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EFFECTS OF SUPPLEMENTATION OF DIFFERENT LEVELS OF GARLIC (*Allium sativum*) ON SELECTED BLOOD PROFILE AND IMMUNITY OF WHITE LEGHORN CHICKEN

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Abstract. The study was conducted to evaluate the effect of feeding different levels of garlic powder inclusion on selected blood profile and immunity of white leghorn chicken. A total of 180 chickens (156 layers and 24 cocks) were randomly distributed in to 12 pens and assigned to 4 treatments. Treatments were rations containing 0, 1, 2, and 3% garlic powder for T1, T2, T3 and T4, respectively. The CP and ME content of treatment rations were 16-16.6% and 3021.31-3244.4 kcal/kg DM, respectively. Blood profile parameters were determined using established laboratory methods. The value of hemoglobin (Hb) increased insignificantly due to supplementation of different levels of garlic powder. Total white blood cell count (TWBC), basophile, lymphocytes, heterophils and monocytes were not affected ($P > 0.05$) by treatments. But, slight rise in lymphocyte and heterophil counts were observed in garlic supplemented groups which may be due to immuno-stimulatory effects of garlic. Packed cell volume (PCV) and eosinophils were affected ($P < 0.05$) by treatments, PCV (38.1, 45,2,41.5 and 39. 2), eosinophils (4.9, 3.2, 3 and 2.8), for T1, T2, T3, and T4, respectively. Mean values of total protein (g/dl) was not affected ($P > 0.05$) by treatment. The mean values of total immunoglobulin (gm/dl) (3.53, 4.09, 5.58, 3.04) was significantly ($P<0.05$) higher in T_3 compared to other treatments. Generally, inclusion of 2% garlic powder has significantly improved total immunoglobulin. But it significantly lowered eosinophils compared to control group. The present study revealed that mixing layer diets with 1-3% garlic powder could be used in practical layer diets to improve some haematological and immunoglobulin values which might consequently improve blood circulation and immunity of White Leghorns Chickens.

Keywords: garlic powder, layers, haematological parameters, immunoglobulins

Introduction

Antimicrobial compounds produced by microorganisms have been used in animal rations as growth promoters for many years (*Church, 1998*). Antibiotics affect birds' gut microflora and they have been used widely to prevent poultry diseases for the improvement of egg and meat production (*Botsoglou, 2002*). However, the use of antibiotics in animal feeds has been linked to antibiotic-resistant bacteria (*Glynn, 1998*). Consequently, many countries have banned the use of sub therapeutic levels of antibiotics in production of animal rations. To prevent a potential economic hardship and alleviate problems associated with antibiotic resistance photogenic feed additives have been developed as alternatives to antibiotics. As a consequence varieties of substances are used in conjunction with, or as alternatives to, antibiotics in poultry diets. Probiotics, prebiotics, organic acids, and plant extracts have all shown promising results for use in organic poultry production (*Griggs, 2005*).

Garlic (*Allium sativum*) is one of the most recognized plant species used for organic poultry production. Garlic is a bulbous perennial herb, closely related to the onion. It has anti-bacterial, anti-viral, anti-fungal, and anti-parasitic properties (*Puvaca et a., 2014*) and has been used traditionally for ages to treat a wide array of diseases, namely, respiratory infections, ulcers, and diarrhea and skin infections (*Fenwick and Hanley, 1985*). *Reuter et al. (1996)* also reported garlic as a plant possessing antibiotic, anticancer, antioxidant, immune modulator, anti-inflammatory, hypoglycemic and cardiovascular- protecting effects. Garlic (*Allium sativum*) gained the trust of many scientists and cultural remedies all over the world for the prevention and treatment of many diseases and is broadly dispersed and consumed as a spice and herbal medicine for thousands of years.

According to reports of *Sonaiya and Swan (2004),* traditional treatment and control of poultry disease is important for Ethiopia as most developing countries. These countries cannot afford to import veterinary medicine and vaccination for chickens. In Ethiopia, farmers were trying to treat their birds traditionally. A survey conducted by *Mengesha et al. (2011)* on the use of garlic as traditional treatment for birds indicated that 48.5% of the respondents were feeding garlic-onion and alcohol with soften injera to sick birds.

