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## **GROWTH PERFORMANCE AND HAEMATOLOGICAL INDICES OF WEANED RABBITS FED GARLIC (*ALLIUM SATIVUM*) AND GINGER (*ZINGIBER OFFICINALE*) SUPPLEMENTED DIETS**

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### **ABSTRACT**

The objective of this study was to evaluate the growth performance, haematology and serum biochemistry of weaned rabbits fed ginger and garlic supplemented diets using 48 weaned rabbits. The rabbits were randomly assigned to four treatment groups in a completely randomized design and each treatment replicated four times. Four diets were formulated with diet 1 containing no supplement. Diets 2 and 3 contained garlic and ginger at 0.25% respectively while diet 4 contained a combination of 0.25% garlic and ginger. Results showed that garlic and ginger supplementation produced significant ( $P < 0.05$ ) effects on weight gain feed intake and feed conversion ratio of the rabbits. Haematological parameters were significantly ( $P < 0.05$ ) enhanced with ginger and garlic supplementation. No significant ( $P > 0.05$ ) difference existed in serum total protein and albumin among the treatment groups. Serum urea and creatinine of treated rabbits were significantly ( $P < 0.05$ ) higher than untreated rabbits while significant reduction in blood cholesterol was recorded for rabbits fed supplemented diets. The study indicated that ginger and garlic could effectively be added to rabbit ration to improve the quality of the feed and the performance of the animals

**Key Words:** Garlic, Ginger, Haematology, Performance, Serum Biochemistry, Weaned Rabbits

### **INTRODUCTION**

In developed countries, livestock sub-sector is an indispensable component of agriculture with the potential for contributing immensely to the economic development of these countries. Contrastingly, in developing countries like Nigeria, the livestock sub-sector tends to be playing a decreasing role in the growth of Nigeria's economy if its relative contribution to the country's Gross Domestic Product (GDP) is taken as a reliable indicator. CBN (2007) reported that livestock as a percentage of agricultural GDP, which was as high as 19% in 1983 and 1984, dropped persistently over time to as low as 10% in 1998 and further to 6% in 2004 and 2005. This is a pathetic situation and a manifestation of the pitiable and deteriorating state of the Nigerian livestock industry which has adversely affected the animal protein supply and consumption of the populace.

Before now, the Nigerian economy depended mainly on conventional livestock for animal protein supply but this has proved to be grossly inadequate. There is therefore, the need to develop cheaper alternative sources of animal protein like rabbit to bridge the wide gap that exist between animal protein supply and intake. According to Spore (2007) and Soyebó (2006), rabbit production has the potential to improve on the diet and income of many poor households. This is due to its high growth and fecundity rate as well as low investment and labour cost. It provides an inexpensive source of white; fine grained, appetizing and tummy to taste meat (Egbeyale *et al.*, 2007) that can be used to bridge the low consumption rate of meat in Nigeria (Aduku and Olukosi 1990). In addition, the FAO recipe to fight hunger has rabbit as its key component (Prathap and Ponnusaing 2007)

Feed is a major component affecting net return from the livestock enterprise, because 80% of the total expenditure in terms of cash is spent on feed (Farooq *et al.*, 2001). To ensure more net return and to

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minimize expenditure on feed are the main challenges, for which many research strategies has been practiced such as introducing feed additives (Pervez, 1992).

Antioxidants, antibiotics, flavouring agents, coccidiostat, antimolds and anticaking agents are synthetic feed additives used to improve the quality of feed for our livestock and their performance. However, current research is looking for natural alternatives to synthetic feed additives. Medicinal herbs such as garlic (*Allium sativum*) and ginger (*Zingiber officinale*) have been reported to possess antibacterial, antiseptic, anti-inflammatory, antiparasitic and immunomodulatory properties (Muhammad *et al.*, 2009). In addition to these attractive properties, herbs have been shown to increase feed palatability and thus feed intake (Horton *et al.*, 1991). Because of the antimicrobial, antioxidant and flavour enhancing properties of garlic and ginger, these herbs may promote growth and feed utilization in monogastric animals such as rabbit. However, the use of ginger and garlic as natural feed additives in rabbit nutrition has not been substantially investigated because of the availability of low costs and proven effective synthetic growth-promoting feed additives. The study therefore was designed to evaluate the effects of garlic and gingers on the growth performance, haematological and serum biochemical indices of weaner rabbits

## **MATERIALS AND METHODS**

The experiment to evaluate the growth performance, haematological and serum biochemistry of weaner rabbit was conducted at the Rabbitry Unit of Ebonyi State University, Abakaliki. The experimental protocol was approved by the Animal Care and Use Committee of the Institution.

