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Hematological and Serum Chemistry Values for the Ring-necked Pheasant (*Phasianus colchicus*): Variation with Sex and Age

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Abstract: The influences of sex and age on hematological parameters were investigated in the ring-necked pheasant. Statistical comparisons were made for differences in values between male and female, 30 adults (52 week old) and 20 juvenile birds (5 week old). A variety of blood parameters showed statistically significant age and sex related differences. Adult males had higher values for Packed Cell Volume (PCV) and juveniles lower values for PCV. Adult females had higher values for basophils, the heterophil/lymphocyte ratio and total plasma protein. Juvenile females had higher values for hemoglobin. Adults had greater White Blood Cells (WBC), heterophils, eosinophils and monocytes. Serum biochemical values (uric acid, gamma glutamyl transferase, protein, albumin and globulins) were determined in young (5 week old) ring necked pheasants. There were no differences in any of these serum parameters among juvenile males and females.

Key words: Pheasant, *Phasianus colchicus*, hematology, serum chemistry

Introduction

The ring-necked pheasants (*Phasianus colchicus* Linnaeus, 1758, *Galliformes*, *Phasianidae*) are birds originated from Asia and highly distributed in the world. Because of the potential of these birds to produce high nutritive meat, the massive production of this species is increasing in many countries.

It is well known that clinical hematological and chemistry data can be useful aids for diagnosis of disease in birds. Moreover, managing abnormalities in birds requires an understanding of how diseases change the blood and biochemical function of the bodies. Because the clinical signs of illness in birds are frequently subtle, hemograms and clinical chemistry are necessary to evaluate cellular changes (Fudge, 1997). In this study we aimed to investigate the variation in hematological values arising from differences between sex and age. Also our objective was to determine some serum biochemical values (uric acid, gamma glutamyl transferase, protein, albumin and globulins) of juvenile ring-necked pheasants to establish data on them presenting the effect of sex on serum blood values.

Materials and Methods

Ring-necked pheasants (*Phasianus colchicus*) were allocated in experimental floor-pen housed, receiving water and feed *ad libitum*. The feed was formulated with corn and soybean according with NRC (1994) recommendations. The adult animals were 52 week old on the breeding season allocated in families with one

male and four female. The juveniles were 5 week old allocated together male and female. Blood samples were collected from the ulnar wing vein from 30 adult birds (15 male and 15 female) and 20 young birds (10 males and 10 female). Aliquots of each blood sample were transferred immediately to a 2-mL glass tube containing ethylenediaminetetraacetic acid (EDTA) for hematological analyses and to a 10-mL plain glass tube containing no anticoagulant for serum chemistry analyses. Thin smears were made immediately after the blood collection to avoid any interference on cell structure.

The hematological analyses were performed according to Jain (1986). Total Red Blood Cells (RBC) and total White Blood Cells (WBC) count were performed by a manual method using hemocytometer with blood diluted on 0.01% of toluidine blue stain. The hemoglobin concentration was measured by cyanmethemoglobin method. The Packed Cell Volume (PCV) by micro hematocrit capillary tubes and centrifuged at 2500 rpm for 5 min. The differential WBC counts were made on blood films stained with Wright's stain, using average of 200 cells. The heterophil/lymphocyte ratio was determinate by division of number of heterophils by the number of lymphocytes. The total plasma protein was determined by the refractometer (Jain, 1986). The serum chemistry parameters (uric acid, gamma glutamyl transferase, serum total protein and albumin) were determined with an automated chemistry analyzer. The globulin value was determined by difference

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Table 1: Age-specific variation in hematological values and total plasma protein for adult pheasants (52 week old) and juvenile pheasants (5 week old) of both sexes (Mean±SD)

Parameters	Adult males	Adult females	Juvenile males	Juvenile females
RBC (/mm ³)	2,720,000 ^a ±129,312	2,370,000 ^a ±121,876	2,350,000 ^a ±286,654	2,030,000 ^a ±564,454
Hemoglobin (g/dl)	15.96 ^a ±1.08	16.74 ^a ±1.07	16.45 ^a ±3.67	19.45 ^b ±2.09
PCV (%)	43.5 ^a ±1.26	38.7 ^b ±1.0	33.8 ^b ±2.02	33.9 ^b ±3.25
WBC (/mm ³)	28,529 ^a ±3,378	27,824 ^a ±3,096	18,300 ^b ±4,945	20,700 ^b ±7,087
Heterophils (/mm ³)	11,726 ^a ±7,621	13,372 ^a ±6,023	6,824 ^b ±2,283	6,529 ^b ±1,893
Lymphocytes (/mm ³)	11,917 ^a ±1,754	7,875 ^a ±1,190	8,960 ^a ±2,738	11,049 ^a ±4,920
Eosinophils (/mm ³)	1,173 ^a ±326	1,285 ^a ±183	367 ^b ±222	307 ^b ±242
Basophils (/mm ³)	2,472 ^a ±583	5,258 ^a ±1,079	1,510 ^b ±938	2,049 ^b ±971
Monocytes (/mm ³)	2,048 ^a ±595	1,271 ^a ±230	723 ^b ±290	766 ^b ±313
Heterophil/Lymphocyte Ratio	1.14 ^b ±0.75	2.12 ^a ±1.07	0.79 ^b ±0.19	0.63 ^b ±0.21
Plasma total protein (g/dL)	4.7 ^a ±0.39	6.77 ^b ±0.28	4.3 ^a ±0.42	4.22 ^a ±0.44

Means followed by different letters in the same line are significantly different (p<0,05)

between serum total protein and albumin. The control of the chemical analysis was made using Qualitrol-N.

