinar si la restricción alimenticia durante la preñez con o sin vitamina E podría tener algún efecto perjudicial o representar algún peligro para los parámetros sanguíneos de las conejas gestantes. Un total de setenta y cinco (75) conejos que consisten en sesenta (60) conejos de 5 meses de edad de diferentes razas (Chinchilla, holandesa, neozelandesa) con un peso vivo inicial de 1,7-2,0 kg se asignaron al azar en 12 tratamientos de 5 repeticiones cada uno. durante el período de embarazo. Las conejas fueron sometidas a dos niveles de restricción alimenticia (0% y 15%) en tres diferentes períodos de gestación (15-19 días, 20-24 días y 25-29 días) con o sin inclusión de vitamina E (0 y 300 mg/kg) . Los datos obtenidos sobre los índices hematológicos se sometieron a Análisis de Varianza en un diseño completamente al azar. Los resultados obtenidos mostraron que la alimentación ad libitum con inclusión de vitamina E aumentó significativamente ($p<0,05$) el valor medio más alto para el volumen de células empaquetadas, la hemoglobina, el recuento de glóbulos blancos y los niveles de neutrófilos de las conejas gestantes que el grupo restringido, esto puede considerarse como un buen indicador del aumento de la eficiencia de la inmunidad. Se puede concluir que la restricción alimenticia y los períodos de restricción alimenticia con o sin inclusión de E no tienen ningún efecto perjudicial sobre los parámetros hematológicos de las conejas gestantes ya que los valores obtenidos en este estudio están dentro de los rangos de valores en sangre informados por los autores para conejas gestantes. hace. Los resultados muestran que la restricción alimenticia no resultó en niveles por encima de los rangos de valores recomendados informados por los autores que han trabajado en conejas gestantes. Lo que demuestra que la restricción alimenticia con o sin inclusión de vitamina E no tiene ningún efecto negativo en las conejas gestantes.

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INTRODUCTION

Rabbit production is attractive/ fascinating because its helps in the supply of high quality meat especially in developing countries with shortage of cereal supply (Fayeye and Ayorinde, 2008). Feeding strategies (feed restriction, skip a day) in growing rabbits are methods used in producing rabbits with lean meat, low feed

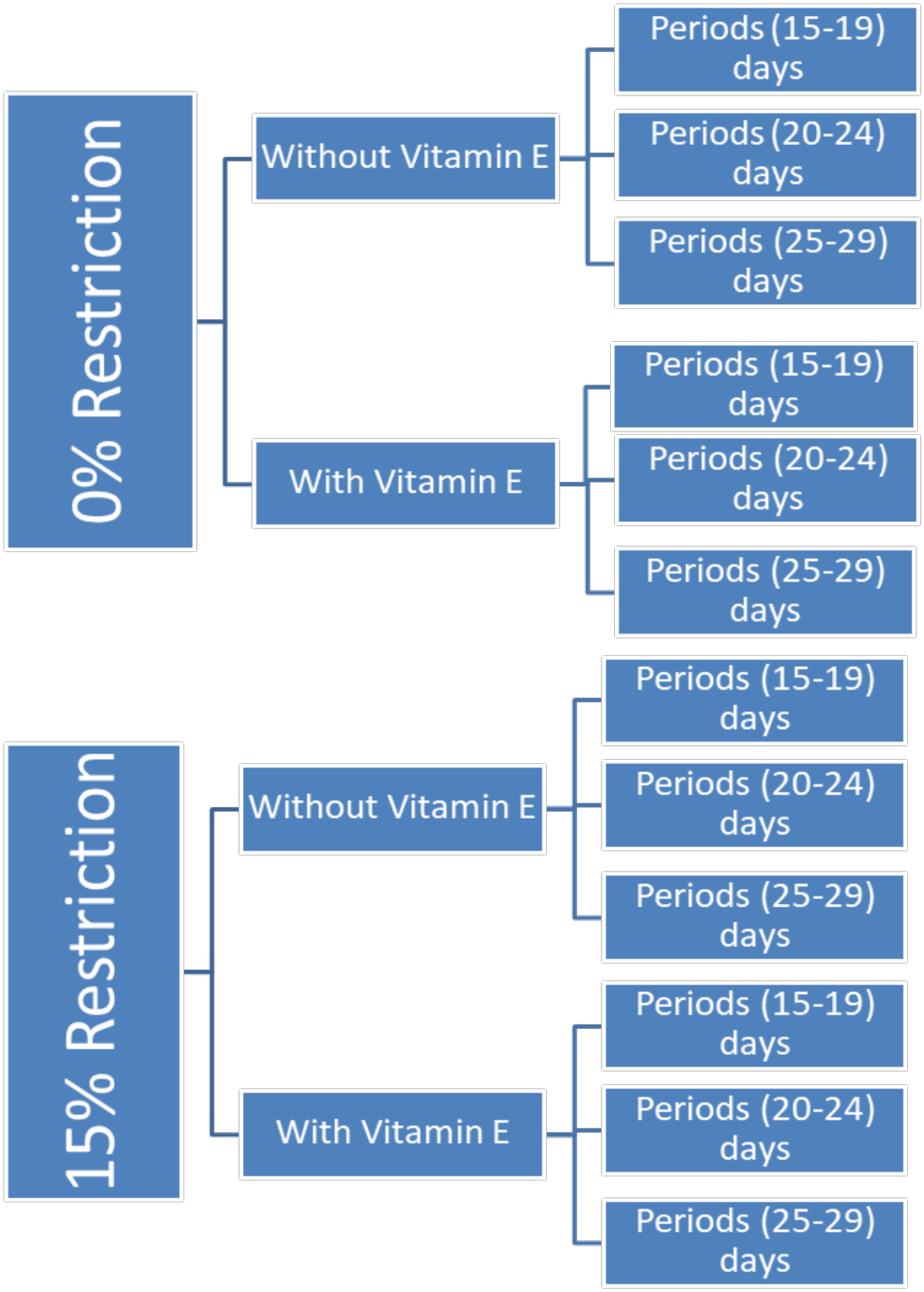

Figure 1. Illustration of treatments arrangement (Ilustración de la organización de los tratamientos).

conversion ratio and best meat quality characteristics (Bovera *et al*., 2008). Vitamin E (α-tocopherol) is important antioxidants that cannot be produce by the body and therefore are needed to be included in the feed of animals. Vitamin E was discovered as antioxidant that helps in reducing/ preventing stress during pregnancy (Krieger and Loch-Caruso, 2001). Mezes and Pusztsi (1988) carried out experiment on the relationship between antioxidant and reactive oxygen species generation in female rabbits during pregnancy.

Haemtological studies are useful indices that can be used in the diagnosis of several diseases as well as extent of damage to blood components (Onyeyili *et al*., 1992; Togun *et al*., 2007). The research carried out by Isaac *et al*. (2013) reported that animals showing good

performance are likely to have good blood composition within their system. Examination of blood constituents of an animal reveals the presence of several metabolites in the body of livestock which plays a vital role in the physiological, nutrition and pathological status of the animal (Aderemi, 2004; Doyle, 2006). Studies carried out by (Afolabi *et al*., 2010) reported that higher or lower values obtained during haematological findings are useful tool used in determining the condition of an animal as affected by environmental factors, pathological factors or nutritional factors.