**Processing of Garlic and Ginger:** The garlic bulbs were divided into cloves which were cut into chips and sun dried. Dried garlic chips were stored in an air tight container which was later pounded. Slices of dried ginger were also pounded, milled and stored. Powdered ginger and garlic were later incorporated in the diets.

**Experimental animals and management:** Forty eight weaner hybrid rabbits of both sexes with initial weights of 609.94 – 611.40g obtained from a commercial Rabbitry in Abakaliki were used for the study. The rabbits were randomly allocated to four treatments groups of 12 rabbits each. Each treatment was further sub-divided into 4 replicate of 3 rabbits. The rabbits were weighed at the beginning of the experiment to obtain their initial body weight and subsequently weekly. Feed and water were supplied *ad libitum* throughout the experimental period of 10 weeks. The rabbits were housed individually in cages in a completely randomized design. Performance criteria measured include weight gain, feed intake and feed conversion ratio.

**Experimental diet:** Four experimental diets were formulated such that diet 1 contained neither garlic nor ginger. Diets 2 and 3 contained 0.25% garlic and 0.25% ginger respectively while diet 4 contained a combination of 0.25% garlic and 0.25% ginger (Table 1)

**Haematological study:** At the end of the feeding trial, 2 rabbits were selected from each replicate group, starved of food but not water for 12 hours. 4 ml of blood sample was taken from the ear vein with a sterile syringe. 2 ml of the blood was put into a bijon bottle containing ethylene diamine tetracetic acid (EDTA) as an anticoagulant for haematological assay. The remaining 2ml of the blood sample was put into a sterile vacutainer tube without an anticoagulant for serum biochemical analysis. The haematological assay was carried out to determine erythrocyte indices such as packed cell volume (PCV), and haemoglobin (Hb) values according to Brown (1976). Red and white blood cell count (WBC) was determined using the haemocytometer method (Dacie and Lewis 1984). Packed cell volume (PCV) and haemoglobin were analyzed by the methods of wintrobe microhaematocrit and cyanomethaemoglobin (Ghai, 1993) respectively. Serum protein, albumin, urea and creatine were analyzed using sigma kit according to Feteris (1965). Blood cholesterol was determined by Liebermann –burchard reaction method (Liebermann, 1985).

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**Statistical analysis:** Data obtained were subjected to a one way analysis of variance ANOVA using the General Linear Model procedure of SAS (version 6.04) (SAS Institute, 1994). Comparison of significant treatment means was by least significance differences (LSD) as outlined by Obi (2002).

### **RESULTS AND DISCUSSION**

The growth performance of the weaner rabbits fed ginger and garlic supplemented diets are as presented in Table 2. Results showed that there were significant ( $P < 0.05$ ) differences in weight gain, feed intake and feed conversion ratio among the treatments. Rabbits fed supplemented diets recorded significantly higher body weight gain than those fed unsupplemented diets. Combination of garlic and ginger gave the highest body weight gain. A difference of 13.29% and 14.14% increase in growth rate was recorded for rabbits fed garlic and ginger supplemented diets respectively compared to the control.

The improvement in body weight gain achieved with mixture of garlic and ginger than garlic and ginger as sole agent in rabbit diets suggest the positive beneficial growth enhancing synergetic effects of these herbs. It could be that a mixture of these herbs may have controlled and limited the growth and colonization of numerous pathogenic and non pathogenic species of bacteria in the gut leading to improved translation of feed to meat. The enhanced body weight observed in this study strengthens the findings of Ahmed and Sharma (1997) and Ademola *et al.*, (2009) who reported significant increase in body weight gain of rats and broilers fed a mixture of garlic and ginger. The enhanced body weight gain of the rabbits fed ginger and garlic supplemented diets indicates the positive nutritive effects of these natural feed additive.

