PERFORMANCE AND HAEMATOLOGICAL PARAMETERS OF LAYING HENS FED DIETS SUPPLEMENTED WITH SELENIUM AND VITAMIN E

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Abstract
An experiment was conducted to assess the effect of supplemental selenium and vitamin E on performance and blood profile of laying hens. In a completely randomised design, ISA brown hens (n=192) at week 20 of age were assigned to six experimental diets: T1 (Basal diet), T2 (Basal diet + 0.5 mg selenium), T3 (Basal diet + 1.0 mg selenium), T4 (Basal diet + 1.5 mg selenium), T5 (Basal diet + 20 mg vitamin E), T6 (Basal diet + 40 mg vitamin E*). Each treatment was replicated four times with eight birds per replicate. Data were recorded daily for performance characteristics.* At week 26, blood was sampled from hens and analysed using standard procedures. Supplemental selenium and vitamin E had no significant effect ($p>0.05$) on hens' *p*erformance. However, dietary supplemental selenium and vitamin E had significant influence on eosinophils and monocytes. Eosinophils of hens on T1 (4.25) was similar to 4.00, 3.50, 4.33 and 3.75 recorded for hens on T2, T3, T4 and T5, respectively but higher than 1.33 obtained for hens on T6. Similarly, monocyte value in T1 (2.0) was similar ($p>0.05$) to T2 (3.25) and T3 (3.25) but lower than 4.00, 3.75 and 4.00 obtained in hens on T4, T5 and T6, respectively. It was therefore concluded that supplementation of vitamin E and selenium up to 40 mg/kg and 1.5 mg/kg, respectively had no significant effects on hen's performance.

Keywords: Performance, Haematology, Selenium, Vitamin E, Stress.

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Introduction

Stress exerts negative effects on the body such as disturbance of acid-base balance of the blood, various changes in metabolism and oxidative damage to the cells (Ertas and Sahik 2002). This often has resultant effect on egg production and quality, feed consumption, live weight and overall productivity in chickens.

When formulating feed for animals, nutritionists take into account several factors including stress management and immunity enhancement as very critical (Linge, 2005). The use of antioxidant nutrients in this respect cannot be overemphasized. Antioxidants are substances that can scavenge, suppress or reduce the formation of reactive oxygen species (Khan *et al*., 2011; Lu *et al*., 2010) that are constantly produced *in vivo* in the course of the physiological metabolism in tissues (Surai, 2015). Reactive oxygen species are detrimental to productive performance in laying birds (Assar *et al*., 2016). Antioxidants nutrients such as vitamin E and selenium *have been implicated in immune functions of domestic animals (Finch and Turner, 1996) and* with important roles in maintaining chicken health, productive and reproductive performance (Surai, 2002). However, there have been conflicting reports (Scheideler, 2010: Adebiyi *et al*., 2004) on the benefits of Selenium and vitamin E in poultry. *Therefore, t*he objective of this study was to evaluate the effect of dietary selenium and α-tocopherol supplementation on performance and haematological status of laying hens.

Materials and methods

Experimental Site and Animal Allotment

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, University of Ibadan, Ibadan, Nigeria. *A total of 192, ISA brown hens at the point of lay (20 weeks of age) were assigned to six experimental diets in an experiment that lasted twenty weeks. The experiment was a completely randomized design with each treatment replicated four times and with eight birds per replicate.*

Experimental Diets

Basal diet was supplemented with selenium and vitamin E as follows: T1=Basal diet, T2=Basal diet + 0.5mg selenium/kg, T3= Basal diet + 1.0mg selenium/kg, T4= Basal diet + 1.5mg selenium/kg, T5=Basal diet + 20mg vitamin E/kg, T6=Basal diet + 40mg vitamin E/kg*)* Feed and water were supplied *ad libitum*. (Jemiseye and Ogunwole 2019).