(Olafedehan *et al.,* 2010) reported that blood components help to reveals the toxicity level of any pathogenic organism in the body of animals. Vitamin E as an antioxidants helps in increasing the immune competence and antibody production in broiler chicks (Singh *et al*., 2006). Vitamin E buffers the health of animal through homeostatic maintenance and other physio-biochemical processes like protein and hormone synthesis Yatoo *et al.* (2013). Hence, this study aims at investigating effect of feed restriction and periods of feed restriction with or without vitamin E inclusion during pregnancy on haematological parameters of gestating rabbit does in tropical environment. Also there is dearth of information and findings on the blood profile of feed restricted pregnant rabbits in tropical environment.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Rabbitary Unit of the Directorate of University Farms, while the Laboratory aspect of the study was undertaken at the College of Veterinary Medicine Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State. The site is located in the rain forest vegetation zone of South-Western Nigeria on latitude 7º 13′ 49.46′ N, longitude 3º 26 11.98′ E and altitude 76m above the sea level. The climate is humid with a mean annual rainfall of 1037mm and mean temperature and humidity of 34.7^{0}C and 83%, respectively (Google Earth, 2015).

Experimental Animals and Management

Seventy five (75) rabbits consisting of sixty (60) 5 months old does of cross breeds consisting (Chinchilla, Dutch, New Zealand) with initial live weight of 1.7-2.0 kg and fifteen (15) mature bucks with live weight of 2.0-2.5 kg were used for the study. The hutches were washed and disinfected before the commencement of the experiment. The does were divided into two groups of thirty (30) rabbits each after balancing for weight and were housed individually in hutches.

Experimental Design

Treatments consisted of two (2) levels of feed restriction (0 and 15%) at three (3) different periods (15-19, 20-24, 25-29 days) during pregnancy with or without vitamin E inclusion (0 and 300mg/kg). The does were divided into 12 groups of 5 replicates of 1 rabbit each.

Treatments consist of three factors: restriction, vitamin E and periods of feed restriction.

0% Restriction (control) were fed 100 g/rabbit/day. (*Ad libitum feeding*)

15% Restriction were fed 85 g/rabbit/day.

The feeding recommendation of 100grams of feed for gestating doe was based on a previous study at the same location (Adeyemo, 2014).

Vitamin E inclusion at 300 mg /kg of feed is according to the recommendation of Virág *et al.* (2008) in rabbits.

Rabbits on 0% restriction were offered 100 grams of feed with or without vitamin E inclusion daily throughout the experimental period of 32 days.

Rabbits on 15% restriction were offered 100 grams of feed daily with or without vitamin E inclusion before and after the restriction periods, while 85 grams of feed were offered during the periods of feed restriction. The composition of concentrate feed fed to the breeder rabbits is shown on **Table I**

Data Collection

The experiment lasted for 32 days, during which blood sample was collected and analyzed for haematological parameters.

Blood Analysis

Blood samples were collected before the commencement of the experiment (before mating) and at the end of the experiment (2days after kindling). At the time of blood collection three rabbits does in each level under each period with or without vitamin E was selected for blood collection. Blood sample of 3ml was withdrawn from the ear vein of each doe by means of sterile hypodermic needle and syringe, 2ml of blood collected was released into labeled sample bottles containing ethylene diamine tetra acetate (EDTA) to prevent blood coagulation and was taken to the laboratory while the remaining 1ml was put into bottles without coagulation for blood serum analysis. The following parameters were determined: Packed cell volume (PCV), haemoglobin concentration (Hb), white blood cells differentials, red blood cells (RBC). Blood parameters were analyzed as described by Jain (1993). Red blood cells (RBC) count was determined using the Neubauer haemocytometer after appropriate dilution (Lamb, 1981).

Statistical Analysis

The experimental layout was in a 2×3×2 factorial arrangement using a completely randomised design using (SAS, 1999). Significantly ($p<0.05$) different means were separated using Duncan's Multiple Range Test of SAS (1999) statistical package.

RESULTS

Table II shows the effect of feed restriction levels, periods of feed restriction and vitamin E inclusion on haematological parameters of gestating rabbit does. The levels of feed restriction did not significantly ($p>0.05$) influenced all the parameters measured before and after mating except for basophils that was signifi-

Table I. Composition of concentrate breeder diets (Composición de las dietas concentradas para reproductoras).

	A	B
Ingredients (%)		
Maize	47.50	47.50
Fish meal	2.00	2.00
Soybean meal	3.00	3.00
Wheat offal	23.00	23.00
Groundnut cake	12.00	12.00
Rice husk	7.00	7.00
Bone meal	3.00	3.00
Oyster shell	2.00	2.00
Salt	0.25	0.25
*Vitamin and Mineral premix	0.25	0.25
	100	100
Vitamin E	-Vit.E	+ Vit.E
Determined Analysis		
ME (Kcal/kg)	2578.8	2578.8
Ash (%)	2.74	2.74
Crude fibre %	10.65	10.65
Crude protein	16.20	16.20
Nitrogen free extract	42.50	42.50

* Premix contained: Vit A 8000 iu, Vit D3 2000 iu, Vit E 4000 iu, Vit K 2 mg, Riboflavin 4.20 mg, Vit B12 0.01 mg, Pantothenic acid 5 mg, Nicotinic acid 20 mg, Folic acid 5 mg, Choline 300 g, Mn 56 mg, Fe 20 mg, Cu 10 mg, Zn 50 mg.

Table II. Effect of restriction levels, periods of feed restriction and vitamin E inclusion on haematological parameters of gestating rabbit does (Efecto de los niveles de restricción, periodos de restricción alimenticia e inclusión de vitamina E sobre parámetros hematológicos de conejas gestantes).