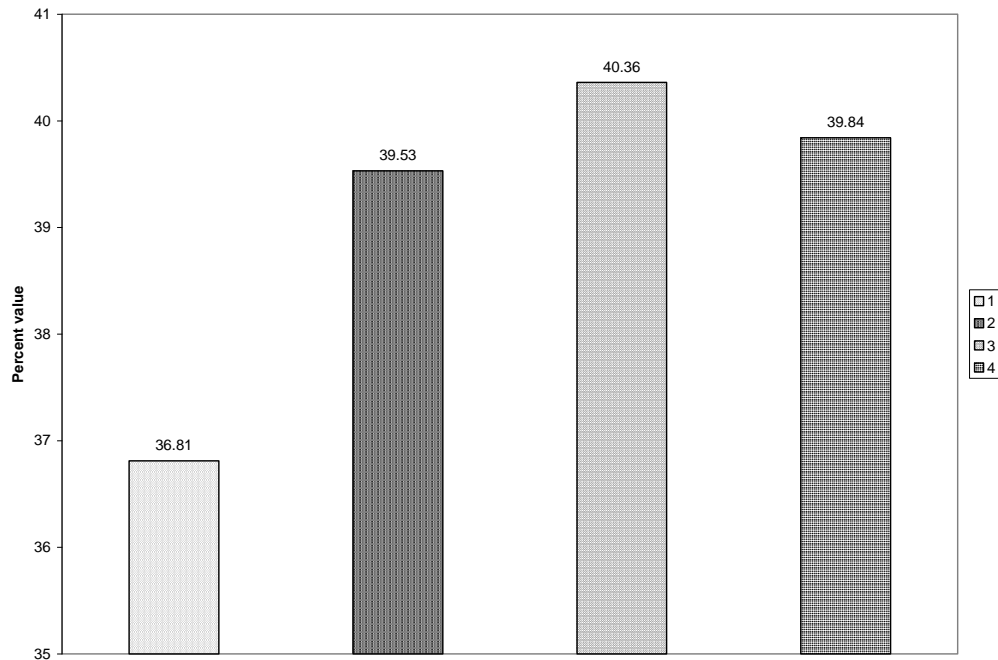
This improvement in growth rate of rabbits fed garlic supplemented diets compared to the control is in line with the findings of Ortsergu *et al.* (2008) and Ademola *et al.*, (2005) who reported increase in weight gain of rabbits and broilers fed garlic supplemented diets respectively. On the other hand, 14.14% increase recorded for rabbits fed ginger supplemented diets compared to the control suggests that ginger positively influenced the utilization of the feed. This observation is in agreement with the reports of Okoye *et al.*, (2006).

There were significant ( $P < 0.05$ ) differences in the feed intake of the rabbits among the treatments. Rabbits fed supplemented diets consumed significantly ( $P < 0.05$ ) higher feed than the control. The sense of taste (Baldwin, 1976) and Smell (Forbes, 1995) are important factors affecting feed intake. According to Schlotant (1983) the quantity of feed consumed by rabbits is dependent to a large extent on the palatability of the diet. The increased feed intake recorded for rabbits fed supplemented diets may be due to improved flavour, palatability and taste of the feed. This may have enhanced the appetite of the rabbits thereby stimulating increased consumption. This observation implies that the level of inclusion of these herbs were within the tolerable limits of the rabbits. It also suggests that the odour of the diets were not extremely pungent to clamp down feed intakes. The increased feed intake observed in this study is in agreement with the reports of Okoye *et al.* (2006); Omege *et al.* (2007) and Adeniyi and Balogun (2002).

