Effects of garlic (*Allium sativum*) and vitamin E on blood profile, growth performance and internal organ characteristics of rabbit bucks

Amaduruonye¹, W., Ekuma¹, B. O., *Onunkwo², D. N. and Herbert¹, U.

¹Department of Animal Breeding and Physiology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

²Department of Animal Nutrition and Forage science, College of Animal Science and Animal Production,

Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

*Corresponding Author's E-mail: donunkwo1@gmail.com. 08033388622

Abstract

Studies have shown that garlic has medicinal, antimicrobial properties, speeds up digestion and widely used as preservatives, spice and condiment in many homes. Vitamin E on the other hand is a fat soluble vitamin with potent antioxidant properties essential for the stabilization of biological membranes, protecting cells from oxidative stress and inhibits angiogenesis. Thus, a study using thirty-six (36) pre-pubertal New Zealand White rabbit bucks was conducted to investigate the response of garlic and vitamin E supplementation on haematological indices, serum biochemistry and growth performance. The bucks were randomly assigned to four dietary treatments and replicated three times in a completely randomized design (CRD). Each dietary treatment consisted of 9 rabbits per treatment with 3 rabbits per replicate. Four dietary treatments were formulated to meet the nutrient requirements of rabbits supplemented at 0% garlic and vitamin E (T_1), 3% garlic (T_2), Vitamin E (T_3), and 3% garlic and Vitamin E (T_4) respectively. Data collected on the growth performance, haematology and serum biochemistry parameters and on the internal organ characteristics were subjected to analysis of variance (ANOVA). Results showed that significant increase ($P < 0.05$) were observed in final body weight, ear length, forelimb, hindlimb and body length for rabbits fed supplementation of garlic, vitamin E and its combination, while tail length, head to shoulder significantly decreases. Hematological parameters showed significant increases in red blood cell count for vitamin E group, while T_2 was higher on MCHC. White blood cell and its differentials increased significantly on T_2 , T_3 and T_4 . Serum biochemical characteristics were significantly higher on total protein, globulin and creatinine; while cholesterol, glucose and ALP reduced significantly on T_2 , T_3 and T_4 . It could be concluded that combination of garlic and vitamin E improved performance and blood profile of rabbit bucks compared to when they are used individually.

Keywords: Hematology, Serum biochemistry, Organs, Rabbits, Garlic, Vitamin E

Introduction

One of the aims of animal feed formulation is to produce the best quality feed at the lowest possible cost. The least cost diet formulation is considered a target so as to achieve a reduction in cost of animal production. Varieties of herbs and spices have been successfully tried in animal production as growth promoters and

immune-stimulants. Nutritional strategies aimed at reducing cost of animal production have led to high deposition of fatty acids in blood of animals (Mayo, 1997). High blood cholesterol and triglycerides are associated with increased risk of cardiovascular diseases (Ademola *et al.*, 2009). Blood profile and growth parameters are significantly affected by such factors as physiology, nutrition, age, climate,

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environment, hormones, and drugs/medications (Forlan, 1999; Iheukwumere *et al.*, 2002; Addass *et al.*, 2012; Tras *et al.*, 2000; Xie *et al.*, 2013 and NseAbasi *et al.*, 2014).

Due to its comparative efficacy, lesser side effect, availability and relatively cheap of plant products, organic and natural products compared to the synthetically produced growth promoters, there has been an increasing interest in the use of plants, herbs, organic and natural products to improve the blood profiles and growth performance in animal production. As a result, plant products, organic and natural products are continuously being scrutinized and explored for their beneficial properties (Ansa *et al.*, 2017). One of such products is *Allium sativum*.

Garlic (*Allium sativum*) is a moderately tall annual herbaceous bulbous plant that belongs to the family of *Amaryllidaceae* of the genus *Allium*. It has adventitious roots and condensed, flattened stem with narrow flat leaves. The bulb consists of many separate strong flavored cloves which served as the storage organ for the plant (Block, 2010; Gafar, *et al.*, 2012). Phytochemical analysis of garlic reveals that garlic contains varieties of enzymes, proteins, B-complex vitamins, minerals, saponins flavonoids and many more (Focke *et al.*, 1990; Ankri *et al.*, 1999; Jennifer, 2002). Documented evidence has shown that garlic has been used in human medicine to treat arthritis, cold, coughs, diabetes, malaria, diarrhea, cholera, tuberculosis and to improve the immune system (Turner, 2004; Sasaki, 2006; Gafar *et al.*, 2012). Researches have also shown that consumption of garlic oil can reduce blood pressure; prevent heart disease, atherosclerosis, high cholesterol and cancer (Andreatta *et al.*, 2005). Garlic has been widely used in many homes as

spice, condiments and preservatives due to its antioxidant, antibiotic and antimicrobial properties (Aaron *et al.*, 2001; Harris *et al.*, 2001; Hammami and El May, 2012).

