

ISSN 1682-8356  
ansinet.org/ijps



INTERNATIONAL JOURNAL OF  
**POULTRY SCIENCE**

**ANSI***net*

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan  
Mob: +92 300 3008585, Fax: +92 41 8815544  
E-mail: editorijps@gmail.com

## Haematological Changes in Guinea Fowls (*Numida meleagris galeata*, Pallas) Following Haemorrhage

F.O. Olayemi

Department of Veterinary Physiology, Biochemistry and Pharmacology,  
University of Ibadan, Ibadan, Nigeria

**Abstract:** Haematological changes associated with haemorrhage were determined in the guinea fowl (*Numida meleagris galeata*, Pallas). The red blood cell, packed cell volume and mean corpuscular haemoglobin decreased significantly ( $p < 0.05$ ) at 4 h post- haemorrhage and returned to normalcy one week after hemorrhage. After 4 h of hemorrhage, the haemoglobin concentration also fell significantly ( $p < 0.05$ ). The fall persisted through the first week post-haemorrhage, it returned to normal value after 4 weeks of haemorrhage. The mean corpuscular volume was not affected for the first week after haemorrhage, but it fell significantly ( $p < 0.05$ ) at the fourth week of haemorrhage. The mean corpuscular haemoglobin was not altered by hemorrhage. This study showed that guinea fowls withstood 30% loss of blood and the haematological values were fully restored by the fourth weeks after haemorrhage.

**Key words:** Haematology, guinea fowls, haemorrhage

### INTRODUCTION

There are numerous studies on the effects of hemorrhage on the haematological values and the response of various domestic animals to blood loss. The changes observed after hemorrhage have been reported for rat (Davis *et al.*, 1954), rabbit (Critz and Merrick, 1959), dog (Jain, 1986), horse (Torten and Schalm, 1964), cow (Schnappauf *et al.*, 1967), monkey (Krise and Wald, 1959) and West African goat (Oyewale *et al.*, 1997a). However, there have been little studies on the haematological responses of birds to haemorrhage. These include the study of Palmer *et al.* (1979) on the haematological changes after haemorrhage in wild pigeons, the haematological response of the Japanese quail to haemorrhagic stress which was studied by Gildersleeve *et al.* (1985) and the description of the effect of hemorrhage on the haematology of the Nigerian domestic fowl (Oyewale *et al.*, 1997b).

A lot of attention is currently being focused on the guinea fowl (*Numida meleagris galeata*, Pallas) and there are on-going attempts to domesticate them. There are some reports on the haematology of these birds that are ubiquitous in the northern part Nigeria (Oyewale, 1988; Durotoye and Oyewale, 1988; Oyewale, 1990; Oyewale, 1991). There has not been any report on the haematological responses of these birds to haemorrhage. This study has assumed great importance due to the fact that these birds are constantly being transported from the northern to the southern part of Nigeria, where the greater numbers of consumers of these birds reside. And in the course of transportation many of these birds suffer varying degrees of injury and with the consequent blood loss. The knowledge of the response of these birds to hemorrhage is therefore very

important, and that is why the haematological response of guinea fowls to hemorrhage is therefore presented in this manuscript.

### MATERIALS AND METHODS

Eight adult guinea fowls with average body weight ( $\pm$  SD) of  $1.22 \pm 0.13$  kg were bought from a local market at Ibadan, Nigeria and then transferred to the Animal House of the Department of Veterinary Physiology, Biochemistry and Pharmacology, University of Ibadan, Ibadan, Nigeria. They were fed commercially prepared grower's mash (14.5% protein, 4.8% fat, 7.2% fiber, 0.8% calcium, produced by Bendel feeds and flour mill Ltd., Benin, Edo State, Nigeria). Water was supplied *ad libitum*. They were treated against nematodes with piperazine hydrochloride (Wormazine®, Alfansan International BV 3440AB woerden, Holland) at 1 g/liter of water. The birds were acclimatized to the new environment for 21 days before the commencement of this study.

Thirty percent (30%) of the calculated blood volume (Bond and Gilbert, 1958) was removed through the jugular vein of each bird, this is with a view of inducing haemorrhage. The average ( $\pm$ SD) volume of blood removed from the jugular vein of the bird was  $29.78 \pm 2.32$  ml/kg. The first 2 ml blood sample served as the control or pre haemorrhage sample, while that obtained at the end of blood withdrawal served as the 0 h sample (2 ml). Two ml blood sample was also collected 1 h, 4 h, 1 wk and 4 wk post-haemorrhage. All samples were collected into bottles containing ethylene diamine tetraacetic acid (EDTA) (2 mg/ml of blood). Red Blood Cells (RBC) were counted with haemocytometers. Packed Cell Volume (PCV) was determined using the

microhaematocrit method. Haemoglobin (Hb) concentration was measured by the cyanmethaemoglobin method. From the values obtained the haematimetric indicies (Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC)) were calculated (Jain, 1986).

