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Growth, haematology and serum biochemical responses of rabbit bucks administered carrot *(daucus carota*) seed meal

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Abstract

An experiment was conducted with 24 crossbred rabbit bucks (8 months old, 1770±55.05g) to assess their growth performance, haematological and serum biochemical responses to carrot seed meal (CSM). The administered treatments were 0, 0.2, 0.4, 0.6mg CSM/kg in treatments 1 (control), 2, 3 and 4, respectively, orally drenched into each animal on treatment basis, with six rabbits per treatment for twelve weeks. Feed intake, weight gain and carcass yield were monitored. Blood samples were collected at baseline, day 45 and day 70 from each rabbit. Average body weight gain ranged from 169.60±9.08g (T4) to 337.26±9.08g (T3), the average weekly feed intake ranged from 882.40±12.06g (T4) to 1014.30±12.06g (T2) and carcass yield from 47.75±8.57g (T4) to 61.25±8.75g (T3). All haematological parameters were not significantly different among the treatments except eosinophils at the mid stage of the experiment. All serum parameters were not significantly different at baseline. Aspartate amino transferase, Alanine amino transferase, bilirubin, globulin, triglyceride and low density lipoprotein were similar among the treatments, while the total protein, albumin, albumin/globulin were significantly ($p<0.05$) influenced by treatments at the mid stage. At the end line, only triglycerides, low density lipoprotein and high-density lipoprotein were significantly ($p<0.05$) different among the treatments. However, the values were within the physiological range for healthy rabbits. It was concluded that carrot seed meal did not adversely affect the blood profile and health status of rabbits with CSM up to 0.4mg/kg enhanced growth performance in rabbit bucks.

Keywords: Carrot seed meal, Rabbit growth, Blood profile, Rabbit bucks

Description of Problem

As a result of rise in human population especially in developing countries such as Nigeria, demand for animal protein has increased significantly. This trend is projected to continue over the next few decades. This has notified the need to enhance meat production such as rabbit because of their prolificacy, high fecundity, short generational interval, high meat quality and their consumption is without cultural and religious bias so as to meet the animal protein need of the fast-growing populace.

Despite the attractive prospect of between 83% and 140% returns on capital investment reported in rabbit farming (1), rabbit production is yet to be appreciated by Nigerians. In Nigeria, rabbit production like other animal production enterprises, is confronted by many challenges among which include disease, heat stress and reproduction related challenges (2).

Carrot (*Daucus carota*) is one of the important root vegetables, rich in bioactive compounds like carotenoids and dietary fibers with appreciable levels of several other functional components having significant health-promoting properties (3).

The consumption of carrot and its products is increasing steadily due to its recognition as an important source of natural antioxidants having anti-cancerous properties (3). Carrots have long been said to be good for vision. Scanty report has emerged, that they can also improve the fertility of male humans and male animals. Dietary beta-carotene is recognised as the major precursor of vitamin A which is needed for good eyesight, growth, reproduction and maintenance of epithelial tissues. Carrot seed also contain antioxidants such as vitamins E and C which play an important role in maintaining animal health, productive and reproductive performance (4). Thus, this research was carried out to examine the effect of carrot seed meal on the growth parameters, carcass characteristics, haematology and serum biochemistry of rabbit bucks.

Materials and methods

Experimental Site

The experiment was carried out at the Rabbitry Unit of the Teaching and Research Farm and the Animal Physiology Laboratory in the Department of Animal Science, University of Ibadan, Nigeria. Ibadan is located 100miles from the Atlantic Ocean and has average elevation of 700 feet. The Rabbitry unit is located on $7^0 27^{'}$ 00.4" N and 3^0 53' 34.2" E. The region is in the Southwestern Agro–ecological Zone with an annual rainfall of between 1200 mm and 1990 mm as reported by ministry of lands survey of Oyo State.