	Levels of feed restriction		Periods of feed restriction			Vitamin inclusion	
	0%	15%	15-19days	20-24days	25-29days	-Vit. E	+Vit. E
Parameters							
PCV (%)$_{\text{Before mating}}$	34.00 ± 72	32.44 ± 4.97	34.25 ± 4.59	34.08 ± 6.65	31.33 ± 4.43	35.61 ± 4.86^{a}	30.83 ± 4.80^{b}
PCV (%)$_{\text{After kindling}}$	31.50 ± 4.85	32.41 ± 4.13	29.87 ± 3.73^{b}	31.25 ± 4.85^{b}	34.75 ± 3.51^{a}	32.33 ± 4.99	31.58 ± 3.98
Hb (%)$_{\text{Before mating}}$	11.33 ± 1.90	10.81 ± 1.65	11.41 ± 1.53	11.36 ± 2.21	10.44 ± 1.47	11.87 ± 1.62^{a}	10.27 ± 1.60^{b}
Hb (%)$_{\text{After kindling}}$	10.55 ± 1.70	10.83 ± 1.42	9.91 ± 1.24^{b}	10.56 ± 1.77^{ab}	11.60 ± 1.18^{a}	10.86 ± 1.68	10.51 ± 1.44
RBC (× 10^{12}l)$_{\text{Before mating}}$	5.70 ± 0.88	5.65 ± 0.93	5.81 ± 0.73	5.80 ± 1.03	5.40 ± 0.91	5.99 ± 0.82^{a}	5.36 ± 0.87^{b}
RBC (× 10^{12}l)$_{\text{After kindling}}$	6.31 ± 0.73	6.61 ± 0.78	6.16 ± 0.70	6.45 ± 0.82	6.78 ± 0.69	6.45 ± 0.84	6.47 ± 0.70
WBC (× 10^{9}l)$_{\text{Before mating}}$	7.75 ± 1.10	6.86 ± 1.14	8.11 ± 1.14^{a}	7.26 ± 1.21^{ab}	6.55 ± 1.33^{b}	7.30 ± 1.30	7.31 ± 1.45
WBC (× 10^{9}l)$_{\text{After kindling}}$	7.42 ± 1.43	7.35 ± 0.89	7.18 ± 0.59	7.67 ± 1.56	7.31 ± 1.21	7.00 ± 0.87	7.78 ± 1.33
Neutrophils (%)$_{\text{Before mating}}$	30.00 ± 3.94	28.33 ± 2.69	28.37 ± 3.76	28.50 ± 3.87	30.62 ± 2.19	29.91 ± 4.04	28.41 ± 2.58
Neutrophils (%)$_{\text{After kindling}}$	31.16 ± 3.23	30.66 ± 2.60	30.75 ± 3.54	30.37 ± 2.62	31.62 ± 2.54	30.16 ± 2.34	31.66 ± 3.26
Lymphocytes (%)$_{\text{Before mating}}$	68.75 ± 4.05	70.16 ± 2.33	69.75 ± 3.62	70.62 ± 4.10	68.00 ± 1.26	68.58 ± 4.12	70.33 ± 2.07
Lymphocytes (%)$_{\text{After kindling}}$	66.41 ± 3.05	67.75 ± 2.36	66.50 ± 3.30	68.75 ± 2.03	66.00 ± 2.19	67.25 ± 2.72	66.91 ± 2.90
Eosinophils (%)$_{\text{Before mating}}$	0.25 ± 0.39	0.25 ± 0.42	0.25 ± 0.39^{ab}	0.00 ± 0.00^{b}	0.50 ± 0.47^{a}	0.33 ± 0.45	0.16 ± 0.34
Eosinophils (%)$_{\text{After kindling}}$	0.58 ± 0.75	0.41 ± 0.46	0.75 ± 0.62^{a}	0.00 ± 0.00^{b}	0.75 ± 0.65^{a}	0.66 ± 0.72	0.33 ± 0.45
Basophils (%)$_{\text{Before mating}}$	0.16 ± 0.34^{b}	0.58 ± 0.60^{a}	0.37 ± 0.48	0.25 ± 0.62	0.50 ± 0.47	0.25 ± 0.39	0.50 ± 0.61
Basophils (%)$_{\text{After kindling}}$	0.50 ± 0.45^{a}	0.16 ± 0.34^{b}	0.50 ± 0.47^{a}	0.12 ± 0.31^{b}	0.37 ± 0.43^{b}	0.41 ± 0.46	0.25 ± 0.39
Monocytes (%)$_{\text{Before mating}}$	0.75 ± 0.79	0.66 ± 0.85	1.25 ± 0.94^{a}	0.50 ± 0.70^{b}	0.37 ± 0.48^{b}	0.83 ± 0.92	0.58 ± 0.69
Monocytes (%)$_{\text{After kindling}}$	1.33 ± 1.02	1.00 ± 0.85	1.50 ± 0.92	0.75 ± 1.11	1.25 ± 0.65	1.50 ± 0.85^{a}	0.83 ± 0.93^{b}

$^{a, b, c}$:Means in the same row with different superscripts differ significantly ($p<0.05$)
*PVC : Packed cell volume.
Hb : Haemoglobin, RBC :Red blood cell, WBC: White blood cells

cantly ($p<0.05$) influenced. At the beginning of the experiment before mating basophils levels was higher in 15% restricted does compared to 0% restricted does but at the end of the experiment higher levels for basophils values (0.50 ± 0.45 %) was recorded for 0% restricted does compared to lower mean values 0.16± 0.34 % obtained for 15% restricted does.

The periods of feed restriction significantly ($p<0.05$) influenced packed cell volume, haemoglobin, white blood cells, eosinophils, basophils and monocytes. However, all other parameters measured were not significantly ($p>0.05$) influenced by the period of feed restriction.

Vitamin E inclusion did not significantly ($p>0.05$) influence all the parameters measured after kindling except for monocytes that was significantly ($p<0.05$) influenced by vitamin E inclusion. Gestating rabbit does fed diet without vitamin E inclusion recorded higher mean values (1.50 ± 0.85 %) for monocytes compared to lower value 0.83± 0.93 % that was obtained for rabbit does with vitamin E inclusion.

Table III shows the interactive effect between levels and periods of feed restriction on haematological parameters of gestating rabbit does. Significant ($p<0.05$) differences were obtained on packed cell volume, haemoglobin, white blood cell, eosinophils, basophils and monocytes. Higher PCV values was obtained for gestating does on 0% and 15% restriction at 25-29 days of gestation which differ significantly from 27.75 ± 2.04 % obtained at 0% restriction between 15-19 days of gestation. Gestating rabbits on 0% and 15% restriction between 25-29 days of gestation had statistically higher Hb concentration in contrast to what was obtained in 0% restricted does at 15-19 days of gestation. Higher (8.55×10^9/l ± 1.82) mean values for white blood cells was obtained for gestating rabbit does on 0% restriction at 20-24 days of gestation in contrast to (6.80×10^9/l ± 0.47) recorded for 15% gestating rabbit does at 20-24 days of gestation after kindling.

Statistically similar mean values were obtained for eosinophils at 0 and 15% restriction between 15-19days and 25-29 days which differ significantly from 0.00 ± 0.00 obtained for gestating rabbit does on 0% and 15% restriction between 20-24 days of gestation after kindling. Highest basophils level after kindling was obtained from gestating does on 0% restriction while, the least was obtained at 15% restriction between 20-24 days of gestation. Higher monocytes after kindling were obtained from gestating rabbit does on 0 and 15% restriction at 15-19 days and 25-29 days respectively which statistically differs from 0.25 ±0.41 obtained for does on 15% restriction at 20-24 days of gestation

Table IV shows the interactive effect between levels of feed restriction with or without vitamin E inclusion on haematological parameters of gestating rabbit does. Significant ($p<0.05$) differences were obtained on eosinophils, basophils and monocytes across the dietary

Table III. Interactive effect between levels and periods of feed restriction on haematological parameters of gestating rabbit does (Efecto interactivo entre niveles y periodos de restricción alimenticia sobre parámetros hematológicos de conejas gestantes).

