A Study on the Haematology of Layers Fed Diets Fortified with Vitamin C

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ABSTRACT:

The effect of graded levels of vitamin C on haematological parameters of layers was studied. 80 layers at 28 weeks old were allotted to 4 treatments namely; T1, T2, T3 and T4 with vitamin C supplementation at 0, 100, 150 and 200 mg per kg feed respectively. Blood samples were collected at the 4th and 8th weeks of the study. The packed cell volume (PCV) varied significantly (P<0.05) with the highest value in T2 (39.38%) and the lowest in T1 (34.38%). The haemoglobin concentration also varied significantly (P<0.05) with the highest value in T4 (16.63 g/dl) and the lowest in control (11.82 g/dl). The white blood cell count was highest in T1 (11.03 × 10^3/ml), MCH and Platelets were highest (P<0.05) in T4 (42.85 ρg) and T3 (270.25 × 10^3/µl) respectively. The red blood cell, lymphocyte and mean corpuscular volume showed no significant differences (P>0.05). Vitamin C enhanced the haematological performance of the layers.

Keywords: Vitamin C, Haematology, Layers, Feed Supplementation

INTRODUCTION

Vitamins serve crucial functions in almost all bodily processes (immune, hormonal and nervous systems) and must be obtained from feed or supplement as animals' bodies are unable to make vitamins. There are thirteen vitamins classified as either water soluble (C and B complex) or fat soluble (A, D, E and K) (Brain, 1977).

Water soluble vitamins (C and B) are relatively poorly stored in the body (except vitamin B12). They are stored for only a brief period of time and are then excreted by the kidneys. Therefore these vitamins are highly required as constituents of the feed (Guyton and Hall, 2006).

Rao et al. (2004) reported that vitamin C through its oxidant properties maintains the stability of leukocyte membranes and that it is also essential for the optimum functioning of neutrophils, granulocytes and thereby, enhances the phagocytic activity of the neutrophils. They further explained that vitamin C protects birds under heat stress by reducing synthesis of glucocorticoid.

McDowell and Ward (2009) explained that vitamin nutrition should no longer be considered important only for preventing deficiency signs but also for optimising animal health, productivity and product quality.
It has been documented that domestic animals such as poultry have the ability to biosynthesize ascorbic acid (vitamin C) within their body (Surai et al., 2000). However, this synthesis is not enough to handle the extra stress encountered by the birds especially the commercial ones. Thus, there is need for vitamin C supplementation in the feed especially for commercial layers with high production of eggs (Roussan et al., 2008).

Earlier in research, Marks (1975) had proposed vitamin C requirements for poultry to be 50 to 60 mg/kg. McDowell and Ward (2009) recommended 100 mg per kilogram of feed for optimal poultry performance. This suggests that vitamin requirements determined decades ago may not apply to today’s poultry feeds as earlier postulated by Dudley-Cash (1994).

The objective of this study was to determine the effect of graded levels of vitamin C on haematological profiles of layers.

MATERIALS AND METHODS

A total of 80 layers at 28 weeks old were obtained for this study. The birds were fed a commercial layer’s mash; both feed and water were given ad libitum. The birds were randomly allotted to four treatments namely; T1, T2, T3 and T4 with vitamin C supplementation at 0 (control), 100, 150 and 200 mg/kg feed respectively. The study lasted for 8 weeks.

Blood samples were collected via the wing vein at the 4th and 8th weeks of the study. The blood samples were analysed using an automatic haematological analyser machine and the haematological parameters determined were red blood cells (RBC), white blood cells (WBC), haemoglobin concentration (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and platelets concentration.

Data collected were subjected to one way analysis of variance procedure of SAS (2008) and significant differences among treatment means were compared using Least Significant Difference (LSD).

RESULTS AND DISCUSSION

Results of haematological profile of experimental birds are as shown in Table 1. The packed cell volume (PCV) varied significantly among treatments. T2 (100mg of vitamin C) was significantly higher in PCV (P<0.05) than the control (T1) and the other treatment groups. PCV for T2 was 39.58%. The PCV range for this study was from 34.38% (control) to 39.58% (T2). T3, T4 and control were not significantly different (P>0.05). This corroborates the findings of McDowell and Ward (2009) who recommended 100 mg vitamin C for optimal poultry performance. This indicated that supplementing the layers’ feed with 100 mg vitamin C gave the highest PCV.

Haemoglobin concentration (g/dl) also varied significantly (P<0.05) and was higher in T4 (16.63 g/dl) than others. T1, T2 and T3 were not significantly different (P>0.05). The range was from 11.82 (control) to 16.63 g/dl.