Management of experimental animals

A total number of 24 crossbred rabbit bucks (average body weight of 1.77kg) were used for the experiment and the experiment lasted for 10 weeks. The rabbits were acclimatized and quarantined during the physiological adjustment period for 2 weeks. The animals were allotted in a completely randomized design into four treatments, with each treatment having 6 rabbits housed individually in a wooden hutch (55cm x 40cm x 40 cm) suspended from the ground.

Experimental Design and diets

Twenty-four rabbit bucks were randomly allocated into four treatments. Six rabbits were allotted to each treatment. Powdered carrot seed was administered to the rabbits at every other day for 10 weeks by oral drenching at graded levels for each treatment containing 0mg/kg, 0.2mg/kg, 0.4mg/kg or 0.6mg/kg body weight for Treatments 1, 2, 3 and 4, respectively. Rabbits on T1 (0 mg/kg, control group) were drenched with distilled water only. The gross composition of the diet for experimental animals is shown in Table 1. The diets were pelleted and animals were fed *ad libitum* and water was made available to the animals throughout the period of the experiment. The feed intake and weight gain were monitored daily and weekly, respectively.

Processing of carrot (*Daucus carota*) seed extract

Untreated carrot seeds were obtained from the open local market in Farin Gida, Jos, Nigeria. The carrot was blended into powder by the use of electric blender and stored in an air tight container at room temperature before it was subsequently administered to the animals.

Administration of Experimental Treatment

At the time of administration, the powdered carrot seed was weighed using sensitive digital analytical scale. The quantity of the seed to be administered was determined by the body weight of each rabbit buck relative to the treatment dosage. The powdered carrot seed was poured into a syringe, 3mL distilled water was added to it and was mixed thoroughly before the animals were carefully drenched orally.

Table 1: Gross composition (%) of the concentrate fed to experimental animals

Feed Ingredients	Quantity (%)
Maize	30.0
Corn offal	13.0
Groundnut cake	10.0
Palm kernel cake	12.0
Wheat offal	20.5
Brewers dried grain	6.00
Rice bran	5.00
Fish meal	1.00
Bone meal	2.00
Salt	0.25
Premix*	0.20
Total	100.00

*Premix composition per kg diet: Vitamin A – 3,200,000iu, Vitamin D3 1,200iu, Vitamin E 3,200iu Vitamin K3 800mg, Vitamin B1 – 400mcg, Selenium (Se) 40mg, Manganese (Mn) 32,000mg, Pantothenic acid 2000mg, Folic acid 200mg, Choline chloride 60000mg, Iron (Fe) 8,000mg, (Cu) 3,200mg, Zinc (Zn) 2,00mg,

Performance characteristics

The initial weight of each Rabbit was taken before allocation for the purpose of randomization by weight into treatments. Thereafter, data on their initial body weight, weekly feed consumption; changes in the body weight were routinely collected. The weight gain and feed conversion ratio were also determined on a weekly basis.

Blood collection and analysis

At the beginning, middle and end of the experiment (Day1, Day 45 and Day 70), blood samples were collected through the ear vein of each rabbit using a sterilized disposable syringe and needle before feeding. A 2ml blood was collected into labelled sterile vacuum tube containing ethylene-diamine-tetra-acetic acid (EDTA) as anticoagulant which was used for haematological analysis. Another 3 mls of blood was collected into labelled sterile sample bottles without anticoagulant and used for the serum biochemical analysis. Biuret method of serum total protein determination was employed in this assay (5). Albumin was determined using Bromcresol Green (BCG) method (6). The globulin concentration was obtained by subtracting albumin values from the total protein, while the albumin/globulin ratio was obtained by dividing the albumin value by the calculated globulin value. Alkaline Phosphates (ALP), Alanine amino transferase, Aspartate amino transferase activity were determined using spectrophotometric method. The Red Blood Cell (RBC) counts, total White Blood Cell (WBC) counts, haemoglobin (Hb) concentration and Packed Cell Volume (PCV) parameters were determined (7). Blood constants (MCH, MCV, MCHC) were estimated using appropriate formulae as described by Jain (8).