Data collection and analysis

During the period of the trial, pen temperature-humidity index was monitored three times daily, between the hours of 7:00-8:00, 12:00-13:00 and 17:00-18:00 using digital thermo-hygrotherms placed strategically at different locations within the pen house. Temperature Humidity Index (THI) was calculated from the average ambient temperature and relative humidity obtained using the formula: THI = 0.6 T_{db} + 0.4 T_{wb}, where, T_{db} = dry bulb temperature and T_{wb} = wet bulb temperature.
Eggs were collected daily and recorded, hen day egg production was calculated by number of eggs laid divided by number of chicken at the period of data collection, feed intake was calculated by subtracting left over from feed offered to the chickens, egg were weighed with sensitive scale to obtain egg weight and egg mass was calculated from the percent hen day egg production and average egg weight. At week 26 of laying, blood was collected from two birds per replicate via the jugular vein into heparinized test tubes for haematology. Packed cell volume (PCV), haemoglobin (Hb), red blood cells (RBC), white blood cells (WBC) and differential counts were determined using standard procedures (Schalm *et al.*, 1975).

Statistical analysis

Data were subjected to analysis of variance using the SAS (1999) package. Means were separated using Duncan's multiple range test of the same package.

Results and Discussion

Temperature-humidity index of the experimental pen: Temperature-Humidity index of the experimental pen is shown in Figure 1. The maximum and minimum values were 30.40 and 25.10, respectively. The reported temperature and relative humidity were higher than thermoneutral temperature range (18-22 ^{o}C) of laying chicken reported by Charles (2002). Pen house temperatures beyond thermoneutrality have been reported to aggravate stress in chickens (Adedeji and Ogunwole, 2018) as higher ambient temperature and relative humidity have direct implications on feed consumption.

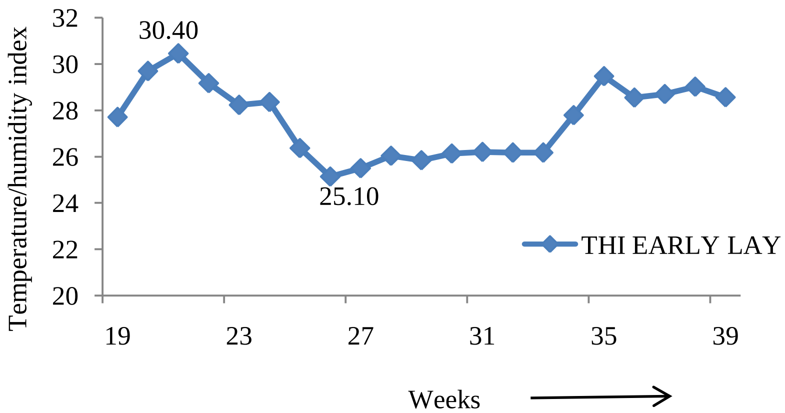

Figure 1: Temperature-humidity index of the experimental pen

Performance of laying chickens: Performance of laying chicken fed diet supplemented with selenium and vitamin E is shown in Table 1. **S**upplementation of layers' diet with selenium and vitamin E at the early laying phase did not have any significant effects (p>0.05) on the performance parameters measured. This observation corroborated earlier findings of Adebiyi *et al.* (2014) that neither vitamin E nor selenium and their combination increased hen day percentage and weight in turkeys. Also, Scheideler (2010) reported that there were no overall effect of vitamin E on egg production. Although, high temperatures have been reported to reduce production performance in laying hens (Deng *et al.*, 2012), this was not so as observed in this study. This may further emphasise the alleviating effect of antioxidants (Se and vitamin E) in stress management *(*Khan *et al*., 2011*)*.