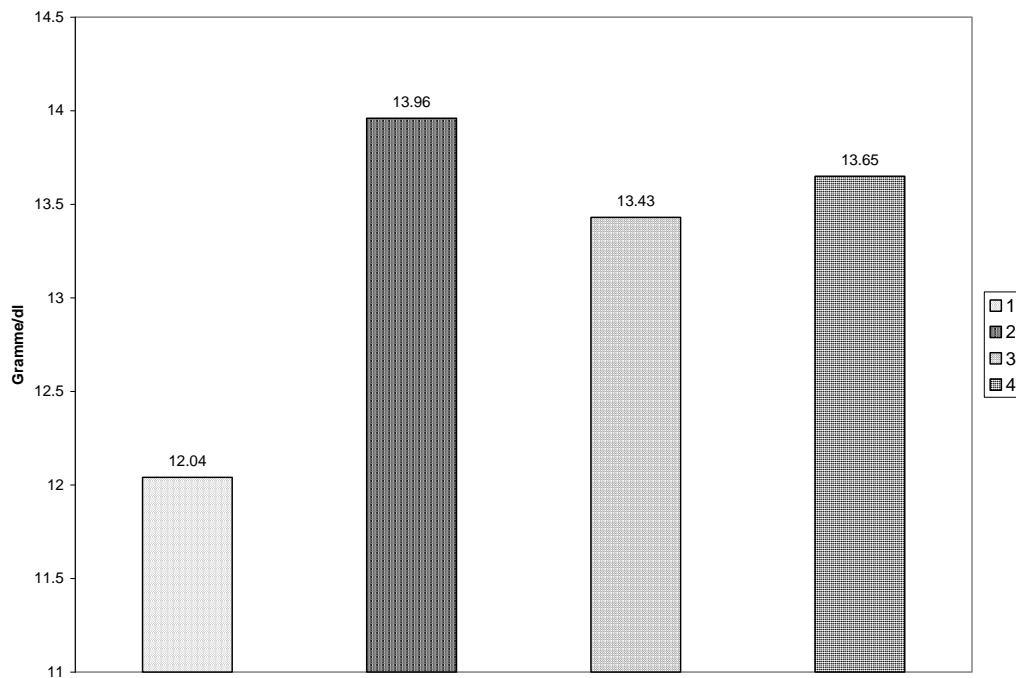
In terms of feed utilization of the diets by the rabbits, the groups fed supplemented diets recorded significantly ( $P < 0.05$ ) superior feed conversion ratio than those fed the control diet. The improvement in feed conversion ratio of the rabbits fed supplemented diets may be due to the antibacterial and antifungal properties of these herbs which might have improved the microflora and gut environment of the rabbits resulting in improved feed utilization. For instance, Reeds *et al.* (1993) attributed the positive effect of garlic on feed conversion ratio to the fact that susceptibility of pathogenic gram-positive bacteria to the antibacterial components of garlic is higher than the physiological desirable intestinal bacteria. According to the authors, the beneficial bacteria are believed to be unaffected by the presence of garlic as they are less sensitive to the inhibitory effect of garlic.

The packed cell volume, haemoglobin, red blood cell and white blood cell volume (haematological characteristics) of the weaner rabbits fed ginger and garlic supplemented diets are as presented in Figures 1,2,3 and 4 respectively. Results on haematological parameters of the rabbits show a general increase in PCV, RBC, WBC, and Hb of rabbits fed ginger and garlic supplemented diets.

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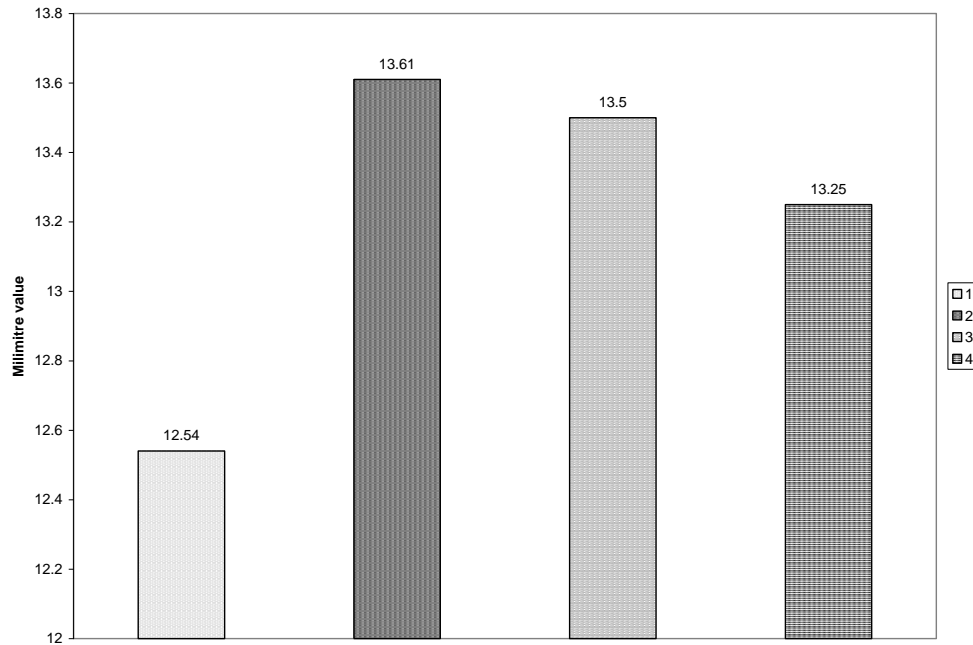


**Figure 1:** Parked cell volume of rabbits fed garlic and ginger supplemented diets. Values are expressed as mean  $\pm$  SE.