Carcass and Organ Evaluation

On the last day in the 10^{th} week, the animals were starved overnight and three animals were randomly selected from each treatment group for carcass and organ evaluation. The rabbits were stunned and bled after severing of the jugular vein with a sharp knife, and evisceration was carried out immediately. Bled weight, eviscerated

weight and carcass weight of each animal was recorded. The weight of internal organs like adrenal, stomach, liver, kidney, spleen, heart and the lungs were recorded as well and their relative weight determined.

Statistical analysis

All data obtained were subjected to one-way analysis of variance (ANOVA) using statistical Analysis Software (SAS) version 9.3. The means were compared using Duncan Multiple Range Test of the same software.

Results

The growth parameters of rabbit bucks administered carrot seed are presented in Table 2. The final live weight, feed conversion ratio and carcass yield were not significantly influenced by administration of carrot seed meal. However, there was a significant difference in the average weekly feed intake. The feed intake of bucks administered T2 and T3 were not significantly different ($p>0.05$) from each other but both were significantly ($p<0.05$) higher than those administered T1 and T4. The relative weight of liver, left and right kidney, spleen, heart, and lungs were not significantly ($p>0.05$) different among the treatments as shown in Table 3. The left and right adrenal glands, gastro intestinaltracts, abdominal fat, the left and right testes and the pancreas were not significantly influenced by the carrot seed meal.

Table 2 Growth performance of rabbit bucks administered carrot seed meal

PARAMETERS	T1 (0 mg/kg)	T (0.2 mg/kg)	T3 (0.4 mg/kg)	T4 (0.6 mg/kg)	SEM
IBW(g)	1752.86	1781.67	1795.00	1795.00	55.05
AFLW(g)	2032.33	2122.83	2132.26	1964.60	34.54
ATWG(g)	297.47	341.16	337.26	169.60	9.08
ATFI(g)	899.20	1014.30	996.50	882.40	12.06
FCR	3.00	2.97	2.95	5.20	1.02
CCY(g)	52.52	59.93	61.25	47.75	8.57

SEM: Standard error of mean, IBW: initial body weight, AFLW: average final live weight, ATWG: average total weight gain, ATFI: average total feed intake, CCY: carcass yield, FCR: Feed conversion ratio.

Table 3: The relative weights of internal organs of rabbit bucks administered carrot seed meal

PARAMETERS	T1 (0 mg/kg)	T2 (0.2 mg/kg)	T3 (0.4 mg/kg)	T4 (0.6 mg/kg)	SEM
Liver	2.04	2.13	2.34	2.25	0.08
L-Kidney	0.25	0.26	0.25	0.27	0.01
R-Kidney	0.25	0.26	0.24	0.25	0.01
Spleen	0.03	0.03	0.03	0.03	0.00
Heart	0.22	0.24	0.27	0.24	0.01
Lungs	0.52	0.56	0.56	0.56	0.03
L-Adrenal	0.02	0.01	0.01	0.01	0.00
R-Adrenal	0.02	0.01	0.01	0.01	0.00
GIT	13.07	14.10	14.29	13.24	0.29
Ab.FAT	2.95	1.84	1.64	2.82	0.25
L-Testes	0.15	0.14	0.15	0.15	0.01
R-Testes	0.13	0.14	0.14	0.17	0.01
Pancreas	0.06	0.06	0.05	0.07	0.00

L: left, R: right, GIT: gastro intestinal tract, Ab: abdominal

The haematological responses of rabbit bucks administered graded levels of carrot seed meal