The white blood cell count (×10³/µl) was significantly different (P<0.05) and was higher in T2, T3 and T1 (control) than T4. There were no significant differences (P>0.05) among T1, T2 and T3. Increased white blood
cell is expected in early infection, the birds were normal throughout the period of the study hence normal range of white blood cell was observed. The range was from $5.02 \times 10^3/\mu l$ (T4) to $11.03 \times 10^3/\mu l$ (control). The RBC, lymphocyte, MCV, MCHC did not vary significantly ($P>0.05$) among treatments indicating that the inclusion of vitamin C had no effect on these parameters.

The (MCH) varied significantly ($P<0.05$) with the highest value in T4 ($42.85\,\mu g$) and the lowest in the control group ($19.75\,\mu g$). The range is thus 19.75 to 42.85μg. Treatment groups T1, T2 and T3 were not significantly different ($P<0.05$). This may be an indication of higher red blood cell formation with a corresponding rise in mean corpuscular haemoglobin in the higher vitamin C supplemented groups. This also indicated that there was no anaemia.

The platelet count differed significantly ($P<0.05$), the highest value was in T3 ($270.25\times 10^3/\mu l$) and the lowest in T4 ($144.38 \times 10^3/\mu l$). Treatment T4 was significantly lower ($P<0.05$) than T2 and T3. Treatments T2 and T3 were similar while control was similar to all other treatment groups. The result of the platelet count did not follow any particular trend.

CONCLUSION

In conclusion, vitamin C was found to be beneficial to the enhancement of the haematological performance of layers in this study.

CONFLICT OF INTERESTS:

The authors declare no conflict of interests whatsoever.

CONTRIBUTION OF AUTHORS:

ASA and SME designed the experiment. Most of the experiments were carried out by SA and OMO. The research for information was carried out by OVM. All authors read and approved of the final manuscript.

REFERENCES


### Table 1: Haematological Profiles of Layers Fed Graded Levels of Vitamin C

<table>
<thead>
<tr>
<th>Parameters</th>
<th>T1(0)</th>
<th>T2(100)</th>
<th>T3(150)</th>
<th>T4(200)</th>
<th>SEM</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed Cell Volume (%)</td>
<td>34.38b</td>
<td>39.58a</td>
<td>35.28b</td>
<td>34.62b</td>
<td>2.05</td>
<td>*</td>
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<tr>
<td>Haemoglobin (g/dl)</td>
<td>11.82b</td>
<td>12.73b</td>
<td>12.88b</td>
<td>16.63a</td>
<td>2.11</td>
<td>*</td>
</tr>
<tr>
<td>White Blood Cell (×10^3/ml)</td>
<td>11.03a</td>
<td>10.21a</td>
<td>10.11a</td>
<td>5.02b</td>
<td>1.40</td>
<td>*</td>
</tr>
<tr>
<td>Red Blood Cell (×10^6/ml)</td>
<td>9.39</td>
<td>8.54</td>
<td>12.28</td>
<td>12.35</td>
<td>1.98</td>
<td>NS</td>
</tr>
<tr>
<td>Lymphocyte (%)</td>
<td>41.25</td>
<td>44.00</td>
<td>42.25</td>
<td>50.00</td>
<td>6.08</td>
<td>NS</td>
</tr>
<tr>
<td>Mean Corpuscular Volume (fl)</td>
<td>92.25</td>
<td>90.75</td>
<td>91.00</td>
<td>79.68</td>
<td>10.50</td>
<td>NS</td>
</tr>
<tr>
<td>Mean Corpuscular Haemoglobin Concentration (%)</td>
<td>229.00</td>
<td>215.75</td>
<td>253.00</td>
<td>222.50</td>
<td>42.55</td>
<td>NS</td>
</tr>
<tr>
<td>Mean Corpuscular Haemoglobin (pg)</td>
<td>19.75b</td>
<td>27.00b</td>
<td>22.45b</td>
<td>42.85a</td>
<td>4.98</td>
<td>*</td>
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<tr>
<td>Platelet (×10^3/µl)</td>
<td>193.50ab</td>
<td>269.75a</td>
<td>270.25a</td>
<td>144.38b</td>
<td>52.88</td>
<td>*</td>
</tr>
</tbody>
</table>

* a, b = means with different superscript on the same row are significantly different
* * = p<0.05, NS = not significant, SEM = standard error of means, LOS = level of significance