Vitamin E (Tocopherol) on the hand is a fat soluble vitamin with potent antioxidant properties essential for the stabilization of biological membranes, protecting cells from oxidative stress, inhibits angiogenesis, has anti-inflammatory activity. It has an anti-ageing property, improve healing process, memory functions, regulating immune functions, maintaining endothelial cell integrity, balancing normal coagulation, enhancing physiological and pathophysiological processes. It is a heart vitamin which has been found to improve circulation, cleans the arteries, inhibits cholesterol oxidation and its deposition in the walls of the arteries thereby prevents atherosclerosis (Wallert *et al.*, 2014; Mathur *et al.*, 2015; Botanical, 2016).

If the chemical and biological properties of garlic, Vitamin E or its combinations are proved to enhance blood profile and growth performance of rabbits in this study without exhibiting deleterious effects on the physiological characteristics of rabbits, its potential as a growth supplement for animals will impact positively on animal production. Therefore, it becomes justifiable to investigate the physiological effects of garlic and Vitamin E on blood profile, internal organs and growth performance and on its overall impacts on the physiology of rabbit bucks.

Materials and methods

Experimental location

This research was conducted at the Rabbitry Unit of the Teaching and Research Farm of the College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Umudike is located in Abia State, Nigeria; at

latitude 05°29' North and longitude 07°31' East; and at an altitude of 122 meters above sea level. It lies within the tropical rainforest zone of South-Eastern Nigeria. The location is characterized by average annual rainfall of 2,177mm in 148-155 rain days. The average ambient temperature is 25.5°C with minimum and maximum temperature of 22°C and 29°C respectively. Relative humidity ranged from 57-91% (NRCRI, 2004).

Collection and preparation of garlic meal

Fresh garlic was purchased from Ubani market, in Umuahia, Abia State, Nigeria. It

was cleaned and washed in running tap water to remove adhering debris and contaminants. Also, it was peeled and cut into small sizes, after which they were air dried under room temperature to a constant weight. The dry garlic was milled using a hammer mill to produce garlic meal. The garlic meal was used in formulating the experimental diets. Four experimental rations were formulated containing 0% (garlic and vitamin E), 3.0% garlic, Vitamin E alone and 3.0% (garlic and vitamin E); representing T₁, T₂, T₃ and T₄ respectively. The compositions of the experimental diets are presented in Table 1.

Table 1: Gross composition and calculated nutrients of experimental diets

Ingredients	Control (T ₁)	Garlic (T ₂)	Vitamin E (T ₃)	Garlic and Vit E (T ₄)
Maize	44.94	44.94	44.94	44.94
Soya beans	17.31	17.31	17.31	17.31
Rice husk	32.00	32.00	32.00	32.00
Fishmeal	2.00	2.00	2.00	2.00
Bone meal	1.00	1.00	1.00	1.00
Limestone	2.00	2.00	2.00	2.00
Vit/min Premix*	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Garlic (%)	0.00	3.00	0.00	3.00
Vitamin E (IU/kg)	0.00	0.00	3000.00	3000.00
Calculated Crude Protein (%)	17.00	17.00	17.00	17.00
Calculated Energy (Kcal/kg)	2505.42	2505.42	2505.42	2505.42
Crude fiber (%)	11.36	11.36	11.36	11.36
Lysine (%)	0.514	0.514	0.514	0.514
Methionine (%)	0.199	0.199	0.199	0.199

*Premix composition (per kg of diet): vitamin A, 12,500 IU; vitamin D3, 2500 IU; vitamin E, 50.00mg; vitamin K3, 2.50mg; vitamin B1, 3.00mg; vitamin B2, 6.00mg; vitamin B6, 6.00mg; niacin, 40mg; calcium pantothenate, 10mg; biotin, 0.08mg; vitamin B12, 0.25mg; folic acid, 1.00mg; chlorine chloride, 300mg; manganese, 100mg; iron, 50mg; zinc, 45mg; copper, 2.00mg; iodine, 1.55mg; cobalt, 0.25 mg; selenium, 0.10mg; antioxidant, 200mg.