The results were statistically evaluated using Student's t-test.

## RESULTS

**Red Blood Cells (RBC):** The RBC counts before haemorrhage was  $2.20 \pm 0.78 \times 10^{12}/L$ . The count was not significantly altered after bleeding ( $1.77 \pm 0.71 \times 10^{12}/L$ ). However, the value obtained 4 h post-haemorrhage ( $1.60 \pm 0.33 \times 10^{12}/L$ ) was significantly lower ( $p < 0.05$ ) than the pre-haemorrhage value. The RBC count of  $2.24 \pm 0.39 \times 10^{12}/L$  at one week was similar to pre-haemorrhage value, while RBC value at 4 weeks was significantly higher than pre-haemorrhage value.

**Packed Cell Volume (PCV):** The mean PCV ( $\pm$ SD) of the Guinea fowl before haemorrhage ( $45.50 \pm 9.02\%$ ) and at the end of bleeding ( $38.13 \pm 10.16\%$ ) did not differ significantly from pre-haemorrhage value. The value however decreased significantly ( $p < 0.05$ ) after 4h. The PCV values of  $39.75 \pm 2.87\%$  and  $43.06 \pm 4.10\%$  obtained after one and four weeks respectively were similar to the pre-haemorrhage value.

**Haemoglobin (Hb):** The Hb concentration of  $13.61 \pm 2.02$  g/dl obtained for the guinea fowl before bleeding was similar to the value of  $11.10 \pm 2.86$  g/dl obtained at the end of bleeding. The Hb concentration ( $5.40 \pm 0.82$  g/dl) decreased significantly ( $p < 0.05$ ) at the end of 4 h. The Hb value at 1 week remained significantly lower ( $p < 0.05$ ) than the pre-haemorrhage value. The Hb value of  $14.18 \pm 2.16$  g/dl was however similar to the pre-haemorrhage value.

**MCV, MCH and MCHC:** The MCH exhibited no significant change from the pre-haemorrhage value, at the end of blood withdrawal, 4 h, 1 week and 4 weeks after hemorrhage in the guinea fowl. The MCHC at the beginning and end of blood withdrawal were similar, however there was a significant fall ( $p < 0.05$ ) in the MCHC value at 4 h post- haemorrhage. The MCHC of

one and four week post-haemorrhage were similar to the pre-haemorrhage value. The MCV value at pre-haemorrhage was similar to was similar to 0 h, 4 h and 1 week post-haemorrhage. However, the MCV value at 4 weeks was significantly ( $p < 0.05$ ) lower than the pre-haemorrhage value.

## DISCUSSION

The haematological values earlier obtained for the adult guinea fowl by Oyewale (1991) were similar to the pre-haemorrhage values for the same species of bird in the present study. The present study revealed that the haematocrit value dropped significantly 4 h post-haemorrhage. Similar observations were observed 1.5 h post-haemorrhage in the pigeon (Palmer *et al.*, 1979) and the Nigerian domestic fowl (Oyewale *et al.*, 1997a,b). This fall in PCV may be due to haemodilution which was caused by decreased capillary blood pressure especially in the muscles (Djojsojito *et al.*, 1968). The drop in PCV, RBC and Hb values at 4 h post-hemorrhage may also have been due to rapid movement of intestinal fluid into the vascular system and from compensatory re-absorption of water by kidney to replace the fluid volume lost through hemorrhage (Sturkie, 1976).

Gildersleeve *et al.* (1985) reported that in the Japanese quails there was an initial shift post-hemorrhage towards greater numbers of more mature erythrocytes and fewer circulating reticulocytes. Reticulocytosis was however indicated 48-72 h post-hemorrhage. In the present study the reticulocyte were not count but the fact that the MCV was not altered shortly after haemorrhage is also an indication that there might also have been an initial shift towards greater numbers of more mature erythrocytes in the present study. Haematological values were also not taken 48-72 h post-hemorrhage in the present study; probably that was why there were no sharp increase in MCV (an indication of reticulocytosis). It might be necessary to determine the post-haemorrhage reticulocyte count of the guinea fowl in future studies.

The RBC was significantly higher at 4 weeks than the pre-haemorrhage value (Table 1), however a contrary observation of significant decrease in the RBC count at 4 weeks was made in the Nigerian domestic fowl (Oyewale *et al.*, 1997b). Furthermore, Oyewale *et al.*

Table 1: Changes in the erythrocyte values (mean $\pm$ SD) of the guinea fowl after haemorrhage