The haematological responses of rabbit bucks before administered carrot seed meal that is at the onset of the experiment is shown in Table 4. The packed cell volume, haemoglobin, red blood cell and platelets were not significantly different ($p>0.05$) among the treatments. Also, the lymphocytes, neutrophils, monocytes and eosinophils were not significantly different across the treatments. The leukocyte counts in rabbits administered T1 and T4 were not significantly different from T3 but were lower than T4. The haematological responses of rabbit bucks administered carrot seed meal at the mid stage of the experiment (day 42) is shown in Table 5. The packed cell volume, haemoglobin, red blood cells, white blood cells and platelets were not significantly different ($p>0.05$) across the treatments. The lymphocytes, neutrophils, monocytes and eosinophils were also similar among the treatments. The haematological responses of rabbit bucks administered carrot seed meal at the end of the experiment is shown in Table 6. The packed cell volume, haemoglobin, red blood cells, white blood cells and platelets were not significantly different across the treatments. Also, the lymphocytes, neutrophils, monocytes and eosinophils were similar among the treatments.

Table 4: The haematological responses of rabbit bucks before administered carrot seed meal at graded levels (at the onset of the experiment)

PARAMETERS	T1 (0mg/kg)	T2 (0.2mg/kg)	T3 (0.4mg/kg)	T4 (0.6mg/kg)	SEM
PCV (%)	34.33	35.33	38.83	39.17	1.14
Haemoglobin(g/dL)	11.15	11.65	12.77	12.98	0.38
Erythrocytes (µL)	5.48	5.81	6.46	6.56	0.2
Leukocytes($\times10^3$/µL)	50.92^{ab}	57.66^{a}	45.75^{b}	54.92^{ab}	1.80
Platelet ($\times10^3$/µl)	107.5	79.7	109.5	100.8	0.40
Lymphocyte (%)	63.33	67.50	65.50	65.88	1.27
Neutrophils (%)	33.67	29.67	31.50	30.50	1.21
Monocytes (%)	1.33	1.33	1.67	1.50	1.13
Eosinophils (%)	1.67	1.50	1.67	0.83	0.2

a,b: mean with different superscript on the same row are significantly different ($p<0.05$) PCV: packed cell volume, SEM: Standard error of mean

Table 5: The haematological responses of rabbit bucks administered carrot seed meal at graded levels at the mid stage (day 42) of the experiment

PARAMETERS	T1 (0mg/kg)	T2 (0.2mg/kg)	T3 (0.4mg/kg)	T4 (0.6mg/kg)	SEM
PCV (%)	37.83	33.80	36.40	35.5	1.44
Haemoglobin(g/dL)	12.33	11.04	11.88	11.63	0.44
Erythrocytes (µL)	3.08	2.86	2.81	2.94	0.12
Leukocytes($\times10^3$/µL)	12.49	13.11	12.48	13.06	0.26
Platelet ($\times10^3$/µl)	136.7	124.8	122.6	141.3	1.25
Lymphocyte (%)	67.00	63.20	65.80	65.00	1.41
Neutrophils (%)	26.17	31.20	27.20	27.00	1.53
Monocytes (%)	3.67	3.20	3.40	2.75	0.25
Eosinophils (%)	2.83^{ab}	2.20^{b}	3.40^{ab}	5.00^{a}	0.42
Basophils (%)	0.33	0.20	0.20	0.25	0.1

a,b: mean with different superscript on the same row are significantly different ($p<0.05$) PCV: packed cell volume, SEM: Standard error of mean

Table 6: **The haematological responses of rabbit bucks administered carrot seed meal at the end of the experiment (day 70)**

PARAMETERS	T1(0 mg/kg)	T2 (0.2 mg/kg)	T3 (0.4 mg/kg)	T4 (0.6 mg/kg)	SEM
PCV (%)	39.00	39.83	40.80	43.00	1.20
Haemoglobin(g/dL)	13.16	13.28	13.54	14.35	0.41
Erythrocytes (µL)	6.52	6.71	6.77	7.11	0.22
Leukocytes($\times 10^3$µL)	4.25	4.32	4.34	4.23	0.14
Platelet ($\times 10^3$/µl)	90.2	86.7	96.4	89.0	0.26
Lymphocyte (%)	68.00	68.50	70.40	69.50	0.96
Neutrophils (%)	28.40	28.17	26.20	27.00	0.97
Monocytes (%)	1.80	1.33	1.60	1.75	0.13
Eosinophils (%)	1.80	2.00	1.80	1.74	0.28