Table 1. Performance of laying chicken fed diet supplemented with selenium and vitamin E

Parameters	T1	T2	T3	T4	T5	T6	SEM
Hen day egg production (%)	40.80	36.98	43.88	35.60	46.34	42.99	1.79
Feed intake (g)	90.46	96.88	92.63	94.04	94.38	98.67	1.38
Egg weight (g)	53.28	57.77	51.95	50.93	53.69	58.72	1.56
Egg mass (g)	21.79	21.46	22.88	17.90	24.94	25.63	1.25

T1-Basal diet, T2-Basal diet+0.5mg selenium/kg, T3-Basal diet+1.0mg selenium/kg, T4-Basal diet+1.5mg selenium/kg, T5-Basal diet+20mg vitamin E/kg, T6-Basal diet+40mg vitamin E/kg. Means in the same row with different superscripts are significantly different (P<0.05). SEM-standard error of mean

Haematological parameters of laying chickens fed levels of dietary selenium and vitamin E supplementation. Table 2 shows the haematological parameters of laying chickens fed levels of dietary selenium and vitamin E supplementation. There were no significant differences (p> 0.05) across treatments for all haematological parameters measured except for monocytes and eosinophils. Eosinophils of hens on T1 (4.25) was similar to 4.00, 3.50, 4.33 and 3.75 recorded for hens on T2, T3, T4 and T5, respectively but higher than 1.33 obtained for hens on T6. Similarly, monocyte value in T1 (2.0) was similar (p>0.05) to T2 (3.25) and T3 (3.25) but lower than 4.00, 3.75 and 4.00 obtained in hens on T4, T5 and T6, respectively. Blood is significant in measuring the physiological, nutritional and pathological status of animals (Olorode *et al*., 2007). Elevated monocyte and eosinophil levels observed in this study was an indication that inclusion of the supplements improved the responsiveness of the immune cells to invading germs. This observation supports earlier position of *Finch and Turner (1996)* on the relevance of Se and vitamin E in immune function. Bush (1991) had earlier pointed out that low levels of WBC especially eosinophil and basophil in chickens could lead to poor immunity against diseases and may be an indication of poor health conditions due to parasitic disturbances. A slight deviation from this was observed in T6 for eosinophils. This however could imply that supplemental vitamin E beyond 20mg/kg of diet may lower eosinophil count in chicken.

Table 2: Haematological parameters of laying chickens fed levels of dietary selenium and vitamin E supplementation

Parameters	T1	T2	T3	T4	T5	T6	SEM
PCV (%)	28.50	28.75	30.75	30.66	31.25	29.33	0.73
RBC ($x100^{6}$ IU/L)	2.91	3.09	3.30	2.87	2.87	3.37	0.10
Hb (g/100mL)	9.30	9.45	10.22	10.03	10.40	9.03	0.28
PLAT ($x100^{5}$)	1.62	1.72	2.41	2.31	2.28	2.06	1.34
WBC ($\times10^{10}$IU)	1.77	1.81	1.98	1.89	1.98	1.85	3.37
LYMP (%)	64.00	64.25	58.50	65.66	63.25	57.00	1.47
HET (%)	29.75	30.25	35.75	25.33	31.50	35.66	1.56
HET:LYMP	0.48	0.48	0.63	0.40	0.50	0.63	0.03
MON (%)	2.00^{b}	3.25^{ab}	3.25^{ab}	4.00^{a}	3.75^{a}	4.00^{a}	0.22
EOS (%)	4.25^{a}	4.00^{a}	3.50^{a}	4.33^{a}	3.75^{a}	1.33^{b}	0.32

T1-Basal diet, T2-Basal diet+0.5mg selenium/kg, T3-Basal diet+1.0mg selenium/kg, T4-Basal diet+1.5mg selenium/kg, T5-Basal diet+20mg vitamin E/kg, T6-Basal diet+40mg vitamin E/kg. PCV-Packed cell volume, RBC_ Red blood cell, WBC_ white blood cell, Hb- Haemoglobin, LYMP-Lymphocytes, HET-Heterophyl, PLAT-platelets, MON- Monocytes, EOS-Eosinophils. [ab]Means in the same row with different superscript are significantly different (P<0.05).

Conclusion

Supplemental selenium and vitamin E in the diets of laying hens had no effects on performance and haematological parameters except for monocytes and eosinophils.

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