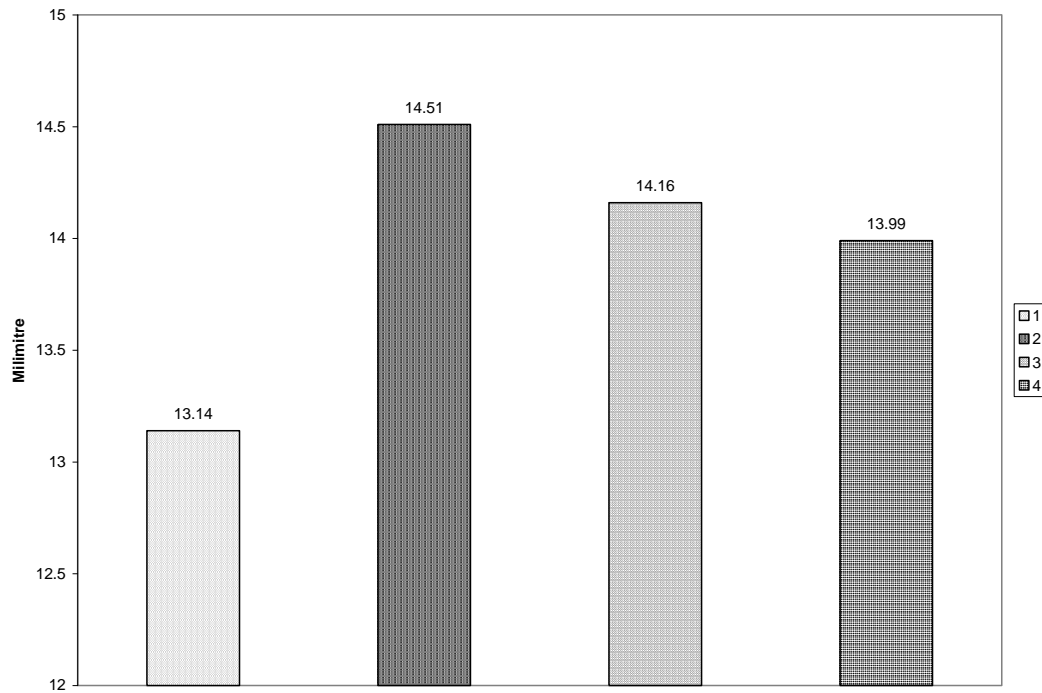


**Figure 2:** Haemoglobin of rabbits fed garlic and ginger supplemented diets. Values are expressed as mean  $\pm$  SE.

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**Figure 3:** Red blood cell count of rabbits fed garlic and ginger supplemented diets. Values are expressed as mean  $\pm$  SE.



**Figure 4:** White blood cell count of rabbits fed garlic and ginger supplemented diets. Values are expressed as mean  $\pm$  SE.

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**Table 1:** Ingredient and chemical composition of the experimental diets

Ingredients	T <sub>1</sub>	T <sub>1</sub>	T <sub>3</sub>	T <sub>4</sub>
	Control	025% garlic	0.25% ginger	0.25% ginger + garlic
Maize	43.5	43.25	43.25	43
Wheat offal	18	18	18	18
Soya bean meal	21.5	21.5	21.5	21
Palm kernel cake	12.5	12.5	12.5	12.5
Fish meal	1	1	1	1
Bone meal	3	3	3	3
Ginger	0	0	0.25	0.25
Garlic	0	0.25	0	0.25
Iodized salt	0.25	0.25	0.25	0.25
Premix*	0.25	0.25	0.25	0.25
<b>Chemical composition</b>				
Crude protein	19.37	19.36	19.35	19.33
Crude fibre	5.57	5.56	5.56	5.55
Ether extract	3.91	3.9	3.9	3.89
Ash	3.21	3.18	3.18	3.17
ME(Kcal/kg)	2711.37	2708.28	2708.29	2708.2

\*Vitamin-mineral premix provide per kg of diet vit. A. 13,340iu; vit. D3. 2680.i.u; vit. E. 10.i.u; vit. K, 2.68 mg; Calcium pantothenate, 10.68mg; vit. B12, 0.022mg; folic acid, 0.668mg; choline chloride, 400mg; chlorotetracycline, 26.68mg; manganese, 133.34mg; iron, 66.68mg; zinc, 53.34mg ; copper, 3.2mg, iodine, 1.86mg; cobalt, 0.268mg, selenium, 0.108mg.