PCV: packed cell volume, SEM: Standard error of mean

Serum biochemical indices of rabbit bucks administered carrot seed meal

Serum biochemical indices of rabbit bucks administered carrot seed meal at graded levels at the onset of the experiment are shown in Table 7. The total protein, albumin, globulin, albumin/globulin ratio, Aspartate amino transferase and Alanine amino transferase were not significantly different ($p>0.05$) among treatments. Alkaline phosphatase, glucose, bilirubin, cholesterol, creatinine, triglyceride, low density lipoprotein and high density lipoprotein were not significantly different across the treatments. Serum biochemical indices of rabbit bucks administered carrot seed meal at the mid stage of the experiment (day 42) are presented in Table 8. The globulin, Aspartate amino transferase and Alanine amino transferase were not significantly different among treatments. Also, glucose, cholesterol, triglyceride and low density lipoprotein, were not significantly influenced by the administration of carrot seed meal across the treatments. The total protein in rabbit bucks administered carrot seed meal (T1 and T4) were not significantly different from each other and T2 but both were significantly ($p<0.05$) higher than T3. The albumin and creatinine in rabbit bucks administered T1 and T2 were not significantly different from each other and T3 but they were significantly ($p<0.05$) lower than T4. The albumin/globulin ratio in rabbit bucks administered T2 and T3 were similar with T1 but both were significantly ($p<0.05$) lower than T4. The Alkaline phosphatase in rabbit bucks administered T1 and T3 were similar but significantly ($p<0.05$) lower than T4. The high density lipoprotein in rabbit administered T2 was higher ($p<0.05$) than all other treatments. Serum biochemical indices of rabbit bucks administered carrot seed meal at the end of the experiment are presented in Table 9. The total protein, albumin, globulin, albumin/globulin ratio and Alanine amino transferase were the same among treatments. Also, Alkaline phosphatase, glucose, bilirubin, cholesterol, and creatinine were not significantly influenced by carrot seed meal across the treatments. The triglyceride and high density lipoprotein in rabbit bucks administered T1 and T2 were not significantly ($p>0.05$) different from each other but were significantly lower than T4, The aspartate amino transferase in rabbits administered T1 and T2 were significantly ($p<0.05$) lower than those administered T4. Low density lipoprotein in rabbit administered T1 and T3. were not significantly different ($p>0.05$) from T4 but lower ($p<0.05$) than T2.

Table 7: Serum biochemical responses of rabbit buck administered graded levels of carrot seed meal at the onset of the experiment

PARAMETERS	T1 (0mg/kg)	T2 (0.2mg/kg)	T3 (0.4mg/kg)	T4 (0.6mg/kg)	SEM
TP(g/L)	6.37	6.63	6.38	6.77	0.11
Albumin (g/dL)	2.90	2.85	2.80	2.85	0.05
Globulin (g/dL)	3.47	3.68	3.92	3.92	0.08
A/G	0.80	0.75	0.75	0.68	0.02
AST (µ/L)	29.00	32.83	32.17	33.17	1.13
ALT (µ/L)	63.33	65.17	64.83	68.667	1.16
ALP (µ/L)	41.17	46.17	41.00	49.332	2.63
Bilirubin (mg/dL)	18.83	19.67	20.00	19.63	0.52
Creatinine (mg/dL)	0.70	0.73	0.70	0.75	0.7
Glucose (mg/dL)	107.17	115.67	106.00	114.17	106.13
Cholesterol (mg/dL)	60.17	63.33	61.17	64.67	59.91
Triglyceride(mg/dL)	29.17	29.50	27.67	27.50	27.08
HDL (mg/dL)	34.17	37.67	36.67	35.83	1.22
LDL (mg/dL)	20.17	19.77	18.97	23.33	1.1