The major phytogenic compound obtained from garlic is allicin. This compound is derived from naturally occurring amino acid allin which is transformed into allicin (dially-thiosulphanate) by the enzyme allinase. This enzyme is inactivated by heat, oxygen and water *(Mantis et al., 1978)* leading to

reduction in both odour and medicinal properties of garlic. In pursuit of improved broilers health and in order to fulfill consumer expectation in relation to food quality, poultry producers commonly apply natural feeding supplements, mainly herbs (*Gardzielewska et al., 2003*). Garlic extract and/or garlic components were able to prevent chemically induced tumors or acute toxic effects of chemicals due to its attribute of containing several bioactive organosulfur compounds. Recent research works on herbal formulations as feed additive have shown encouraging results with regards to weight gain, feed efficiency, lowered mortality and increased liveability in poultry birds (*Kumar, 1991; Babu et al., 1992; Mishra and Singh, 2000; Deepak et al., 2002; Jahan et al., 2008; Puvača et al., 2014*). Furthermore, garlic has been found to have antimicrobial effect (*Shalaby et al., 2006; Durak et al., 2002*; *Weber et al., 1992),* and anti-cancer *(Durak et al., 2002)* activities, and lower cholesterol levels (*Jimoh et al., 2012*).

In general, today many pharmacological properties are attributed to garlic. Garlic has been shown to improve cardiovascular health through improving blood circulation (*Ernst, 1987*), minimizing atherosclerosis (*Yamasaki et al., 1994; Brodia, 1981*), inhibition of blood coagulation because of its effect on platelet aggregation and platelet growth (*Rahman, 2007; Srivastava and Tyagi, 1993; Harenbery et al., 1988; Apitz-Castro et al., 1983*), significantly reducing the level of serum cholesterol and triglyceride (*Streiner et al., 1996; Berthold et al., 1998; Yeh and Liu, 2001; Yamasaki et al., 1994*) and stimulates phagocytotic function of macrophage and lymphocyte proliferation (*Tidy et al., 1990*). However, its impact on blood profile and immunity is poorly investigated and there is dearth of scientific information available. Therefore, this paper seeks to evaluate the effect of different levels of inclusion of garlic (*Allium sativum*) on selected haematological and biochemical parameters of blood of White Leghorn layers.

Materials and Methods

The experiment was conducted at Haramaya University Poultry Farm located 505 km east of Addis Ababa, at an altitude of 1980 m.a.s.l, 9°26ˈN latitude and 42º3ˈE longitude. The mean annual rainfall is 780 mm. The mean annual minimum and maximum temperatures are 8ºC and 24, respectively (*AUA, 1998).*

The feed ingredients used in the formulation of the different experimental rations of this study were maize grain, noug seed cake, soybean meal, wheat short, limestone, salt (NaCl) and vitamin premix (Table 1). The newly harvested or fresh garlic bulbs were purchased from local market. The age of the bulbs, when supplemented was less than 4 months after harvesting. Peeled fresh garlic bulbs (cloves) were grinded and subsequently the garlic paste was thinly spread on a mat and air dried. The drying process which took 5 days on average continued until the garlic paste gets dried to the level it can be mixed thoroughly with the ration. The

prepared garlic powder was mixed with the diet of laying hens based on the specified levels. The diet has been stored at room temperature until it is fed according to the specified levels for layer hens. The layer treatment ration was formulated on an isocaloric and isonitrogenous basis to meet the nutrient requirements of 2800-2900 Kcal ME/Kg DM and 16-17 % CP *(NRC, 1994)*, respectively and water was always available to the animal.