The dates were analyzed by ANOVA, and those with statistical differences were submitted to the Tukey's test at 0.05% using Statistics for Windows®. For hematological parameters there were compared two factors (two sex X two age). The serum chemical parameters were only compared in young animals (5 week old) between male and female.

Results and Discussion

The relation of sex and age to hematological values in the ring-necked pheasants is presented in Table 1. The present study showed that there were no significant differences in RBC and lymphocytes. However, Pujman and Hanusova (1970) reported that adult and young pheasants had higher RBC. Chickens and domestic turkeys have a WBC distribution with lymphocytes as the most numerous leukocytes (Bounous *et al.*, 2000). This also would be expected in pheasants but the numbers of lymphocytes and heterophils in this study were similar. Hematologic studies of some species of adult birds, such as flamingos, are contradictory in that either heterophils or lymphocytes have been identified as the major circulating leukocyte in health (Latimer and Bienzle, 2000).

Adult ring-necked pheasant males had higher PCV levels than adult females and young birds. In general, the PCV increases with age and are higher in male than female birds. Estrogen depresses erythropoiesis, whereas androgens and thyroxin stimulate erythropoiesis (Herbert *et al.*, 1989). The age-related variation of PCV is similar to that reported for adult and young pheasants (Pujman and Hanusova, 1970), for 42 day-old broiler chickens (Bounous and Stedman, 2000) and for Thai indigenous chickens (Simaraks *et al.*, 2004). The hemoglobin value for the juvenile ring-necked pheasant females is higher than values reported for adult and young pheasants (Pujman and Hanusova, 1970) and young female quails (Kundu *et al.*, 1993). The red cell mass of birds is influenced by age, sex, reproductive status and environmental factors (Herbert *et al.*, 1989).

When compared with juveniles, adults had higher significant values for WBC, heterophils, eosinophils and monocytes. The WBC and the different types of leukocytes are influenced by age and hormones (Latimer and Bienzle, 2000). The WBC, heterophils, eosinophils and monocytes for juvenile ring-necked pheasants were similar to those reported for juvenile wild turkeys (Bounous *et al.*, 2000) and higher to those for 30 day-old broiler chickens (Kohayagana *et al.*, 2001). Jain (1986) and Simaraks *et al.* (2004) reported the same results for WBC in adult female chickens and in Thai indigenous chickens, respectively. The biological significance of greater WBC, heterophils, eosinophils and monocyte values in adults versus lower values in juveniles is not clear. Although young birds demonstrate a great variability in total leukocyte counts until 4 to 6 months of age (Fudge, 1997) and age was confirmed to be a further factor affecting the normal values of avian blood (Dein, 1996).

The heterophil/lymphocyte ratio is a good indicator of stress in chickens (Gross and Siegel, 1983). The difference between adult females and males and juveniles may show a physiologic stress probably due to the laying cycle of the adult females (Latimer and Bienzle, 2000). We found that the mean value for the heterophil/lymphocyte ratio obtained in this study for the young birds is very close to that reported for 6 month-old Thai indigenous chickens (Simaraks *et al.*, 2004). Adult ring-necked female pheasants had higher absolute basophils values than adult males and juveniles. As the heterophil/lymphocyte ratio was increased in adult females it seems that the higher basophil numbers showed the same condition of physiological stress (Latimer and Bienzle, 2000).

Adult females had greater plasma total protein values than adult males and young birds. Females of oviparous species demonstrate a marked increase in plasma total protein concentration just before egg production. This estrogen-induced hyperproteinemia is associated with an increase in vitellogenin and lipoproteins, which are necessary for yolk production. These proteins are produced in the liver, transported in the blood and incorporated into the oocytes of the ovary (Lumeij, 1997).

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Table 2: Serum chemistry values for juvenile pheasants (5 week old) for both sexes. (Mean±SD)

Parameters	Male	Female
Uric acid (mg/dL)	5.83±0.88 ^a	5.56±1.65 ^a
GGT (U/L)	5.24±1.61 ^a	5.0±1.15 ^a
Serum total protein (g/dL)	4.02±0.69 ^a	3.6±0.34 ^a
Albumin (g/dL)	1.93±0.42 ^a	1.84±0.19 ^a
Globulins (g/dL)	2.09±0.55 ^a	1.76±0.55 ^a

Means followed by different letters in the same line are significantly different ($p < 0.05$)

Serum chemistry values for young ring-necked pheasants are shown in Table 2. There were no statistical differences in the serum chemistry values (uric acid, GGT, serum total protein, albumin and globulins) between male and female juvenile ring-necked pheasants. However, Bakhiet *et al.* (2006) reported that young Sudanese geese (8-10 weeks old) had higher uric acid levels. On the other hand, the uric acid values were similar to those reported for Thai indigenous chickens (Simaraks *et al.*, 2004) and for 4 week-old SPF brown leghorns (Ross *et al.*, 1978). The blood uric acid concentration is influenced by species and diet (Lumeij, 1997). The same results for serum total protein and albumin in juvenile wild turkeys (Bounous *et al.*, 2000) and young Sudanese geese (Bakhiet *et al.*, 2006) were reported. However, Ross *et al.* (1978) reported lower serum total protein and albumin values in 4 week-old SPF brown leghorns. Age, seasonal changes, diet and captive status were found to have an effect on serum protein values in birds (Lumeij, 1997). There is no information available on serum Gamma Glutamyl Transferase (GGT) values for domestic birds to compare with our results.

Conclusions: In conclusion, we found that many of the hematological parameters differed significantly in accordance with age and sex. The clinical chemistry results of ring-necked pheasants obtained in this study can be considered as representative values for juveniles of this species.

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