TP: Total protein, HDL: High density lipoprotein, LDL: Low density lipoprotein SEM: Standard error of mean, AST: Aspartate amino transferase, ALT: Alanine amino transferase, ALP: Alkaline phosphatase, A/G:Albumin Globulin ratio

Table 8: Serum biochemical responses of rabbit bucks administered graded levels of carrot seed meal at the mid stage (Day 42) of the experiment

PARAMETERS	T1(0mg/kg)	T2(0.2mg/kg)	T3(0.4mg/kg)	T4(0.6mg/kg)	SME
TP (g/L)	7.58^{a}	7.45^{ab}	6.66^{b}	7.75^{a}	0.16
Albumin (g/dL)	3.20^{ab}	3.05^{ab}	2.72^{b}	3.38^{a}	0.09
Globulin (g/dL)	4.42	4.40	3.94	4.38	0.09
A/G	0.72^{ab}	0.65^{b}	0.64^{b}	0.75^{a}	0.02
AST (µ/L)	36.83	37.83	33.20	40.25	1.27
ALT (µ/L)	65.00	68.00	66.80	67.50	1.26
ALP (µ/L)	51.17^{ab}	47.50^{b}	52.80^{ab}	64.50^{a}	2.26
Bilirubin (mg/dL)	23.57	22.15	19.86	24.75	0.83
Creatinine (mg/dL)	0.78^{ab}	0.82^{ab}	0.70^{b}	0.88^{a}	0.03
Glucose (mg/dL)	116.50	112.83	118.60	118.00	2.00
Cholesterol (mg/dL)	66.33^{ab}	69.67^{a}	63.00^{ab}	70.25^{a}	1.14
Triglyceride (mg/dL)	31.00	33.83	30.20	38.00^{a}	1.42
HDL (mg/dL)	35.17^{ab}	41.50^{a}	34.60^{b}	39.00^{ab}	1.17
LDL (mg/dL)	23.97	21.40	22.36	23.65	0.70

abc: mean with different superscript on the same row are significantly different ($p<0.05$). TP: Total protein, HDL: High density lipoprotein, LDL: Low density lipoprotein SEM: Standard error of mean, AST: Aspartate amino transferase, ALT: Alanine amino transferase, ALP: Alkaline phosphatase, A/G:Albumin Globulin ratio.

Table 9: Serum biochemical responses of rabbit bucks administered carrot seed meal at the end of the experiment (Day 70)

PARAMETERS	T1 (0mg/kg)	T2 (0.2mg/kg)	T3 (0.4mg/kg)	T4 (0.6mg/kg)	SEM
TP (g/L)	6.37	7.18	6.88	6.90	0.11
Albumin (g/dL)	2.77	2.88	2.66	2.85	0.55
Globulin (g/dL)	3.97	4.30	4.10	4.03	0.32
A/G	0.65	0.65	0.64	0.68	0.01
AST (µ/L)	34.00^{b}	35.50^{ab}	32.60^{b}	42.50^{a}	1.38
ALT (µ/L)	64.17	64.50	68.40	66.75	1.00
ALP (µ/L)	49.17	43.00	55.40	52.25	2.45
Bilirubin(mg/dL)	21.13	20.12	18.80	20.58	0.634
Creatinine(mg/dL)	0.68	0.67	0.60	0.65	0.03
Glucose (mg/dL)	112.50	107.17	109.20	112.50	2.09
Cholesterol (mg/dL)	65.17	66.50	61.40	67.50	1.07
Triglyceride (mg/dL)	31.17^{ab}	28.83^{ab}	27.4^{b}	35.00^{a}	1.22
HDL (mg/dL)	35.83^{ab}	37.83^{ab}	32.80^{b}	40.00^{a}	1.07
LDL (mg/dL)	27.77^{ab}	31.90^{a}	28.52^{ab}	25.50^{b}	0.82

a,b: mean with different superscript on the same row are significantly different ($p<0.05$). TP: Total protein, HDL: High density lipoprotein, LDL: Low density lipoprotein SEM: Standard error of mean, AST: Aspartate amino transferase, ALT: Alanine amino transferase, ALP: Alkaline phosphatase, A/G:Albumin Globulin ratio.