Table 1. Proportion of ingredients used in formulating the experimental diet

Ingredients	%
Maize	42.7
Wheat short	18
Noug seed cake	23
Soybean meal	8
Limestone	7
Salt (NaCl)	0.5
Vitamin premix	0.8
Total	**100**

The experiment was conducted in a completely randomized design (CRD), with 4 treatments each with 3 replications. A total of 156 White Leghorn pullets and 24 cockerels at 8 months of age were obtained from Haramaya University Poultry Farm. They were randomly distributed to each replication making up 13 White Leghorn layers per pen and 2 cockerels per replicate and a total of 45 birds per treatment. The garlic-free diet was used as the control diet. The treatment ration was formulated as indicated in Table 2.

Table 2. Layout of the experiment

Treatment	No of replication	No of birds / replication	No of birds / treatment
T1- Ration containing 0% garlic	3	15	45
T2- Ration containing 1% garlic	3	15	45
T3-Ration containing 2% garlic	3	15	45
T4-Ration containing 3% garlic	3	15	45
Total			**180**

Birds were adapted to experimental diets for 7 days before the actual data collection started. The experimental houses have wire-mesh partitioned pens with teff straw litter material of approximately 10 cm depth. Before the placement of the birds into the experimental house the experimental pens, watering and feeding troughs, and laying nests were thoroughly cleaned, disinfected and sprayed against external parasites. The feed was offered in a group per pen or replication twice a day at 08.00 and 17.00 hours throughout the experimental period. Feed were offered in hanging tubular feeders, which were suspended approximately at a

height of the backs of the birds and water was provided in a plastic fountains placed on a flat wood at the center of the pen. The feeding and watering troughs were cleaned every morning before the daily meal was offered. Water was available all the time and the experiment lasted for 90 day (three months). Vitamins were given to the birds, turning the litter and changing of extremely wet litter with clean and dry was carried out whenever required.

The chemical analysis was carried out at Haramaya University nutrition laboratory. Chemical analysis of the feed was made in duplicate. When the mean result of duplicates was not similar, the mean value of the two duplicates was taken, provided that the percentage error was not greater than 5%. For chemical analysis of the feed ingredients representative samples were taken from each of the feed ingredients used in formulation of the experimental diet, and chemical analysis was done before formulation of the treatment diets. The samples were subjected to proximate (Weende) method of *A.O.A.C (1990)* to determine dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and total ash content. Nitrogen was determined by using Kjeldhal procedure and CP was computed by multiplying the N content by 6.25. The metabolisable energy (ME) value was determined indirectly based on previously published method *(Wiseman 1987).*

$$ME\ (Kcal/\ kg\ DM) = 3951 + 54.4EE - 88.7CF - 40.8Ash$$

The calcium, phosphorus and other mineral contents analysis were determined by atomic absorption spectrophotometer and UV (ultra violet).

For the determination of hematological parameters, blood was collected via the jugular vein-puncture using sterile syringes and needles (25G). Accordingly, four birds were randomly selected from each replications and 2 ml blood was collected. Then the blood was transferred immediately into a set of sterile tubes containing anticoagulant, disodium-salt of ethylene diamine tetraacetic acid (EDTA). The values for the hemoglobin (HB) were obtained using the whole blood. The percentage Packed Cell Volume (PCV) was determined by centrifugation of capillary tubes for 5 minute at 1200 rpm and the hemoglobin content was determined by Actin hematin method. Total white blood cell count was conducted by using haemocytometer by the method described by *Campbell (1980),* and differential white blood cell count was determined on blood smear prepared by Wright's stain. The hematological parameters were determined by the methods described by *Davice and Lewis (1991).*

For serum biochemistry analysis four birds were randomly selected from each replications and three ml of blood samples in the set of bottles containing no anti-coagulant was kept in the refrigerator at about 4°C for about 3 hours to aid sedimentation. The samples were later spun in a centrifuge at 3,000 rpm for 10 minutes and the serum was separated, stored and frozen at -20°C for analysis. Refractometer was used to assess the total serum protein. Zinc sulfate turbidity test was used to estimate total immunoglobulin concentration from serum (*Mcevan et al., 1969).* Zinc sulfate solution was prepared by adding 250 mg of zinc sulfate in 1 liter of distilled water. Then 0.1 ml serum sample was added to 6 ml of zinc sulfate solution to make the test solution. To prepare the control, 6 ml of distilled water was added to the serum instead of zinc sulfate solution. Both test and control mixtures were shaken and kept at room temperature for 60 minute. The optical density (OD) of the test and the control solutions were recorded separately at 545 nm using spectrophotometer.