Experimental animals and management

Thirty-six pre-pubertal New Zealand White rabbit bucks were purchased from the Teaching and Research farm of the College of Animal Science and Animal Production, Michael Okpara University of agriculture Umuahia and from Bethel Rabbit Farms in Umuahia, Abia State, Nigeria. Two weeks pre-experimental period were used to

quarantine, vaccinate the rabbits against ecto and endo-parasite and to get the rabbits acclimatized to the experimental procedures. The rabbits were randomly assigned to four experimental treatments and replicated three times with three rabbits per replicate in a completely randomized design. The experimental animals were housed in hutches throughout the

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experimental period. Feed and clean drinking water were provided *ad libitum*. Routine management practices were also carried out appropriately. The study lasted for 14 weeks.

Experimental design

The study was a CRD with 4 treatments consisting of 0% (garlic and vitamin E), 3.0% garlic, Vitamin E alone and 3.0% (garlic and vitamin E); designated T₁, T₂, T₃ and T₄ respectively. T₁ served as the control. The vitamin E was supplemented at 3000IU/kg of feed. Nine rabbits were randomly assigned to each treatment and replicated 3 times. The experimental model is as follows:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where Y_{ij} = individual observation on the rabbit characteristics.

μ = overall mean

T_i = treatment effect

e_{ij} = random error assumed to be independently, identically and normally distributed with zero means and constant variances.

Data collection and evaluation

Weight determination

Initial and final body weights of the rabbits were measured on arrival to the rabbit Farm and at the end of the experiment, respectively. Subsequently, body weights and other growth performance parameter were taken at weekly interval throughout the study. All weight measurements were done using electronic weighing scale (OHAUS Champ II). Weight gain was calculated as the difference between the final and the initial weight of the rabbits. *At the end of the experiment, rabbits sampled from each replicate were slaughtered and; their internal organs were collected, measured and recorded.*

Linear body measurements

These were taken at weekly intervals

throughout the study using a measuring tape calibrated in centimeter.

Haematology

Blood samples for hematological examination were collected from the rabbit bucks. A 5-ml syringe fitted with a sterile needle was used to collect about 2 ml of blood and quickly transferred to ethylenediaminetetraacetic acid (EDTA) sample bottles. The EDTA sample bottles were shaken gently to prevent clotting. The following hematological indices were determined: Packed cell volume, Hemoglobin, Red Blood Cell, White Blood Cell, Mean Cell Volume, Mean Cell Hemoglobin and Mean Cell Hemoglobin Concentration. Packed cell volume (PCV) was determined by the micro-hematocrit method as described by Dacie and Lewis, (1991). Hemoglobin (Hb) concentration was determined using a spectrophotometer through the cyanomethaemoglobin method as described by Kelly (1979). Red blood cell (RBC), white blood cell (WBC) counts and its 'differentials' were determined using Neubauer hemocytometer method as described by Jain (1986) and Feldman *et al.* (2000). Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated according to Jain (1986) and Bain *et al.* (2006).

Serum biochemistry

Two milliliter of blood was collected and transferred into sample bottles without anticoagulant. The blood was allowed to clot for 30 min, after which it was centrifuged at 3000 revolutions per minutes for 10 min in order to separate the serum from the clot. After the centrifugation, the serum was carefully collected and transferred into a clean sample bottle and the blood chemistry tests were performed thereafter. The following serum chemistry indices were

determined as described by Kahn, *et al.*, (2010): Total protein (g/dl), Albumin (g/dl), Globulin (g/dl), Blood urea (mg/dl); serum creatinine (mg/dl); Total bilirubin (mg/dl), conjugated bilirubin (mg/dl); Aspartate aminotransferase (AST) (μ l); Alanine amino transferase (ALT) (μ l) and alkaline phosphatase (μ l). The blood for serum cholesterol and glucose were collected and analyzed spectrophotometrically and colorimetrically, respectively as described by Stockbridge *et al.* (1989) for cholesterol and Thomas and Labor (1992) for glucose. The blood for Hematology and Serum biochemistry were analyzed at the College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike.