Levels of feed restriction	0%			15%		
Periods of feed restriction	15-19days	20-24days	25-29days	15-19days	20-24days	25-29days
Parameters						
PCV (%)$_{\text{Before mating}}$	36.66 ± 5.35	34.66 ± 5.98	30.66 ± 4.96	31.83 ± 1.94	33.50 ± 7.79	32.00 ± 4.19
PCV (%)$_{\text{After kindling}}$	27.75 ± 2.04^{b}	31.25 ± 4.66^{ab}	35.50 ± 4.20^{a}	32.00 ± 3.94^{ab}	31.25 ± 5.47^{ab}	34.00 ± 2.77^{a}
Hb (%)$_{\text{Before mating}}$	12.22 ± 1.78	11.55 ± 1.99	10.22 ± 1.65	10.61 ± 0.64	11.16 ± 2.59	10.66 ± 1.39
Hb (%)$_{\text{After kindling}}$	9.20 ± 0.73^{b}	10.72 ± 1.88^{ab}	11.72 ± 1.39^{a}	10.62 ± 1.28^{ab}	10.40 ± 1.82^{ab}	11.47 ± 1.06^{a}
RBC (× 10^{12}l)$_{\text{Before mating}}$	6.15 ± 0.86	5.77 ± 0.82	5.17 ± 0.81	5.47 ± 0.41	5.82 ± 1.29	5.67 ± 1.01
RBC (× 10^{12}l)$_{\text{After kindling}}$	5.75 ± 0.39	6.37 ± 0.70	6.82 ± 0.68	6.57 ± 0.71	6.52 ± 0.98	6.75 ± 0.76
WBC (× 10^{9}l)$_{\text{Before mating}}$	8.30 ± 0.90^{a}	7.85 ± 1.36^{ab}	7.10 ± 0.75^{abc}	7.90 ± 1.39^{ab}	6.67 ± 0.72^{bc}	6.00 ± 1.62^{c}
WBC (× 10^{9}l)$_{\text{After kindling}}$	6.87 ± 0.26^{b}	8.55 ± 1.82^{a}	6.85 ± 1.15^{b}	7.50 ± 0.69^{ab}	6.80 ± 0.47^{b}	7.77 ± 1.19^{ab}
Neutrophils (%)$_{\text{Before mating}}$	29.75 ± 4.16	28.75 ± 5.11	31.5 ± 2.14	27.00 ± 3.03	28.25 ± 2.60	29.75 ± 2.04
Neutrophils (%)$_{\text{After kindling}}$	31.00 ± 3.64	29.75 ± 3.54	32.75 ± 2.04	30.5 ± 3.76	31.00 ± 1.26	30.5 ± 2.64
Lymphocytes (%)$_{\text{Before mating}}$	68.25 ± 4.33	70.25 ± 5.61	67.75 ± 1.17	71.25 ± 2.18	71.00 ± 2.28	68.25 ± 1.40
Lymphocytes (%)$_{\text{After kindling}}$	65.5 ± 3.82	68.75 ± 2.60	65.00 ± 0.70	67.50 ± 2.64	68.75 ± 1.54	67.00 ± 2.77
Eosinophils (%)$_{\text{Before mating}}$	0.50 ± 0.44^{ab}	0.00 ± 0.00^{c}	0.25 ± 0.41^{bc}	0.00 ± 0.00^{c}	0.00 ± 00^{c}	0.75 ± 0.00^{a}
Eosinophils (%)$_{\text{After kindling}}$	1.00 ± 0.70^{a}	0.00 ± 0.00^{b}	0.75 ± 0.88^{a}	0.50 ± 0.44^{ab}	0.00 ± 0.00^{b}	0.75 ± 0.41^{a}
Basophils (%)$_{\text{Before mating}}$	0.25 ± 0.41^{ab}	0.00 ± 0.00^{b}	0.25 ± 0.41^{ab}	0.50 ± 0.54^{ab}	0.50 ± 0.83^{ab}	0.75 ± 0.41^{a}
Basophils (%)$_{\text{After kindling}}$	0.75 ± 0.41^{a}	0.25 ± 0.41^{ab}	0.50 ± 0.44^{ab}	0.25 ± 0.41^{ab}	0.00 ± 0.00^{b}	0.25 ± 0.41^{ab}
Monocytes (%)$_{\text{Before mating}}$	1.25 ± 0.75^{a}	0.75 ± 0.88^{ab}	0.25 ± 0.41^{b}	1.25 ± 1.17^{a}	0.25 ± 0.41^{b}	0.50 ± 0.54^{ab}
Monocytes (%)$_{\text{After kindling}}$	1.75 ± 0.88^{a}	1.25 ± 1.40^{ab}	1.00 ± 0.70^{ab}	1.25 ± 0.98^{ab}	0.25 ± 0.41^{b}	1.50 ± 0.54^{a}

$^{a, b, c}$:Means in the same row with different superscripts differ significantly ($p<0.05$)
*PVC: Packed cell volume. WBC: White blood cells
Hb: Haemoglobin. RBC:Red blood cell.

Table IV. Interactive effect between levels of feed restriction with or without vitamin E inclusion on heamatological Parameters of gestating rabbit does (Efecto interactivo entre los niveles de restricción alimenticia con o sin inclusión de vitamina E sobre los parámetros hematológicos de conejas gestantes).

Levels of feed restriction	0%		15%	
Vitamin E inclusion	+Vit. E	-Vit. E	+Vit. E	-Vt. E
Parameters				
PCV (%)$_{Before\ mating}$	30.55 ± 5.19^{b}	37.44 ± 4.00^{a}	31.11 ± 4.67^{b}	33.77 ± 5.16^{ab}
PCV (%)$_{After\ kindling}$	30.50 ± 5.28	32.50 ± 4.47	32.67 ± 1.78	32.16 ± 5.78
Hb (%)$_{Before\ mating}$	10.18 ± 1.73^{b}	12.48 ± 1.33^{a}	10.37 ± 1.55^{a}	11.25 ± 1.72^{ab}
Hb (%)$_{After\ kindling}$	10.01 ± 1.79	11.08 ± 1.52	11.01 ± 0.79	10.65 ± 1.89
RBC (× 10^{12}l)$_{Before\ mating}$	5.18 ± 0.82^{b}	6.21 ± 0.62^{a}	5.55 ± 0.93^{ab}	5.76 ± 0.97^{ab}
RBC (× 10^{12}l)$_{After\ kindling}$	6.33 ± 0.87	6.30 ± 0.61	6.61 ± 0.49	6.61 ± 1.03
WBC (× 10^{9}l)$_{Before\ mating}$	7.66 ± 1.13	7.83 ± 1.12	6.96 ± 1.70	6.76 ± 1.30
WBC (× 10^{9}l)$_{After\ kindling}$	7.90 ± 1.58	6.96 ± 1.17	7.67 ± 1.11	7.05 ± 0.51
Neutrophils (%)$_{Before\ mating}$	29.00 ± 3.25	31.00 ± 4.49	27.83 ± 1.69	28.83 ± 3.46
Neutrophils (%)$_{After\ kindling}$	33.00 ± 2.63	29.33 ± 2.77	30.33 ± 3.41	31.00 ± 1.56
Lymphocytes (%)$_{Before\ mating}$	70.50 ± 2.71^{a}	67.00 ± 4.54^{b}	70.16 ± 1.32^{ab}	70.16 ± 3.14^{ab}
Lymphocytes (%)$_{After\ kindling}$	65.83 ± 2.53	67.00 ± 3.56	68.00 ± 2.96	67.50 ± 1.71
Eosinophils (%)$_{Before\ mating}$	0.16 ± 0.35	0.33 ± 0.43	0.16 ± 0.35	0.33 ± 0.50
Eosinophils (%)$_{After\ kindling}$	0.16 ± 0.35^{b}	1.00 ± 0.82^{a}	0.50 ± 0.50^{ab}	0.33 ± 0.43^{b}
Basophils (%)$_{Before\ mating}$	0.00 ± 0.00^{b}	0.33 ± 0.43^{b}	1.00 ± 0.50^{a}	0.16 ± 0.35^{b}
Basophils (%)$_{After\ kindling}$	0.50 ± 0.43^{a}	0.50 ± 0.50^{a}	0.00 ± 0.00^{b}	0.33 ± 0.43^{ab}
Monocytes (%)$_{Before\ mating}$	0.33 ± 0.70^{b}	1.16 ± 0.66^{a}	0.83 ± 0.61^{ab}	0.50 ± 1.06^{ab}
Monocytes (%)$_{After\ kindling}$	0.50 ± 0.50^{b}	2.16 ± 0.66^{a}	1.16 ± 1.17^{b}	0.83 ± 0.35^{b}