Total immunoglobulin (gm/d1), was calculated using the following formula

- Zinc sulfate turbidity (ZST) units = (optical density of test – optical density of control × 10)
- Total immunoglobulin (gm/d1) = 0 .04 + 0.98(ZST) units.

The data was subjected to statistical analysis using *Statistical Analysis Software (SAS) (2008)* version. Least significance difference (LSD) was used to locate the treatment means that were significantly different (*Gomez and Gomez, 1984*). The model used for statistical analysis was $\boldsymbol{Yij = \mu + Ti + eij}$, where: **Yij** = the response variable; $\boldsymbol{\mu}$ = over all mean; **Ti** = treatment effect and **eij** = random error

Results and Discussion

The chemical composition of feed ingredients used and the four compound rations are shown in Table 3 and Table 4, respectively. The garlic powder has good nutrient contents including minerals.

Table 3. Chemical composition of feed ingredients used to formulate experimental ration

Chemical composition	Feed Ingredients				
	MG	WS	SBM	NSC	GP
DM (%)	89.6	90.3	93.0	92.2	91.4
CP (DM %)	8.46	14.7	39.0	29.6	11.96
EE (DM %)	6.2	3.3	9.2	8.1	1.59
Ash (DM %)	5.9	5.53	5.75	9.1	3.169
CF (DM %)	2.8	9.9	5.7	18.3	0.9
Ca (DM %)	0.02	0.19	0.35	0.35	0.28
P (DM %)	0.09	0.78	0.83	0.32	0.698
Fe(ppm)	-	-	-	-	0.08
Mg(% DM)	-	-	-	-	0.66
K(% DM)	-	-	-	-	0.75
ME (Kcal/Kg)	3799.2	3030.7	3711.0	2401.8	3828.09

MG= Maize grain; WS= Wheat short; SBM =Soybean meal; GP = Garlic powder; NSC= Noug seed cake; DM=Dry matter; CP = Crude protein; EE = Ether extract; CF = Crude fiber; Ca = Calcium; Fe = Iron; Mg = Magnesium; K= Potassium; P= Phosphorus; ME = Metabolizable energy; Kcal= Kilo calorie and kg = Kilogram.

From the analysis result, it can be seen that soybean meal (SBM) and noug seed cake (NSC) are rich in crude protein (CP) content that make these ingredients to be a good source of protein supplement for poultry. The CP content of the NSC used in the current experiment is comparable to previous findings of *SDDP* (1997) and *Fantie and Solomon* (*2008*) which is 29.6% and 28.9% CP, respectively. Values for the CP and ME content of maize grain used in the current experiment were 8.46% and 3799.2 kcal/kg DM, respectively. The DM and CP content of wheat short used in this study were similar to *Meseret* (*2006*) which was 90.3% DM and 14.7% CP values.

Table 4. Chemical composition of experimental treatment diets containing different proportions of garlic powder

Chemical Components	Treatments			
	T_1	T_2	T_3	T_4
DM (%)	92.0	90.2	91.2	91.8
CP (% DM)	16.0	16.3	16.6	16.0
EE (% DM)	6.4	7.5	6.1	6.9
Ash (% DM)	13.4	12.0	13.4	13.1
CF (% DM)	7.0	7.0	8.0	8.0
P (% DM)	1.10	1.16	1.28	1.02
Ca (% DM)	2.81	3.15	2.86	3.38
ME kcal/kg	3127.15	3244.48	3021.31	3083.0

DM = Dry matter, CP = Crude protein, EE = Ether extract. CF = Crude fiber, Ca = Calcium, P= Phosphorus, ME = Metabolizable energy, kcal= Kilo calorie and kg = Kilogram, T1 = Ration containing no garlic powder, T2 =Ration containing 1% garlic powder, T3 =Ration containing 2% garlic powder, T4 =Ration containing 3% garlic powder.