Statistical analysis

Data collected on different parameters were subjected to ANOVA in accordance with the methods of Steel and Torrie (1980). Significant means were separated according to Duncan's Multiple Range Test

(Duncan, 1955).

Results and discussion

Effects of garlic and vitamin E supplementation on the linear body measurements of rabbit bucks are presented in Table 2. The initial body weight, ear width and heart girth of the rabbits fed diets supplemented with garlic, vitamin E and its combination were statistically similar ($p < 0.05$) to the control. There were significant increases ($p < 0.05$) on the length of forelimb (16.88 on T_2 , 16.33 on T_3 and 16.50 on T_4); length of hind limb (27.17 on T_2 , 26.00 on T_3 and 27.83 on T_4); ear length and body length (37.83 on T_2 , 35.50 on T_3 and 38.08 on T_4) of the rabbits fed diets supplemented with garlic, vitamin E and its combination, while tail length and head to shoulder reduced significantly. The body weight increased significantly ($p < 0.05$) on T_2 (2.38kg) and T_4 (2.38kg) compared to the control.

Table 2: Linear body measurements of rabbit bucks fed diets supplemented with garlic and vitamin E.

Parameters	Control (T ₁)	Garlic (T ₂)	Vitamin E (T ₃)	Garlic and Vit E (T ₄)	SEM
Final Body weight (kg)	2.14 ^b	2.38 ^a	2.14 ^b	2.38 ^a	0.04
Initial body weight (kg)	1.80	1.80	1.77	1.80	0.03
Ear length (cm)	11.67 ^b	13.08 ^a	11.83 ^b	13.25 ^a	0.10
Ear width (cm)	5.17	5.04	5.25	5.17	0.02
Length of forelimb (cm)	15.17 ^b	16.88 ^a	16.33 ^a	16.50 ^a	0.09
Length of hind limb (cm)	24.83 ^b	27.17 ^a	26.00 ^{bc}	27.83 ^a	0.17
Tail length (cm)	12.33 ^a	11.58 ^b	11.33 ^b	10.08 ^c	0.10
Heart girth (cm)	25.58	25.75	25.58	26.58	0.06
Head to shoulder (cm)	6.17 ^a	5.09 ^b	5.17 ^b	5.92 ^a	0.06
Body length (cm)	33.08 ^c	37.83 ^a	35.50 ^b	38.08 ^a	0.25

^{abcd}: means with different superscripts along rows are significantly different ($p < 0.05$). SEM=standard error of treatment means.

The significant increases observed on the linear growth parameters of rabbit bucks fed garlic and vitamin E supplementation is an indication that the supplementation of garlic and vitamin E promote development of bones especially the long bones. The body weight and linear traits contributes significantly to the life time performance of

the animal. Research on linear body measurements have been used to evaluate breed performance, predict weight gain and to evaluate reproductive performance (Chineke *et al.*, 2000).

The effect of dietary supplementation of garlic and vitamin E on organ weight of rabbit bucks are presented in Table 3. There

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were significant increases ($p < 0.05$) on the paired kidney (0.64 in T_2 , 0.77 in T_3 and 0.66 in T_4) and right kidney (0.32 on T_2 , 0.37 on T_3 and 0.33 on T_4) of the rabbits fed diets supplemented with garlic, vitamin E and its combination, while the weight of the lungs (0.55 on T_2 , 0.50 on T_3 and 0.45 on T_4)

reduced significantly compared to the control. The body weight significantly increased in T_2 (2.38kg) and T_4 (2.38kg), while the heart and left kidney increased significantly in T_3 and T_4 . The weight of the liver increased significantly on T_3 (3.16) and reduces on T_2 (2.29) and T_4 (2.16).