$^{a, b, c}$:Means in the same row with different superscripts differ significantly ($p<0.05$)
*PVC: Packed cell volume. Hb : Haemoglobin.
RBC : Red blood cell.WBC: White blood cells.

cantly ($p<0.05$) influenced. At the beginning of the experiment before mating basophils levels was higher in 15% restricted does compared to 0% restricted does but at the end of the experiment higher levels for basophils values (0.50 ± 0.45 %) was recorded for 0% restricted does compared to lower mean values 0.16± 0.34 % obtained for 15% restricted does.

The periods of feed restriction significantly ($p<0.05$) influenced packed cell volume, haemoglobin, white blood cells, eosinophils, basophils and monocytes. However, all other parameters measured were not significantly ($p>0.05$) influenced by the period of feed restriction.

Vitamin E inclusion did not significantly ($p>0.05$) influence all the parameters measured after kindling except for monocytes that was significantly ($p<0.05$) influenced by vitamin E inclusion. Gestating rabbit does fed diet without vitamin E inclusion recorded higher mean values (1.50 ± 0.85 %) for monocytes compared to lower value 0.83± 0.93 % that was obtained for rabbit does with vitamin E inclusion.

Table III shows the interactive effect between levels and periods of feed restriction on haematological parameters of gestating rabbit does. Significant ($p<0.05$) differences were obtained on packed cell volume, haemoglobin, white blood cell, eosinophils, basophils and monocytes. Higher PCV values was obtained for gestating does on 0% and 15% restriction at 25-29 days of gestation which differ significantly from 27.75 ± 2.04 % obtained at 0% restriction between 15-19 days of gestation. Gestating rabbits on 0% and 15% restriction between 25-29 days of gestation had statistically higher Hb concentration in contrast to what was obtained in 0% restricted does at 15-19 days of gestation. Higher (8.55×10^{9}/l ± 1.82) mean values for white blood cells was obtained for gestating rabbit does on 0% restriction at 20-24 days of gestation in contrast to (6.80×10^{9}/l ± 0.47) recorded for 15% gestating rabbit does at 20-24 days of gestation after kindling.

Statistically similar mean values were obtained for eosinophils at 0 and 15% restriction between 15-19days and 25-29 days which differ significantly from 0.00 ± 0.00 obtained for gestating rabbit does on 0% and 15% restriction between 20-24 days of gestation after kindling. Highest basophils level after kindling was obtained from gestating does on 0% restriction while, the least was obtained at 15% restriction between 20-24 days of gestation. Higher monocytes after kindling were obtained from gestating rabbit does on 0 and 15% restriction at 15-19 days and 25-29 days respectively which statistically differs from 0.25 ±0.41 obtained for does on 15% restriction at 20-24 days of gestation

Table IV shows the interactive effect between levels of feed restriction with or without vitamin E inclusion on haematological parameters of gestating rabbit does. Significant ($p<0.05$) differences were obtained on eosinophils, basophils and monocytes across the dietary treatments after kindling. Eosinophils was significantly ($p<0.05$) influenced by the levels of feed restriction with or without vitamin E inclusion with gestating rabbit does on 0% restriction without vitamin E inclusion having increased eosinophils levels compared to the same level with vitamin E inclusion having the least across the dietary treatments. Basophils levels after kindling at 0% restriction with or without vitamin E inclusion recorded statistically similar mean values which differs significantly ($p<0.05$) from 0.00 ± 0.00 obtained for does on 15% restriction with vitamin E inclusion. Monocytes after kindling was also significantly ($p<0.05$) higher from rabbit does on 0% restriction without vitamin E inclusion compared to other dietary treatments that recorded statistically similar mean values.

Table V shows the interactive effect of diets with or without vitamin E inclusion and periods of feed restriction on haematological parameters of gestating rabbit does. Significant ($p<0.05$) differences were obtained for eosinophils, basophils and monocytes levels after kindling. Higher eosinophils levels were obtained for rabbit does without vitamin E inclusion at 15-19days of gestation and 25-29 days of gestation while the least was obtained at 20-24 days with or without vitamin E inclusion. Comparable mean values were obtained for basophils after kindling at most dietary treatments. However, rabbit does fed diet without vitamin E inclusion at 15-19 days of gestation differed significantly ($p<0.05$) from rabbit does at 20-24 days without vitamin E inclusion. Results obtained on monocytes shows that comparable mean values were obtained at most dietary treatments. However, does fed without vitamin E inclusion at 15-19 days of gestation differed significantly ($p<0.05$) from rabbit does at 20-24 days of gestation with vitamin E inclusion.

Interactive effect between levels and periods of feed restriction with or without vitamin E inclusion on haematological parameters of gestating rabbit does is shown in **Table VI**. Significant ($p<0.05$) differences were obtained on all the parameters measured.

PCV after kindling was significantly ($p<0.05$) influenced by levels and periods of feed restriction with or without vitamin E inclusion with gestating rabbit does on 0% restriction between 25-29 days of gestation recording the highest values (36.50 ± 3.50 %)compared to the same level with vitamin E inclusion at 15-19 days and 20-24 days of gestation that recorded lower (27.50%). Haemoglobin concentration across the dietary treatments were significantly ($p<0.05$) affected. Gestating rabbit does on 0% restriction at 25-29 days

Table V. Interactive effect with or without vitamin E inclusion and periods of feed restriction on heamatological Parameters of gestating rabbit does (Efecto interactivo con o sin inclusión de vitamina E y periodos de restricción alimenticia sobre parámetros hematológicos de conejas gestantes).