The CP content of the treatment diets varied between 16.0% to 16.6% which was within the range of CP requirement (14-19%) as suggested by *Leeson and Summers* (*2001*) for layers. Similarly, *Tadelle (1997)* noted that the protein requirement of high producing laying hens should be between 16-18% of the diet to meet the needs of egg production, maintenance and growth of body tissues. The ME content of treatment diets were slightly decreased in T3 and T4 in comparison to T1 and T2 level of garlic powder and the results of the whole treatment s were slightly greater than the anticipated 2800 kcal/kg. The Ca content of treatment diets were within the range of 2.5-3.5 % DM needed for layers (*Eekeren et al., 2006*).

Hematological parameters of layers are presented in Table 5. In the present study, dietary supplementation of garlic powder in feed was found to cause insignificant increase ($P>0.05$) in the mean values of hemoglobin (Hb) as compared to control group. But, there has been report of significant rise in Hb concentration due to garlic supplementation in rats (*Iranloye, 2002)* which might be due to species variation. Garlic extract is an active oxygen scavenger. It is thus possible that garlic components compete with Hb in the RBC for oxygen resulting in hypoxia which then stimulates Hb synthesis and RBC production.

The one test offering more information than any other procedure about anemia and dehydration is packed cell volume. The normal PCV in avian species is 35% - 50%. The result from this study showed that PCV of T2 diet consumed hens was significantly higher ($P<0.01$) than that of layers fed T3, T4 and the control. In agreement with our results, the findings reported by *Oluwole* (*2001*) that the mean values of RBC and PCV in rats given 200 mg/day garlic for 30 days did not significantly differ from the control ($P > 0.05$), however, there were significant increase in RBC and PCV for animals given low dose (100 mg/day) of garlic for 30 days (*Iranloye, 2002*) observed a significant increase in RBC, PCV, WBC and total Hb concentration in garlic fed rats. The numerical increase observed in the Hb and PCV of birds fed garlic supplemented diets suggest that the diets were better utilized and assimilated into the blood stream for use by the birds. The normal PCV, Hb and other haematological values portray the nutritional status of the broiler chicken and thus indicating adequate nourishment of the birds (*Church et al., 1984*).

There was no significant difference in lymphocytes, basophils, monocytes and neutrophil in birds fed with garlic containing diet as compared to control birds. The mean values of eosinophils decreased ($P < 0.01$) with increasing levels of garlic powder (Table 3). The mean value of eosinophils was decreased in layer chicken fed garlic supplemented diets which suggests that garlic complemented the antiparasitic action of eosinophils. Garlic (*Allium sativum*) has antihelmintic action in vitro against *Heterakis gallinae* and *Ascaridia galli*, *Heamomonchus contortus*, a free- living nematode of *Rhabditis* sp (*Nagaich, 2000; Zafar-iqbal et al., 2001; Chybowski, 1997*). The present study also revealed slightly increased lymphocytes in the garlic fed groups in layer chickens. In agreement with the findings reported

by *Prasad et al.* (*2009*) slight rise in lymphocyte and heterophil count was observed in garlic supplemented groups, which may be due to immuno-stimulatory effects of garlic. *Yan et al*. (*2010*) noted that fermented garlic powder supplementation increased the lymphocyte count compared with the control group. *Chen et al*. (*2008*) suggested that dietary garlic powder (1 g/kg) increased the lymphocyte concentration in pig. *Tadi et al*. (*1990*) had suggested that garlic can stimulate the phagocytotic function of macrophage and lymphocyte proliferation. *Koy et al*. (*1998*) also concluded that allium could promote the lymphocyte synthesis, cytokine release, phagocytosis and natural killer cell activity. In the present study, dietary supplementation of garlic powder in layer chicken showed no significant (P>0.05) difference in the mean values of total leucocyte count (TLC) as compared to control diet. However, mean values of total leucocyte count (TLC) of T2 and T4 held numerically higher than T1, T3 and the control. In agreement with the present results of the experiment, garlic supplementation does not affect total and differential leucocyte counts in broiler chicks (*Jafari et al., 2008*). Conversely, *Ademola* (*2004*) reported increase in total white blood cells and heterophils by about 18.7% and 20.4%, respectively, in garlic powder treated birds as compared to control birds.

