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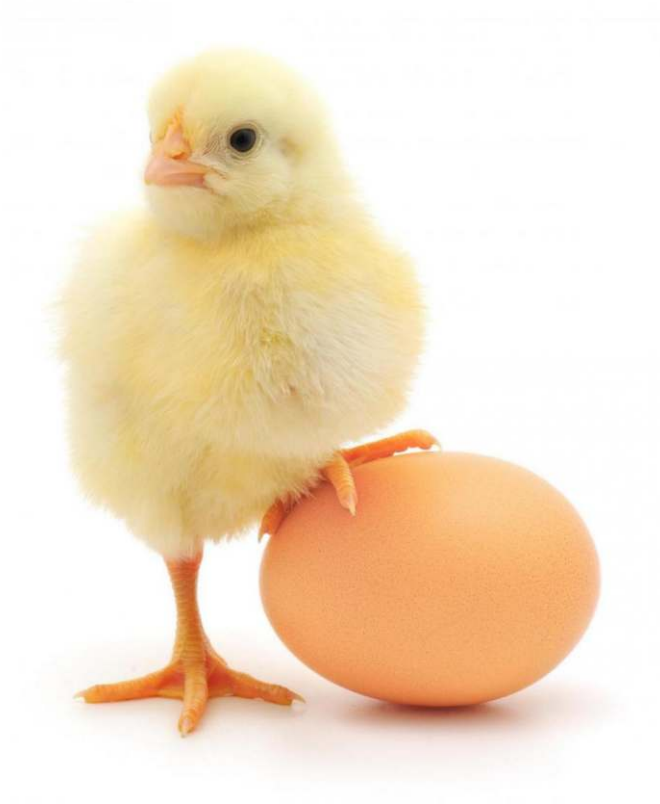

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Hematology of the Bronze Turkey *(Meleagris gallopavo)*: Variations with Age and Gender

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Abstract: One hundred and ten Bronze Turkeys: 40 females (19-23 week-old), 13 males (19-23 week-old), 35 females (30-32 week-old) and 22 males (30-32 week-old), were investigated to analyse the influences of age and sex on hematological parameters. Statistical comparisons were made for differences in values between male and female and among different ages. Lymphocytes were the major circulating leukocyte for all birds. Total serum protein, lymphocytes and basophils were significantly different between females of both ages. The RBC values were significantly different between males of both ages.

Key words: Avian hematology, Bronze Turkeys, *Meleagris gallopavo*, total plasma protein

INTRODUCTION

Turkeys (*Meleagris gallopavo* Linnaeus, 1758, *Galliformes*, *Meleagrididae*) are birds originated in North America that were domesticated in Europe and now are an important source of food in many parts of the world (Brant, 1998). Turkeys were bred mainly for their beautifully colored plumage until about 1935, after which the breeding emphasis changed to their meat qualities (Agricultural Alternatives, 2004). All over the world turkeys are reared for their tasty and high-quality meat (Prabakaran, 2003).

Hematological analyses are among the methods which may contribute to the detection of some changes in health status and can be a useful aid for diagnosis diseases in birds. Most reports of avian blood ranges do not state age or gender distinctions and limited hematologic data are available for domestic turkeys. For this reason, this study aimed to investigate the effect of age and gender on haematological values in Bronze Turkeys.

MATERIALS AND METHODS

Turkeys were allocated in experimental floor-pen housed, receiving water and feed *ad libitum*. The feed was formulated with corn and soybean for growing birds according to NRC (1994) recommendations.

Blood samples were collected from the superficial ulnar vein of 110 Bronze Turkeys: forty female turkeys (19-23 week-old), thirteen male turkeys (19-23 week-old), thirty-five female turkeys (30-32 week-old) and twenty-two male turkeys (30-32 week-old). Aliquots of each blood sample were transferred immediately to a 2-mL glass tube containing EDTA (ethylenediaminetetraacetic acid). Thin smears on glass slides were made immediately after the blood collection to avoid any interference on cell structure. Total Red Blood Cell (RBC) and total White Cell (WBC) counts were performed by a manual method using blood diluted on 0.01% toluidine blue stain (Zinkl, 1986). The hemoglobin concentration was measured by cyanmethemoglobin method. The Packed Cell Volume (PCV) was determined by the microhematocrit method in capillary tubes and centrifuged at 12,000 g for 5 min. Differential WBC counts, using an average of 200 cells, were made from blood films stained with Wright´s stain. The total plasma protein was determined using a refractometer (Jain, 1986).

The data were analyzed by ANOVA and those with statistical differences were submitted to the Tukey´s test at 0.05%, using Statview® (version 5.0).