Vitamin E inclusion	+Vit. E			-Vit. E		
Periods of feed restriction	15-19days	20-24days	25-29days	15-19days	20-24days	25-29days
Parameters						
PCV (%)$_{\text{Before mating}}$	32.16 ± 1.60^{bc}	29.66 ± 6.88^{c}	30.66 ± 4.90^{bc}	36.33 ± 5.78^{ab}	38.50 ± 1.76^{a}	32.00 ± 4.19^{bc}
PCV (%)$_{\text{After kindling}}$	30.25 ± 3.40	30.00 ± 3.86	34.50 ± 3.49	29.50 ± 4.32	32.50 ± 5.75	35.00 ± 3.86
Hb (%)$_{\text{Before mating}}$	10.72 ± 0.53	9.88 ± 2.29	10.22 ± 1.65	12.11 ± 1.92	12.83 ± 0.58	10.66 ± 1.38
Hb (%)$_{\text{After kindling}}$	9.97 ± 1.32	9.97 ± 1.23	11.60 ± 1.28	9.85 ± 1.28	11.15 ± 2.14	11.60 ± 1.20
RBC (× 10^{12}l)$_{\text{Before mating}}$	5.50 ± 0.40	5.12 ± 0.99	5.47 ± 1.16	6.12 ± 0.89	6.47 ± 0.54	5.37 ± 0.69
RBC (× 10^{12}l)$_{\text{After kindling}}$	6.35 ± 0.66	6.37 ± 0.76	6.70 ± 0.76	5.97 ± 0.74	6.52 ± 0.94	6.87 ± 0.67
WBC (× 10^{9}l)$_{\text{Before mating}}$	8.72 ± 1.14^{a}	6.80 ± 0.75^{b}	6.40 ± 1.25^{b}	7.50 ± 0.80^{ab}	7.70 ± 1.48^{ab}	6.70 ± 1.51^{b}
WBC (× 10^{9}l)$_{\text{After kindling}}$	7.22 ± 0.73	8.17 ± 1.79	7.95 ± 1.29	7.15 ± 0.49	7.17 ± 1.25	6.67 ± 0.77
Neutrophils (%)$_{\text{Before mating}}$	27.75 ± 2.56	27.25 ± 1.60	30.25 ± 2.70	29.00 ± 4.85	29.75 ± 5.17	31.00 ± 1.70
Neutrophils (%)$_{\text{After kindling}}$	32.00 ± 3.86	31.00 ± 2.82	32.00 ± 3.53	29.50 ± 3.00	29.75 ± 2.48	31.25 ± 1.17
Lymphocytes (%)$_{\text{Before mating}}$	70.50 ± 1.51^{ab}	72.00 ± 1.67^{a}	68.50 ± 1.48^{ab}	69.00 ± 5.02^{ab}	69.25 ± 5.45^{ab}	67.50 ± 0.83^{b}
Lymphocytes (%)$_{\text{After kindling}}$	66.00 ± 2.77	68.75 ± 2.67	66.00 ± 2.77	67.00 ± 3.96	68.75 ± 1.40	66.00 ± 1.70
Eosinophils (%)$_{\text{Before mating}}$	0.25 ± 0.41^{b}	0.00 ± 0.00^{b}	0.25 ± 0.41^{b}	0.25 ± 0.41^{b}	0.00 ± 0.00^{b}	0.75 ± 0.41^{a}
Eosinophils (%)$_{\text{After kindling}}$	0.50 ± 0.44^{ab}	0.00 ± 0.00^{b}	0.50 ± 0.54^{ab}	1.00 ± 0.70^{a}	0.00 ± 0.00^{b}	1.00 ± 0.70^{a}
Basophils (%)$_{\text{Before mating}}$	0.50 ± 0.54	0.50 ± 0.83	0.50 ± 0.54	0.25 ± 0.41	0.00 ± 0.00	0.50 ± 0.44
Basophils (%)$_{\text{After kindling}}$	0.25 ± 0.41^{ab}	0.25 ± 0.41^{ab}	0.25 ± 0.41^{ab}	0.75 ± 0.41^{a}	0.00 ± 0.00^{b}	0.50 ± 0.44^{ab}
Monocytes (%)$_{\text{Before mating}}$	1.00 ± 0.89^{ab}	0.25 ± 0.41^{b}	0.50 ± 0.54^{b}	1.50 ± 1.00^{a}	0.75 ± 0.88^{ab}	0.25 ± 0.41^{b}
Monocytes (%)$_{\text{After kindling}}$	1.25 ± 0.98^{ab}	0.00 ± 0.00^{b}	1.25 ± 0.88^{ab}	1.75 ± 0.88^{a}	1.50 ± 1.18^{ab}	1.25 ± 0.41^{ab}

$^{a, b, c}$:Means in the same row with different superscripts differ significantly ($p<0.05$)
*PVC : Packed cell volume. Hb : Haemoglobin.
RBC :Red blood cell.
WBC: White blood cells.

Table VI. Interactive effect between levels and periods of feed restriction with or without vitamin E inclusion on blood haematological parameters of gestating rabbit does (Efecto interactivo entre niveles y periodos de restricción alimenticia con o sin inclusión de vitamina E sobre parámetros hematológicos de conejas gestantes).