Table 5. Effect of different levels of garlic powder on hematological parameters of white leghorn chicken

Parameters	Treatments				SEM	SL
	T1	T2	T3	T4		
PCV (%)	38.1[b]	45.2[a]	41.5[b]	39.2[b]	0.938	*
Hemoglobin (%)	9.8	10.5	11.2	11.0	0.234	NS
WBC (In thousand/ml)	31.1	32.2	31.5	32.6	0.5	NS
Eosinophils	4.9 [a]	3.2[b]	3.0[b]	2.8[b]	0.269	***
Basophile	2.4	2.1	2.6	2.3	0.074	NS
Lymphocytes	73.3	76.3	76.5	75.8	0.719	NS
Monocytes	6.8	6.3	5.4	6.2	0.251	NS
Heterophils	12.3	12.3	12.4	12.9	0.405	NS

Means with in a row with different superscripts are significantly different; *=Significant at (P<0.05);***= Significant at (P< 0.001); PVC= Packed cell volume, WBC= White blood cell count, ml=Milliliter, T1 = Ration containing 0% garlic powder, T2 =Ration containing 1% garlic powder, T3 =Ration containing 2% garlic powder, T4 =Ration containing 3% garlic powder.

Serum biochemistry of layers is presented in Table 6. The mean values of total immunoglobulin (gm\dl) was significantly (P<0.05) higher in T_3 compared to other treatments. There was no significant (P>0.05) difference in the mean values of total protein (g\dl). But, the total plasma protein decreased with increasing level of dietary garlic (control, 1, 2, and 3%) and approached the normal protein level (4.5 g/dl). More garlic level (3%) administrated group has nearly normal plasma

protein concentration (6.16) compared with control group (9.37).The normal plasma protein concentration in birds is less than in mammal, and it generally ranges from 2.5 to 4.5 g/dl. Hyperproteinemia in most birds is indicated by plasma protein concentration of greater than 4.5 g/dl. Hyperproteinemia usually is the result of dehydration, acute or chronic inflammation, or preovulatory condition in hens. Dehydrated birds subjected to chronic stress or other immunosuppressive condition may demonstrate this type of plasma protein profile (*Mary et al., 2004*).

Table 6. Effect of different levels of garlic powder on serum biochemistry and yolk cholesterol of white leghorn chicken fed rations containing different levels of garlic powder

	Levels of garlic powder (%)					
Parameters	T1	T2	T3	T4	SEM	SL
Total Protein (g\dl)	9.37	9.33	7.35	6.16	0.683	NS
Total immunoglobulin (gm\dl)	3.53^{b}	4.09^{b}	5.58^{a}	3.04^{b}	0.343	*
Total yolk cholesterol (mg/dl)	18.5	19.0	17.1	19.8	0.482	NS

Means with in a row with different superscripts are significantly different; *=Significant at (P<0.05); T1 = Ration containing 0% garlic powder, T2 =Ration containing 1% garlic powder, T3 =Ration containing 2% garlic powder, T4 =Ration containing 3% garlic powder.