RESULTS AND DISCUSSION

Table 1 summarizes the relation of age and sex to hematological values in Bronze turkeys. The present study showed that there were no significant differences ($p>0.05$) for PCV, hemoglobin, WBC, heterophils, monocytes and the heterophil/lymphocyte ratio. Bounous *et al*. (2000) reported found similar results for PCV in 4 month-old wild turkeys and Rhian *et al*. (1944) also

Table 1: Age-specific variation in hematological values and total plasma proteins for Bronze Turkeys (*Meleagris gallopavo*) of both sexes (Mean±SD)

Parameters	Females (19-23 weeks)	Males (19-23 weeks)	Females (30-32 weeks)	Males (30-32 weeks)
RBC (/mm^3)	1,133,700^{ac}±226,319	1,298,769^{c}±201,218	1,051,470^{ab}±274,264	963,304^{b}±267,108
Hemoglobin (g/dL)	16.2±2	16.7±1.8	17.6±1.9	17.2±1.7
PCV (%)	37.3±4.5	38.8±4.6	36.8±3.8	36.3±3
WBC (/mm^3)	8,650±2,118	7,461±1,713	7,794±3,150	7,826±3,498
Heterophils (%)	31.8±7.2	31.1±5.4	36.3±12.5	36.5±9.1
Lymphocytes (%)	58.3^{a}±8	59.2^{a}±6.4	49.4^{bc}±13.7	52.8^{ac}±9.1
Eosinophils (%)	1.1^{ab}±0.9	0.7^{ab}±0.8	2^{a}±2.9	0.7^{b}±1
Basophils (%)	4.9^{a}±2.3	5.3^{ab}±1.9	7.1^{b}±3.3	6.3^{ab}±2.9
Monocytes (%)	3.9±2	3.6±1.3	5.1±2.8	3.7±1.9
Heterophil/Lymphocyte Ratio	0.6±0.2	0.5±0.1	0.7±0.3	0.7±0.3
Total plasma protein (g/dL)	4.2^{a}±0.7	4.3^{ab}±0.6	4.9^{b}±0.6	4.5^{ab}±0.4

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

found similar values for PCV in 16 month-old Bronze Turkey hens. The WBC values in this study were lower than values reported for 4 month-old wild turkeys (Bounous *et al*., 2000).

There were significant differences in RBC values between 19-23 week-old and 30-32 week-old males, between 19-23 week-old females and 30-32 week-old males and also between 19-23 week-old males and 30-32 week-old females (Table 1). The red cell mass of birds is influenced by sex, environmental factors, age, hormonal influences and disease. In general, the total erythrocyte count increase with age and are higher in male than female birds (Herbert *et al*., 1989; Campbell, 2004). Moreover, slight increases in the peripheral RBC mass may occur in the excited or stressed avian patient (Fudge, 2000).

Heterophils are the most abundant leukocyte in the peripheral blood of most species of birds in most studies, whereas some avian species are lymphocytic (have lymphocytes as the predominant cell type in the differential count) (Fudge, 2000; Latimer and Bienzle, 2000). The turkeys in this study had lymphocytes as the most abundant leukocyte in the peripheral blood. Hematological studies of wild turkeys showed a similar condition (Bounous *et al*., 2000) and according to Bounous and Stedman (2000) the lymphocytes are the predominant leukocyte in the peripheral blood of chickens and turkeys.

The lymphocyte values were significantly lower in 30-32 week-old females. The different types of leukocytes are influenced by age, hormones and stress (Maxwell, 1993; Latimer and Bienzle, 2000). According to Dein (1986), age is a further factor affecting the normal values of avian blood and there is wide variation in the normal leukograms among birds of the same species (Campbell, 1994). However, the biological significance of lower lymphocyte counts in older females in this study is not clear and there is no information available on lymphocyte values for female turkeys to compare with our results. Significant differences were found for basophil counts between 19-23 week-old and 30-32 week-old females. As the 30-32 week-old females were pre-laying birds, this higher basophil counts might be associated with physiological stress probably due to the laying cycle of the hens. Schmidt *et al*. (2007) reported a similar condition in adult female pheasants during breeding season. Venkataratnan and Clarkson (1962) reported similar values for adult turkeys.

The normal plasma protein concentration in birds generally ranges from 2.5-4.5 g/dL (Campbell, 2004). When compared with 19-23 week-old females, 30-32 week-old females had higher significant values for total plasma protein concentrations. However, 19-23 week-old and 30-32 week-old males had similar values for total plasma proteins as 30-32 week-old females. The explanation of this difference between females of different ages might reside in the fact that age and stage of development strongly influences the concentration of total proteins in birds (Hochleithner, 1994). On the other hand, Martin *et al*. (1981) reported higher values (5.2-6.0) of total plasma protein concentrations in 6 month-old female wild turkeys during the reproductive cycle, confirming the fact that since 30-32 week-old females evaluated in this study were pre-laying hens, there may be a positive effect from higher estrogen levels in the breeding season.

Normal hematologic values for avian species determined by different laboratories can vary significantly. This variation is caused by differences in blood sampling and analytic techniques; also, reference ranges for avian RBC vary significantly among reports (Campbell, 2000; Fudge, 2000). Thus, the results found in this study, indicate the importance to evaluate the factors that may influence the hematologic results such as age, gender, physiologic status and laboratory methodology.

Conclusion: Some hematologic parameters showed significant differences between age and gender, especially RBC, lymphocytes, basophils and total plasma protein concentrations. The hematologic data obtained in this study can be considered preliminary

reference values, which are particularly important for turkey production.

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