Levels of feed restriction	0%						15%					
Periods of restriction	15-19days	20-24days	25-29days	15-19days	20-24days	25-29days	15-19days	20-24days	25-29days	15-19days	20-24days	25-29days
Vitamin E inclusion	+Vit. E	+Vit. E	+Vit. E	-Vit. E	-Vit. E	-Vit. E	+Vit. E	+Vit. E	+Vit. E	-Vit. E	-Vit. E	-Vit.E
Parameters												
PCV(%)$_{\text{Before mating}}$	32.00 ± 0.00^{dc}	32.33 ± 8.50^{dc}	27.33 ± 3.51^{d}	41.33 ± 2.51^{a}	37.00 ± 1.00^{abc}	34.00 ± 4.00^{bcd}	32.00 ± 2.51^{dc}	27.00 ± 5.00^{d}	34.00± 4.02^{bcd}	31.00 ± 1.52^{dc}	40.00 ± 0.00^{ab}	30.00 ± 4.00^{dc}
PCV(%)$_{\text{After kindling}}$	27.50 ± 2.50^{c}	27.50 ± 3.50^{c}	36.50 ± 3.50^{a}	28.00 ± 2.00^{bc}	35.00 ± 0.00^{abc}	34.50 ± 5.50^{abc}	33.00 ± 0.00^{abc}	32.50 ± 2.50^{abc}	32.50 ± 2.50^{abc}	31.00 ± 6.00^{abc}	30.00 ± 8.00^{abc}	35.50 ± 2.50^{ab}
Hb (%)$_{\text{Before mating}}$	10.66 ± 0.00^{dc}	10.77 ± 2.83^{dc}	9.11 ± 1.17^{d}	13.77 ± 0.83^{a}	12.33 ± 0.33^{abc}	11.33 ± 1.33^{bcd}	10.77 ± 0.83^{dc}	9.00 ± 1.66^{d}	11.33± 1.33^{bcd}	10.44 ± 0.50^{dc}	13.33 ± 0.00^{bc}	10.00 ± 1.33^{dc}
Hb (%)$_{\text{After kindling}}$	8.85 ± 0.75^{c}	9.10 ± 0.90^{c}	12.10 ± 1.30^{a}	9.55 ± 0.65^{bc}	12.35 ± 0.35^{a}	11.35 ± 1.65^{abc}	11.10 ± 0.20^{abc}	10.85 ± 0.85^{abc}	11.10 ± 1.30^{abc}	10.15 ± 1.85^{abc}	9.95 ± 2.65^{abc}	11.85 ± 0.85^{ab}
RBC(× 10^{12}l)$_{\text{Before mating}}$	5.40 ± 0.10^{bcd}	5.55 ± 1.25^{bcd}	4.60 ± 0.60^{d}	6.90 ± 0.40^{a}	6.00 ± 0.00^{abc}	5.75 ± 0.55^{bcd}	5.60 ± 0.60^{bcd}	4.70 ± 0.60^{d}	6.35 ± 0.85^{ab}	5.35 ± 0.15^{bcd}	6.95 ± 0.25^{a}	5.00 ± 0.70^{dc}
RBC(×10^{12}l)$_{\text{After kindling}}$	5.85 ± 0.75^{abc}	5.80 ± 0.50^{abc}	7.35 ± 0.45^{ab}	5.65 ± 0.25^{abc}	6.95 ± 0.05^{abc}	6.30 ± 0.40^{abc}	6.85 ± 0.25^{abc}	6.95 ± 0.45^{abc}	6.05 ± 0.05^{abc}	6.30 ± 1.00^{abc}	6.10 ± 1.30^{abc}	7.45 ± 0.05^{a}
WBC(× 10^{9}l)$_{\text{Before mating}}$	8.90 ± 0.70^{a}	6.80 ± 1.00^{abc}	7.30 ± 0.30^{abc}	7.70 ± 0.70^{ab}	8.90 ± 0.60^{a}	6.90 ± 1.10^{abc}	8.55 ± 1.65^{ab}	6.85 ± 0.65^{abc}	5.50 ± 1.20^{c}	7.30 ± 1.00^{abc}	6.50 ± 0.90^{bc}	6.50 ± 2.10^{bc}
WBC(× 10^{9}l)$_{\text{After kindling}}$	6.80 ± 0.30^{c}	9.80 ± 0.20^{a}	7.10 ± 1.30^{c}	6.95 ± 0.25^{c}	7.30 ± 1.90^{c}	6.60 ± 1.20^{c}	7.65 ± 0.85^{bc}	6.55 ± 0.25^{c}	8.80 ± 0.60^{ab}	7.35 ± 0.65^{bc}	7.05 ± 0.55^{c}	6.75 ± 0.25^{c}
Neutrophils(%)$_{\text{Before mating}}$	27.50 ± 3.50^{ab}	27.00 ± 0.00^{ab}	32.50 ± 1.50^{a}	32.00 ± 4.00^{ab}	30.50 ± 7.50^{ab}	30.50 ± 2.50^{ab}	28.00 ± 2.00^{ab}	27.50 ± 2.50^{ab}	28.00 ± 1.00^{ab}	26.00 ± 4.00^{b}	29.00 ± 3.00^{ab}	31.50 ± 0.50^{ab}
Neutrophils(%)$_{\text{After kindling}}$	32.50 ± 2.50^{ab}	32.00 ± 4.00^{ab}	34.50 ± 0.50^{a}	29.50 ± 4.50^{ab}	27.50 ± 0.50^{b}	31.00 ± 1.00^{ab}	31.50 ± 5.50^{ab}	30.00 ± 1.00^{ab}	29.50 ± 3.50^{ab}	29.50 ± 1.50^{ab}	32.00 ± 0.00^{ab}	31.50 ± 1.50^{ab}
Lymphocytes(%)$_{\text{Before mating}}$	71.00 ± 2.00^{abc}	73.00 ± 0.00^{a}	67.50 ± 1.50^{abc}	65.50 ± 4.50^{c}	67.50 ± 7.50^{abc}	68.00 ± 1.00^{abc}	70.00 ± 2.00^{abc}	71.00 ± 2.00^{abc}	69.50 ± 0.50^{abc}	72.50 ± 2.50^{ab}	71.00 ± 3.00^{abc}	67.00 ± 0.00^{bc}
Lymphocytes(%)$_{\text{After kindling}}$	65.50 ± 2.50^{ab}	67.50 ± 3.50^{ab}	64.50 ± 0.50^{b}	65.50 ± 5.50^{ab}	70.00 ± 0.00^{a}	65.50 ± 0.50^{ab}	66.50 ± 3.50^{bc}	70.00 ± 1.00^{a}	67.50 ± 3.50^{ab}	68.50 ± 1.50^{ab}	67.50 ± 0.50^{ab}	66.50 ± 2.50^{ab}
Eosinophils (%)$_{\text{Before mating}}$	0.50 ± 0.00^{ab}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.50^{ab}	0.00 ± 0.00^{ab}	0.050 ± 0.50^{ab}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.00^{ab}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.00^{a}
Eosinophils(%)$_{\text{After kindling}}$	0.50 ± 0.50^{bc}	0.00 ± 0.00^{c}	0.00 ± 0.00^{c}	1.50 ± 0.50^{a}	0.00 ± 0.00^{c}	1.50 ± 0.50^{a}	0.50 ± 0.50^{bc}	0.00 ± 0.00^{c}	1.00 ± 0.00^{ab}	0.50 ± 0.50^{bc}	0.00 ± 0.00^{c}	0.50 ± 0.50^{bc}
Basophils(%)$_{\text{Before mating}}$	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.50^{ab}	0.00 ± 0.00^{b}	0.50 ± 0.50^{ab}	1.00 ± 0.00^{a}	1.00 ± 1.00^{a}	1.00 ± 0.00^{a}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.50^{ab}
Basophils(%)$_{\text{After kindling}}$	0.50 ± 0.50^{ab}	0.50 ± 0.00^{ab}	0.50 ± 0.00^{ab}	1.00 ± 0.00^{a}	0.00 ± 0.00^{b}	0.50 ± 0.00^{ab}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	0.50 ± 0.50^{ab}	0.00 ±0.00^{b}	0.50 ±0.50^{ab}
Monocytes(%)$_{\text{Before mating}}$	1.00 ± 1.00^{ab}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}	1.50 ± 0.50^{a}	1.50 ± 0.50^{a}	0.50 ± 0.50^{ab}	1.00 ± 1.00^{ab}	0.50 ± 0.50^{ab}	1.00 ± 0.00^{ab}	1.50 ± 1.50^{a}	0.00 ± 0.00^{b}	0.00 ± 0.00^{b}
Monocytes(%)$_{\text{After kindling}}$	1.00 ± 0.00^{bcd}	0.00 ± 0.00^{d}	0.50 ± 0.50^{dc}	2.50 ± 0.50^{a}	2.50 ± 0.50^{a}	1.50 ± 0.50^{abc}	1.50 ± 1.50^{abc}	0.00 ± 0.00^{dc}	2.00 ± 0.00^{ab}	1.00 ± 0.00^{bcd}	0.50 ± 0.50^{dc}	1.00 ± 0.00^{bcd}

$^{a, b, c, d}$:Means in the same row with different superscripts differ significantly ($p<0.05$)

*PVC : Packed cell volume. Hb: Haemoglobin, RBC , Red blood cell, WBC: White blood cells

of gestation with vitamin E inclusion and 20-24days of gestation without vitamin E inclusion recorded statistically higher Hb levels while, the least was obtained at 0% restriction at 15-19 days and 20-24 days of gestation with vitamin E inclusion.

