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COMPARATIVE STUDY ON HEMATOLOGICAL AND BIOCHEMICAL CHARACTERIZATION BLOOD PROFILE IN BIRDS GROWN IN FARMS OF ROMANIA

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Abstract

Current research is a part of a research program aimed to study the relationship between morphology and physiological status of turkey pineal gland in relation to the degree of somatic development. Research is carried out at S.C. Galli Gallo Codlea, which is the only unit in Romania for breeding and slaughter of turkeys. The measurements were performed on an important livestock specie for modern husbandry industry, namely turkey, the expansion of this area being useful for providing knowledge on the relationship between technology growth for modulation of microclimate parameters and growth performance. Were followed hematological and biochemical blood parameters,with the purpose of providing a parallel between turkey (Meleagris gallopavo-gallopavo) and chicken (Gallus gallus).

Key words*: hematology, biochemistry, turkey, chicken.*

INTRODUCTION

Hematological and biochemical determinations are essential in veterinary diagnosis. Clinical examinations together with laboratory determinations lead to a prompt and early diagnosis. The introduction of rapid hematological and biochemical tests facilitates the achievement of a metabolic profile in birds that leads to the improvement and restoration of growth and nutritional conditions.

Research regarding the metabolic profile in poultry is related to the fact that they are characterized by an intense metabolism and any nutritional imbalances are have immediate repercussions in the general metabolism of birds with strong effects on health, that are reflected in the production (Vatn et al., 2000; Simeanu, 2009).

Hematological investigations aim at identifying the origins of different haematological disturbances in order to obtain appropriate productions.

Hematological values and biochemical determinations in chickens and turkeys have been made to reflect the health and body homeostasis. Establishing haematological status enables maintenance by interpreting the influence of variations in poultry practice (food, microclimate parameters, light regime) (Simeanu, 2004; Simeanu, 2018).

MATERIALS AND METHODS

As biological material was used:

- turkey BUT Big 6 hybrid: by sex, grown on permanent litter in "blind" halls
- chicken Lohmann Brown hybrid: by sex, grown on permanent litter

Measurements of metabolic parameters were made by performing haematological profile (WBC, Lym., Neu., Mon., Eo., RBC, MCV, HCT, MCH, MCHC, RDW, Hb) by automated analyser, the principle of fluorescence using flow cytometry conductor laser and hydrodynamic focusing and biochemical profile (total protein, cholesterol, triglycerides, uric acid, calcium, magnesium, ALT, amylase, ALP, albumin) by photo spectrometric method (Kheiri et al., 2006).

Blood sampling was conducted from brachial vein in both hybrids at the age of 120 days at turkeys an 56 days at chickens.

Morphostructural pineal gland was observed by histological examination.

Level microclimate factors were provided in

accordance with the provisions of specific technological guide of these birds' categories.
Throughout the experiment, feeding was done *ad libidum* (Law et al., 1990; Foye et al., 2006).

RESULTS AND DISCUSSIONS

The need for haematological profile in birds, chickens, respectively turkeys lies in the fact that they are characterized by an intense metabolism and possible nutritional imbalances are reflected promptly in their metabolism.
Usually, at birds, the white series is less used, however it can provide essential information on the health of individuals.
The hemogram is a basic screening test, being one of the most commonly required laboratory tests, often the first step in establishing a hematological status and the diagnosis of various hematological and non-hematological conditions. Quantification of hematological parameters is sometimes associated with blood smear examination that brings precious information, further focusing the research on other specific tests.
Gender, age, and certain conditions such as: shock, massive i.v. administration of fluids, etc., which can lead to the dehydration, respectively hyperhydration of the individual, as well as certain treatments should be communicated to the laboratory. It is preferable to avoid as much stress as possible at the time of harvesting.
In the case of regular (daily or every other day) monitoring of certain parameters, the blood sample for the hemogram must be obtained at the same time of the day (due to the circadian physiological fluctuations of some parameters) (Fischbach, 2009).
The number of erythrocytes is the basic test for erythropoiesis. Erythrocytes are further investigated by measuring the hemoglobin and hematocrit, and based on them; the analyser calculates the erythrocyte counts: VEM, HEM, CHEM and RDW, which qualitatively characterize the erythrocyte population.
The number of erythrocytes as a single parameter is of low diagnostic value; a correct assessment of the body's erythrocyte mass can only be obtained in correlation with the hematocrit. The number of erythrocytes is influenced by changes in plasma volume, such as in pregnancy or in hydro-electrolyte balance disorders (Means, 2004).
The RBC count, HCT, HGB, MCV, MCHC, and RDW are also used to determine the presence and severity of anaemia (Tvedten, 2010).
In our research we obtained distinct significant differences in expression of neutrophils between this two studied populations and significant differences in expression of monocytes (Table 1).
The number of erythrocytes varies by age and sex and the amount of hemoglobin is influenced by the composition of feed rations. Interpreting the obtained results on the total number of erythrocytes and the amount of haemoglobin were obtained significant differences. Also, significant distinct differences were seen in haemoglobin expression.
Determination of biochemical profile indicators were conducted to obtain information on possible differences tooth two populations.
Total protein showed a mean value of 25.20 g/L at turkeys and 38.29 g/L in chickens. Following the statistical interpretation of results were obtained very significant differences, which can be correlated with higher feed intake and thus combined with a high intake of protein.
Protein intake in poultry influences protein, albumin and uremia levels, and so a feed that is poor in protein given over a 14-day period leads to a lower egg production.
In current practice it is important for birds to measure the enzymatic activity. In laying hens, it was noticeable that after the laying period hepatic and bone metabolism had undergone through some changes (Table 1, Figure 1).
AST (TGO) - aspartate aminotransferase is an enzyme that is part of the transaminase class and catalyses the transfer of the amino group from aspartate to the ketone ketoglutarate group with oxaloacetic acid formation. Unlike ALT that is mainly found in the liver, AST is found in several tissues: myocardium, liver, skeletal muscle, kidney, pancreas, brain tissue, spleen, thus being a less specific indicator for the liver function. At the hepatic cell level, AST isoenzymes are found in both cytosol and mitochondria.
In the interpretation of the obtained results there were very significant differences

regarding the expression of enzymes, increased values being observed in hens, AST had an average value of 16.56 U/I versus 7.1 U/I in the turkey. ALT also had a mean value well above the normal limit of 1227 U/I versus 287.9 U/I recorded in turkeys.