Discussion

Administration of 0.4mg/kg carrot seed produced a significantly increased final live weight gain in rabbits than all other treatments, while rabbits exposed to 0.6mg/kg showed weight depression. This could be attributed to the effect of toxic anti nutritional factors such as alkaloids possibly present in the seed meal which have the potential to inhibit growth activities (9,10,11). The feed conversion ratio (FCR) did not show significant difference among the treatment groups. This observation indicates that all the inclusion levels have similar effect on feed conversion ratio which is an indicator of superiority of the diet (12). The FCR range of 2.95 to 5.20 observed in this study is lower than 6.96 to 7.9 reported by (13) as the average feed conversion ratio for young rabbits fed *Mucuna utilis* which adjudged carrot seed to have promoted better feed utilisation. The carcass yield that ranged from 53.25 to 54.93% was within the range of 50 to 60% reported by (14) who further stated that the` dressing percentage will tend to be 50% or less if rabbit were young. The values obtained from this study for these organs which were not significant indicate no adverse effect of carrot seed compared with the control. Although, these values do not conform to those reported for rabbits fed sun-dried cassava waste (15), graded levels of pineapple waste meal (16), boiled pigeon pea seed meal (17) concentrates, *Aspilia africana* and *Tridax procumbens* (18) and *Mucuna utilis* leaf meal (13). This could be as a result of the nature of the test ingredient, age, sex, species of the experimental animal and environmental influence in carrying out the experiment.

The effect of carrot seed meal on all haematological parameters except leukocytes and eosinophils at the onset and the mid stage of the experiment were not significantly different in the rabbit bucks across the treatment groups. The PCV values (33.80 to 37.83%) were within the normal range of 30 to 50% (19) and 33 to 50% (20)

for growing rabbits. The values obtained for all the treatment groups indicate nutritional adequacy of all diets since values did not indicate mal- or under nutrition (21) and no adverse effect induced by carrot ,seed meal. The RBC count (5.48 to 6.56 µL) and (6.52 to 7.11 µL) at the onset and at the end of the experiment, respectively were within the range of 5 to $8x10^6/mm^3$ reported by(22). Rabbits fed concentrates, *Aspilia africana* and *Tridax procumbens* (18), sesame seed meal (23,24) and rabbits fed *Mucuna utilis* leaf meal (13) reported similar values with the results obtained in this study. These values are also similar to normal physiological range for rabbits (24, 25,26,27,28).

The serum proteins obtained in this study compared with the values (6.00-8.30 g/l) for healthy rabbits (29). It was reported that serum total protein and albumin values below the standard physiological range were an indication that the animals suffered from hypoproteinemia and hypoalbuminemia (30). The high level of serum protein in rabbits administered 0.2, 0.4 and 0.6 mg/kg carrot seed meal indicated some positive alteration in their protein metabolism, since serum protein and albumin syntheses are related to the amount of available protein (31) in the diet, the result also suggests that there was no muscle wastage in the rabbits and that the animals did not survive at the expense of body reserves since protein synthesis is related to the amount of dietary protein. This implies better utilisation of the dietary proteins by the animals within each treatment thereby facilitating total protein availability. The range of 2.80 - 2.90 g/l for albumin obtained in this present study fell within the normal range of 2.5 - 4.5 gdl^{-1} (22) and 2.42 - 4.05 g/dL (29) which is an indication of proper functioning of the liver and related visceral organs in the rabbits as evidence in the observed similar values for liver and non-liver specific enzymes.

Conclusion/Application

Based on the result obtained from this study, it can be concluded that

1. Carrot seed meal up to 0.4mg/kg enhanced growth performance in rabbit buck thus improving rabbit production.
2. Administering up to 0.4mg/kg body weight orally seed meal will help in maintaining good health status and improve blood profile of the animals.

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