The result obtained for RBC after kindling shows that mean value for RBC increased positively without vitamin E inclusion at 15% restriction. Highest RBC mean value was obtained at 15% restriction between 25-29 days of gestation without vitamin E inclusion while the least mean values were obtained at 0% restriction at 15-19 days of gestation without vitamin E inclusion. At the end of the experiment, WBC varied ($p<0.05$) across the dietary treatments. Gestating rabbit does on 0% restriction at 20-24 days of gestation with vitamin E inclusion recorded higher mean value ($9.80\times10^9/l \pm 0.20$) while, lowest mean value ($6.55\times10^9/l \pm 0.25$) was obtained for 15% restricted does at 20-24 days of gestation with vitamin E inclusion. Significant ($p<0.05$) difference means was obtained for Neutrophils levels with gestating rabbit does on 0% restriction at 25-29 days of gestation with vitamin E inclusion recording the highest mean value (34.50 ± 0.50 %) compared to 27.50 ± 0.50 % obtained for 0% restricted does at 20-24days of gestation without vitamin E inclusion. Basophils levels was significantly ($p<0.05$) influenced across the dietary treatments. The highest mean value (1.00 ± 0.00 %) was recorded for 0% restricted does at 15-19 days of gestation without vitamin E inclusion while other dietary treatment recorded comparable mean values. Highest mean value (2.50 ± 0.50 %) for monocytes was recorded at 0% restriction at 15-19 days and 20-24 days of gestation without vitamin E inclusion compared to other dietary treatments.

DISCUSSION

Effects of levels of feed restriction on haematological parameters shows that significant difference was obtained on basophils levels of gestating rabbit does. Higher basophils obtained in non-restricted group could not attributed to treatment effect has it still within the range reported by some authors.

The effects of periods of feed restriction showed significant differences in packed cell volume, haemoglobin and eosinophils in the blood of gestating rabbit does. The results obtained on packed cell volume in this study could not be attributed to the treatment effect, this result though significant is lower than packed cell volume reported by Tumova *et al.* (2007) in growing rabbits. Lower packed cell volume obtained in this study could be attributed to blood loss at parturition of does. The result obtained on haemoglobin concentrations in this study though significant is within the range reported by El-speiy *et al.* (2015) who reported that haemoglobin concentrations in growing rabbits varies between 9.25 and 12.65%) in restricted and *ad libitum* fed-rabbits. Eosinophils values obtained in this study though significant for the periods of feed restriction is within the range of values (0-4%) reported by Research Animal Resources (2009).

Interactive effects between levels and periods of feed restriction on haematological parameters of gestating rabbit does shows that significant difference was obtained on packed cell volume. This result though significant is lower than packed cell volume reported by Tumova *et al.* (2007) who reported a range from 35.67 to 37.87% in restricted and *ad libitum* fed growing broiler rabbits. Haemoglobin concentration obtained in this study across the dietary treatments though significant is lower than values reported by Tumova *et al.* (2007). White blood cells count obtained in this study though significant is higher than range of values reported by El-speiy *et al.* (2015) and Tumova *et al.* (2007) who reported that white blood cells ranged from 5.14-5.54 10^3mm^3 to 5.99 ± 1.93-7.02 ± 2.11 in growing rabbits, this might implies that the animal might be fighting some infections during the cause of the experiment. Eosinophils, basophils and monocytes were significantly influenced by levels and periods of feed restriction. The results obtained in this study though significant are within the range of values reported by Research Animal Resources (2009).

Interactive effect between levels of feed restriction and vitamin E inclusion on heamatological parameters of gestating rabbit does shows that eosinophils were significantly influenced across the dietary treatments. The results obtained in this study were lower than those reported by Selim *et al.* (2008) that eosinophil levels ranged from 1.66% ± 0.33 to 2.00% ± 0.60 in *ad libitum* fed rabbits with or without vitamin E inclusion. The result obtained on basophil and monocytes levels in this study were significantly affected. The mean values obtained though significant is lower than mean values reported by Selim *et al.* (2008) who reported a range of 0.66% ± 0.30-1.00% ± 0.00 for basophil levels in the blood and 2.33% ± 0.30- 3.00% ± 0.57 for monocytes levels in the blood.

Interactive effect between levels and periods of feed restriction with or without vitamin E inclusion on heamatological parameters of gestating rabbit does showed that packed cell volume was significantly influenced across the dietary treatment. Higher packed cell volume obtain in *ad libitum* fed rabbits with vitamin E inclusion at kindling corroborates with the findings of Abdel-khalek *et al.* (2008) who reported significant difference in packed cell volume of New Zealand white rabbits does with vitamin E inclusion during lactation. Heamoglobin concentrations obtained in this study are in contrast with the work of Abdel-khalek *et al.* (2008) who reported lower haemoglobin concentration without vitamin E inclusion compared to groups with vitamin E inclusion. The result obtained on red blood cells showed significant difference across the dietary treatments. This result agreed with the findings of Selim *et al.* (2008) that reported higher values without vitamin E inclusion than in vitamin E included diets in New Zealand white rabbits. White blood cells were significantly influenced by the dietary treatments. The result obtained on white blood cells in this study was statistically higher with vitamin E inclusion for *ad libitum* fed gestating does; this result is in contrast with the findings of Selim *et al.* (2008) who reported lower white blood cells at higher levels (80ppm) of vitamin E inclusion in growing rabbits. Neutrophils were significantly affected by levels and periods of

feed restriction with or without vitamin E inclusion. The result obtained shows that neutrophils level was statistically higher with vitamin E inclusion in *ad libitum* fed gestating rabbit does. This result disagrees with the findings of Selim *et al.* (2008) who reported that with vitamin E inclusion at 80ppm neutrophil levels was lower than in control group without vitamin E inclusion. Lymphocytes counts of gestating rabbit does obtained in this study was significantly affected. The results obtained in this study though significant is higher than mean values reported by Selim *et al.* (2008) in New Zealand rabbits fed control diet with or without vitamin inclusion. Eosinophils concentration was significantly influenced by the dietary treatments. Results obtained in this study is in agreement with the work of Selim *et al.* (2008) who reported higher mean values for eosinophils levels in growing rabbits fed control diet than rabbits fed control diet with vitamin E. The result obtained on basophil in this study showed that dietary treatment was significantly affected; this result is contrary to the findings of Selim *et al.* (2008) who reported significantly higher values for rabbits on higher vitamin E inclusion. Monocytes varied across the levels and periods of feed restriction with or without E inclusion. The result obtained in this study though significant is lower than what was reported by Selim *et al.* (2008) in *ad libitum* fed rabbits without vitamin E inclusion.

CONCLUSION

It may be concluded that feed restriction and periods of feed restriction with or without E inclusion does not have any detrimental effect on hematological parameters of gestating rabbit does. The results shows that feed restriction did not resulted in levels above the recommended ranges of values reported by authors that have worked on gestating rabbit does. Which shows that feed restriction with or without vitamin E inclusion does not have any negative effect on gestating rabbit does.

ETHICAL APPROVAL

All rules guiding animal welfare and procedures were strictly adhere to following the rules and regulations of Animal welfare committee of College of Animal Science and Livestock Production Federal University of Agriculture Abeokuta

CONFLICT OF INTEREST

The authors declare that there was no conflict of interest

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