Parameters	Pre (n = 8)	0 h (n=8)	4 h (n = 8)	1 wk (n = 8)	4 wk (n = 8)
RBC ( $\times 10^{12}/L$ )	2.20 $\pm$ 0.78	1.77 $\pm$ 0.71	1.60 $\pm$ 0.33*	2.24 $\pm$ 0.39	2.82 $\pm$ 0.71*
PCV (%)	45.50 $\pm$ 9.02	38.13 $\pm$ 10.16	30.33 $\pm$ 7.57*	39.75 $\pm$ 2.87	43.06 $\pm$ 4.10
Hb (g/dl)	13.61 $\pm$ 2.02	11.10 $\pm$ 2.86	5.40 $\pm$ 0.82*	11.03 $\pm$ 2.40*	14.18 $\pm$ 2.16
MCH (pg)	60.88 $\pm$ 23.62	47.48 $\pm$ 14.96	39.94 $\pm$ 14.26	52.72 $\pm$ 15.49	49.18 $\pm$ 9.57
MCHC (g/dl)	28.04 $\pm$ 4.98	26.87 $\pm$ 3.19	16.95 $\pm$ 4.80*	27.96 $\pm$ 5.13	32.38 $\pm$ 4.56
MCV (fl)	235.96 $\pm$ 104.13	231.39 $\pm$ 80.05	187.14 $\pm$ 10.28	194.85 $\pm$ 47.77	163.84 $\pm$ 53.42*

Value significantly different from pre- haemorrhage values at \* $p < 0.05$

(1997b) reported a significant decrease in the PCV and Hb values at 4 weeks post-haemorrhage, however the present study revealed similar PCV and Hb value at the pre- haemorrhage and 4 weeks post-haemorrhage. The implication of this on our finding is that the guinea fowl recovered faster than the Nigerian domestic fowl from haemorrhage.

## REFERENCES

- Bond, C.F. and P.W. Gilbert, 1958. Comparative study of blood volume in representative aquatic and non-aquatic birds. *Am. J. Physiol.*, 194: 519-521.
- Critz, J.B. and A.W. Merrick, 1959. Serum electrolyte and changes in young rabbits following haemorrhage. *Am. J. physiol.*, 199: 173-175.
- Davis, W.M., J.D. Bigelow and E.I. Alpen, 1954. Changes in red cell volume and osmotic fragility of erythrocytes in the rat following acute blood loss. *Am. J. physiol.*, 178: 17-22.
- Djojogugito, A.M., B. Folkow and A.G.B. Kovach, 1968. The mechanism behind the rapid blood volume restoration after haemorrhage in birds. *Acta Physiol. Scand.*, 74: 114-122.
- Durotoye, L.A. and J.O. Oyewale, 1988. A comparative study of erythrocyte osmotic fragility between the guinea fowl (*Numida meleagris galeata*) and the Nigerian domestic fowl (*Gallus domesticus*). *Bull. Amin. Hlth. Prod. Afr.*, 36: 73-76.
- Gildersleeve, R.P., M.J. Galvin, J.P. Thaxton and D.I. McRee, 1985. Hematological responses of Japanese quail to acute hemorrhagic stress. *Comp. Biochem. Physiol. A.*, 81: 403-409.
- Jain, N.C., 1986. *Schalm's Veterinary Haematology*, 4th Edn. Lea and Febiger, Philadelphia.
- Krise, G.M. and N. Wald, 1959. Haematological effects of acute and chronic experimental blood loss in the *Macaca mullatta* monkey. *Am. J. Res.*, 20: 1081-1085.
- Oyewale, J.O., A.A. Olofintila and S.A. Famakinde, 1997a. Haematological changes after haemorrhage in the domestic fowl. *Vet. Arhiv.*, 67: 193-201.
- Oyewale, J.O., T.O. Okewumi and F.O. Olayemi, 1997b. Haematological changes in the West African dwarf goats following haemorrhage. *J. Vet. Med.*, A44: 619-624.
- Oyewale, J.O., 1988. Some aspects of the haematology of the guinea-fowl (*Numida meleagris galeata*, Pallas) Ph.D. Thesis, University of Ibadan, Ibadan.
- Oyewale, J.O., 1990. The effect of egg-laying on the osmotic fragility of erythrocytes, leucocytes values and blood volume in the guinea-hen. *Anim. Technol.*, 4: 59-64.
- Oyewale, J.O., 1991. Osmotic fragility of erythrocytes of guinea-fowls at 21 and 156 weeks of age. *Vet. Arhiv.*, 61: 49-56.
- Palmer, J., K.P. Klugman and J. Hattingh, 1979. Haematological changes associated with haemorrhage in the pigeon. *Comp. Biochem. Physiol.*, 53A: 585-589.
- Schnappauf, H., H.B. Stein, C.R. Sipe and E.P. Cronkite, 1967. Erythropoietic response in calves following blood loss. *Am. J. Vet. Res.*, 28: 275-277.
- Sturkie, P.D., 1976. *Avian Physiology*. Springer-Verlag. New York.
- Torten, M.O. and W. Schalm, 1964. Influence of the equine spleen on rapid changes in the concentration of erythrocytes in peripheral blood. *Am. J. Vet. Res.*, 25: 500-504.