Conclusions

The present study revealed significantly increased hemoglobin (Hb) due to supplementation of different levels of garlic powder. These effects are may be due to the presence of some bioactive constituents and/or their metabolites in garlic. Total white blood cell count (TWBC), basophile, lymphocytes, heterophils and monocytes were not affected (P > 0.05) by treatment. But, slight rise in lymphocyte and heterophil counts were observed in garlic supplemented groups which may be due to immuno-stimulatory effects of garlic. Packed cell volume and eosinophils were affected (P < 0.05) by treatment, PCV (38.1, 45,2,41.5 and 39. 2 (SEM=.0938)), eosinophils (4.9, 3.2,3 and 2.8 (SEM=.269)), for T1, T2, T3, and T4, respectively. The mean values of eosinophils decreased in layer chicken fed garlic supplemented diets suggests that the antiparasitic action of garlic. The numerical increase observed in the Hb and PCV of birds fed garlic supplemented diets suggest that the diets were better utilized and assimilated into the blood stream for use by the birds.). Mean values of total protein (g/dl) (9.37, 9.33, 7.35 and 6.16 (SEM= 0.683)) was not affected (P > 0.05) by treatment, the mean values of total immunoglobulin (gm\dl) (3.53, 4.09, 5.58, 3.04, (SEM= .343)) was significantly (P<0.05) higher in T_3 compared to other treatments. Generally, the inclusion of 2% garlic powder has significantly improved total immunoglobulin. Additionally, 2% garlic inclusion has significantly lower eosinophils compared to control group. On the basis of the results of the present study, it was concluded that mixing layer diets with 1-3% garlic powder can be used in practical layer diets

improved some haematological value and total immunoglobulin which could contribute to improved blood circulation and immunity of White Leghorns Chickens.

Efekat dodavanja različitih nivoa luka (*Allium Sativum*) na određeni profil krvi i imunitet White Leghorn pilića

Tesfaheywet Zeryehun, Meseret Asrat, Negassi Amha, Mengistu Urge

Rezime

Studija je sprovedena kako bi se procenio efekat uključivanja različitih nivoa praška od belog luka u ishrani na izabrani profil krvi i imunitet pilića White Leghorn. Ukupno 180 pilića (156 nosilja i 24 petlića) su nasumično raspoređeni u 12 bokseva i u 4 tretmana. Tretmani su bili obroci koji sadrže 0, 1, 2 i 3% praška belog luka - T1, T2, T3 i T4, respektivno. Sadržaj SP i ME tretmana iznosio je 16-16,6% i 3021,31 -3244,4 kcal/kg SM, respektivno. Parametri profila krvi određeni su korišćenjem utvrđenih laboratorijskih metoda. Vrednost hemoglobina (Hb) se povećala neznatno kao rezultat dodavanja različitih nivoa praška belog luka. Ukupni broj bijelih krvnih zrnaca (TWBC), bazofila, limfocita, heterofilia i monocita nisu bili pod uticajem (P>0,05) tretmana. Međutim, mali porast broja limfocita i heterofila je primećen u grupama hranjenih dodatkom belog luka, što može biti posledica imuno-stimulativnih efekata belog luka. Kombinovani volumen ćelija (PCV) i eozinofili su bili pod uticajem (P<0,05) tretmana, PCV (38,1; 45,2; 41,5 i 39,2 (SEM = 0,038)), eozinofila (4,9; 3,2; 3 i 2,8 = .269)), za T1, T2, T3 i T4, respektivno. Srednje vrednosti ukupnog proteina (g/dl) (9,37; 9,33; 7,35 i 6,16 (SEM = 0.683)) nisu bile pod uticajem tretmana (P> 0.05). Srednje vrednosti ukupnog imunoglobulina (gm/dl) (3;53; 4,09; 5,58; 3,04, (SEM = .343) su značajno (P <0.05) veće u T3 u poređenju sa drugim tretmanima. Uglavnom, uključivanje 2% značajno je poboljšalo ukupan imunoglobulin, ali je značajno smanjio eozinofil u poređenju sa kontrolnom grupom. Ovo istraživanje je pokazalo da se dopunjavanje obroka za nosilje sa 1-3% belog luka u prahu može koristiti u obrocima za nosilje u praksi, kako bi se poboljšale hematoloških i imunoglobulinske vrednosti što bi moglo dovesti do poboljšanja cirkulacije krvi i imuniteta pilića White Leghorn.

Ključne reči: beli luk u prahu, nosilje, hematološki parametri, imunoglobulini

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