Table 3: Relative Organ weight of rabbit bucks fed diet supplemented with garlic and vitamin E

Parameter	Control (T_1)	Garlic (T_2)	Vitamin E (T_3)	Garlic and Vit E (T_4)	SEM
Final Body weight (kg)	2.14 ^b	2.38 ^a	2.14 ^b	2.38 ^a	0.04
Heart(%)	0.19 ^{ab}	0.19 ^{ab}	0.22 ^a	0.22 ^a	0.01
Lungs (%)	0.60 ^a	0.55 ^b	0.50 ^{bc}	0.45 ^c	0.02
Left kidney (%)	0.31 ^c	0.32 ^c	0.40 ^a	0.33 ^b	0.12
Right kidney (%)	0.28 ^d	0.32 ^c	0.37 ^a	0.33 ^b	0.01
Paired kidney (%)	0.59 ^c	0.64 ^b	0.77 ^a	0.66 ^b	0.02
Pancreas (%)	0.66	0.69	0.77	0.66	0.02
Liver (%)	2.81 ^b	2.29 ^c	3.16 ^a	2.16 ^c	0.15

^{abcd}: means with different superscripts along rows are significantly different ($p < 0.05$). SEM=standard error of treatment means.

The significant increases on the percentage organ weights showed that garlic, vitamin E and its combinations did not have detrimental effect on the organs, but favours the growth and development of these internal organs. The increase in live weight of bucks on garlic, vitamin E and its combination as observed in this study inferred a higher rate of nutrient absorption and utilization.

The result of hematological parameters of rabbit bucks fed diets supplemented with garlic and vitamin E are shown in Table 4. The hemoglobin concentrations, packed

cell volume (PCV), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) of the rabbits fed diets supplemented with garlic, vitamin E and its combinations were statistically similar ($p > 0.05$) with the control group. The hemoglobin concentration and packed cell volume fall within the normal range (9.3 – 19.3g/dl for haemoglobin and 25.0 - 45.0% for PCV) as recommendation by Kronfield and Mediway (1975); Mitruka and Rawnsley (1977) for healthy rabbits. This indicates that the supplementations do not have detrimental effect on the synthesis of these hematological parameters.

Table 4: Hematological parameters of rabbit bucks fed diets supplemented with garlic and vitamin E.

Parameter	Control (T_1)	Garlic (T_2)	Vitamin E (T_3)	Garlic and Vit E (T_4)	SEM
Hemoglobin (g/dl)	10.17	9.43	12.16	10.62	0.49
PCV (%)	34.33	28.00	36.33	35.50	1.39
RBC ($\times 10^6/\text{mm}^3$)	5.72 ^b	4.71 ^b	7.56 ^a	5.10 ^b	0.34
MCV (fl)	59.68	59.57	181.80	65.69	32.43
MCH (pg)	17.47	20.02	16.22	20.82	0.68
MCHC (%)	29.19 ^d	34.39 ^a	33.45 ^{ab}	31.55 ^{ac}	1.15
WBC ($\times 10^9/\text{mm}^3$)	5.82 ^c	6.38 ^b	6.40 ^b	8.47 ^a	0.36
Lymphocytes (%)	67.33 ^c	77.00 ^a	73.00 ^b	80.00 ^a	2.24
Neutrophils (%)	16.00 ^c	18.66 ^b	16.83 ^c	21.66 ^a	1.22
Eosinophil (%)	8.00	5.00	1.66	6.00	1.05
Basophils (%)	0.00	0.66	0.667	1.00	0.19
Monocytes (%)	0.66 ^c	0.66 ^c	2.00 ^b	5.00 ^a	0.57

^{abcd}: means with different superscripts along rows are significantly different ($p < 0.05$). SEM=standard error of treatment means.

There were significant increases ($p<0.05$) in erythrocyte counts of bucks on vitamin E supplementation, while those of bucks on T_2 and T_4 are statistically similar to the control. These were within the normal range ($4.0-8.0 \times 100 \text{ ml}$) as recommended by Mitruka and Rawnsley (1977) for a normal physiological haematology of healthy rabbits. This suggests that vitamin E has a positive effect on erythropoietic cells and tissues of rabbits. The mean corpuscular hemoglobin concentration (MCHC) of the bucks on garlic, vitamin E and its combinations were significantly ($p<0.05$) higher compared to the control. There were significant increases ($p<0.05$) in the white blood cell (WBC) of bucks in T_2 , T_3 , T_4 compared to the control.