**Table 2:** Performance of weaned rabbits fed ginger and garlic supplemented diets

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM
Initial body weight (g)	611.32	609.94	610.92	611.4	
Final body weight (g)	1498.24 <sup>c</sup>	1632.86 <sup>b</sup>	1660.03 <sup>b</sup>	1712.20 <sup>a</sup>	5.28
Body weight gain (g)	886.92 <sup>b</sup>	1022.92 <sup>a</sup>	1049.11 <sup>a</sup>	1100.80 <sup>a</sup>	5.29
Daily body weight gain (g)	12.67 <sup>b</sup>	14.61 <sup>a</sup>	14.99 <sup>a</sup>	15.73 <sup>a</sup>	0.63
Total feed intake (g)	4867.15 <sup>b</sup>	4867.80 <sup>a</sup>	4895.10 <sup>a</sup>	4958.12 <sup>a</sup>	8.57
Daily feed intake (g)	63.53 <sup>b</sup>	69.54 <sup>a</sup>	69.93 <sup>a</sup>	70.83 <sup>a</sup>	1.02
Feed conversion ratio	5.01 <sup>c</sup>	4.76 <sup>b</sup>	4.67 <sup>b</sup>	4.57 <sup>a</sup>	0.26

<sup>a,b,c</sup> Different letters indicate significant differences (a < b < c, P < 0.05).

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**Table 3:** serum metabolites of rabbits fed ginger and garlic supplemented diets.

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	SEM
Total protein (g/L)	6.32	6.88	6.8	6.71	0.34
Albumin (g/L)	4.2	4.24	4.18	4.28	0.23
Urea (g/L)	5.42 <sup>c</sup>	6.45 <sup>a</sup>	6.38 <sup>a</sup>	5.99 <sup>b</sup>	0.38
Creatinine (mg/dl)	1.28 <sup>b</sup>	1.60 <sup>a</sup>	1.65 <sup>a</sup>	1.60 <sup>a</sup>	0.19
Cholesterol (g/l)	0.75 <sup>b</sup>	0.61 <sup>a</sup>	0.63 <sup>a</sup>	0.59 <sup>a</sup>	0.2

Different letters indicate significant differences (a < b < c, P < 0.05).

The results of serum biochemistry of weaned rabbits fed the experimental diets are shown in Table 3. There was no significant (P > 0.05) difference in the serum total protein and albumen concentration of the rabbits among the treatment groups.

Dietary supplementation of ginger and garlic significantly (P<0.001) increased the concentration of serum urea and creatinine of the rabbits compared to the control. However, ginger and garlic supplementation significantly (P<0.001) reduced the concentration of serum cholesterol of the rabbits.

The general increase in PCV, RBC, WBC, and Hb of rabbits fed ginger and garlic supplemented diets indicates that ginger and garlic may contain blood forming factors that may have stimulated more blood production by the rabbits fed supplemented diets than those fed unsupplemented diets. This also suggests that these herbs may have helped in boosting the immune system of the rabbits. The serum total protein concentration of 6.38 – 6.88g/dl recorded in this study is within the normal standard value of 5.0- 8.0g/dl reported by CCAC (1980). This implies that ginger and garlic did not impair the synthesis and concentration of serum protein and albumin.

Elevated blood cholesterol levels has been reported by Omage *et al.* (2002) as the most important risk factor in heart disease alongside elevated blood pressure and some other factors. According to the authors any medication, nutrient or procedure that reduces the level of the risk factors is of benefit in the prevention of heart disease. The hypocholesterolemic effect of ginger could have possibly resulted from the inhibition of cellular cholesterol biosynthesis. The reduction in serum cholesterol suggests that these herbs could be used to lower some of the risk factors associated with the development of cardiovascular diseases and cancer whether in animals or human beings (Ademola *et al.*, 2009). It has been reported that lowering blood levels, of cholesterol may help to prevent heart disease, angina, stokes and heart attacks (Anonymous, 2008). The results are in agreement with the reports of O'Brien and Reiser (1979) and Fuhrman *et al.* (2000) who reported that Plant foods possess cholesterol-suppressive capacity. The hypocholesterolemic effects of ginger and garlic observed in this study coupled with observations that rabbit meat is generally low in fat, cholesterol and sodium makes rabbit meat a dependable source of animal protein for man.

This study has demonstrated that feeding ginger and garlic supplemented diets are effective in improving the performance and haematological characteristics of weaner rabbits. However a combination garlic and ginger through their synergistic effect may be a promising additive that could be used in commercial rabbit production.

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