Significant increases ($p<0.05$) were also observed on the differential white blood cell counts (lymphocyte and Neutrophils), while Eosinophil and Basophil were statistically similar ($p>0.05$) to the control. The monocyte of the bucks in T_2 was statistically similar to the control while that of T_3 and T_4 were significantly higher ($p<0.05$). This observation collaborated reports by Suleria *et al.* (2013b) on improvement in WBC and its differentials in rabbits fed aqueous garlic extract. This is an indication that the rabbits were nutritionally stable, physiologically sound and healthy. From these observations, it could be inferred that both garlic and vitamin E stimulates the immune system and improves the health status of the rabbit bucks.

Table 5 : Serum biochemistry parameters of rabbit bucks fed diets supplemented with garlic and vitamin E.

Parameters	Control (T_1)	Garlic (T_2)	Vitamin E (T_3)	Garlic and Vit E (T_4)	SEM
Total protein (g/dl)	7.75 ^c	9.08 ^b	8.73 ^b	10.36 ^a	0.29
Globulin (g/dl)	4.25 ^b	5.13 ^a	5.18 ^a	5.66 ^a	0.16
Albumin (g/dl)	3.50 ^b	3.95 ^b	3.55 ^b	4.70 ^a	0.20
Urea (mg/dl)	28.50	34.50	34.33	28.08	1.74
Creatinine (mg/dl)	0.51 ^c	2.86 ^a	1.74 ^b	1.23 ^b	0.28
Cholesterol (mg/dl)	102.00 ^a	96.08 ^b	90.71 ^b	81.74 ^c	5.70
Glucose (mg/dl)	104.66 ^a	81.66 ^c	98.00 ^b	95.33 ^b	3.27
Total bilirubin (mg/dl)	0.48	0.39	0.33	0.42	0.36
Conjugated bilirubin (mg/dl)	0.28	0.22	0.14	0.35	0.36
ALT (μl)	29.46 ^b	31.60 ^b	38.63 ^a	22.10 ^c	2.47
AST (μl)	35.26	35.56	24.58	24.38	3.95
ALP (μl)	22.12 ^a	20.39 ^b	18.07 ^{bc}	17.22 ^c	0.80

^{abcd}: means with different superscripts along rows are significantly different ($p<0.05$). SEM=standard error of treatment means.

The result of serum biochemistry of rabbit bucks fed diets supplemented with garlic and vitamin E are shown in Table 5. No significant differences ($p<0.05$) were observed in serum urea, total bilirubin, and conjugated bilirubin and on aspartate aminotransferase (AST) compared with the control. Significant increases ($p<0.05$) were observed in total protein, globulin and creatinine, while serum glucose,

cholesterol and alkaline phosphatase (ALP) reduced significantly. Furthermore, the combination of vitamin E and garlic significantly increased ($p<0.05$) serum albumin. Supplementation of vitamin E significantly increased ($p<0.05$) the alanine aminotransferase, while its combination with garlic reduces the alanine aminotransferase (ALT) significantly. From these observations, it could be deduced that

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combination of garlic and vitamin E improved some serum biochemical parameters of rabbit bucks compared to when they are used individually.

The reduction in glucose, cholesterol and alkaline phosphatase on garlic supplementation as observed in this study is in line with the findings of these researchers (El-Demerdash *et al*, 2005 and Suleria *et al*, 2013a, b) who reported significant reduction on serum glucose, cholesterol and ALP on diabetic rats and rabbits administered aqueous garlic extract respectively. It could be concluded that garlic is effective against hypercholesterolemia and hyperglycemia and, therefore, could be used to cure various life threatening disorders.

The increase in total protein, albumin and its absorption might have been responsible for the increase in final body weight of the rabbit bucks (Table 2). Also, the globulins are made up of the immunoglobulin and the antibodies. Therefore, the significant increase on globulin must have resulted to improved immune system and the disease fighting ability of the rabbit bucks.

Conclusion

Having studied the effects of garlic (*Allium sativum*) and vitamin E on blood profile, growth performance and internal organs characteristics of rabbit bucks, it could be concluded that combination of garlic and vitamin E improved performance and blood profile of rabbits bucks compared to when they are used individually. Garlic, vitamin E and its combination has the ability to boost the immune system, antibodies production and disease fighting ability of rabbit bucks by improving the white blood cells, the 'differentials' and serum globulin. Garlic is effective against hypercholesterolemia and hyperglycemia and therefore, could be used to cure various life threatening disorders.

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Received: 10th July, 2017

Accepted: 9th December, 2017