Table 1. Hematological values at chicken and turkey

Parameter	Turkey			Chicken			ANOVA test
	$\bar{X} \pm s_{\bar{x}}$	s	V%	$\bar{X} \pm s_{\bar{x}}$	s	V%	Significance
WBC (m/mm^3)	22.540±3.04	7.46	33.12	11.93±3.78	9.27	154.61	$\hat{F}$ = 4,76; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
LYM (%)	35.33±2.0	5.11	14.48	48.18±5.8	14.35	239.19	$\hat{F}$ = 4,27; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
MON(%)	9.68±0.7	1.71	17.73	12.40±0.9	2.38	39.69	$\hat{F}$ = 5,14; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{5\%} < \hat{F} < F_{1\%}$ =>*
NEU (%)	54.15±2.7	6.71	12.40	33.05±4.2	10.53	175.50	$\hat{F}$ = 17,12; F5% (1;10) = 4,96; F1% (1;10) = 10,04; F0,1% (1;10) = 21,04; F1%<< F0,1% =>**
EO (%)	0.96±0.96	1.67	173.20	7.14±3.89	8.71	174.31	$\hat{F}$ = 2,54; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
BA (%)	0.35±0.16	0.39	113.92	0.41±0.15	0.37	6.27	$\hat{F}$ = 0,09; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
RBC (M/mm^3)	2.00±0.35	0.87	43.86	2.98±0.11	0.27	4.56	$\hat{F}$ = 8,12; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{5\%} < \hat{F} < F_{1\%}$ =>*
MCV (fl)	127.46±4.46	10.93	8.57	108.75±0.84	2.07	34.49	$\hat{F}$ = 16,98; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{0,1\%}$ (1;10) = 21,04; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>**
HCT (%)	26.13±5.33	13.06	50.00	32.33±1.04	2.56	42.76	$\hat{F}$ = 1,30; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
MCH (pg)	80.51±14.21	34.80	43.23	39.33±0.3	0.91	15.26	$\hat{F}$ = 8,39; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{5\%} < \hat{F} < F_{1\%}$ =>*
MCHC (g/dL)	65.53±13.32	32.65	49.82	36.18±0,2	0.64	10.82	$\hat{F}$ = 4,85; $F_{5\%}$ (1;10) = 4,96; $\hat{F} < F_{5\%}$ => ns
RDW	7.93±0.1	0.42	5.32	6.51±0.21	0.52	8.71	$\hat{F}$ = 26,62; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{0,1\%}$ (1;10) = 21,04; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>***
HB (g/dL)	13.63±0.3	0.78	5.75	11.71±0.3	0.92	15.36	$\hat{F}$ = 15,05; $F_{5\%}$ (1;10) = 4,96; $F_{1\%}$ (1;10) = 10,04; $F_{0,1\%}$ (1;10) = 21,04; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>**

$\bar{X} \pm s_{\bar{x}}$ = mean ± standard deviation of the mean; s = standard deviation; V% = coefficient of variation

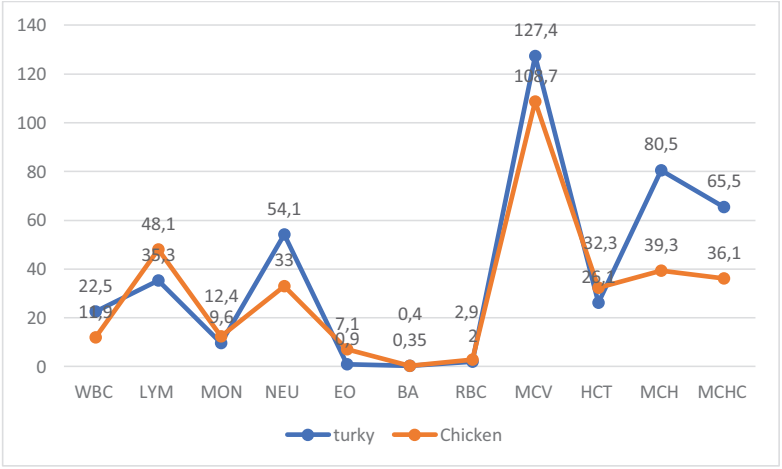

Figure 1. Variation of hematological values of turkey and chicken

Significant differences were obtained separately in AST, ALT and amylase expression enzymes. Significant differences were recorded at magnesium and uric acid values.
Triglycerides from the adipose tissue, but also other tissues, are the most important reservoir of energy inside the body. In the adipose tissue they are stored in the form of glycerol, fatty acids and monoglycerides, which are converted inside the liver into triglycerides that enter the VLDL (80%) and LDL (15%) (Tabel 2, Figure 2).

Table 2. Biochemical values index at turkey and chicken

Parameter	Turkey			Chicken			ANOVA test
	$\bar{X} \pm s_{\bar{x}}$	s	V%	$\bar{X} \pm s_{\bar{x}}$	s	V%	Significance
Total proteins (g/L)	25.20±1.84	4.52	17.96	38.29±2.08	5.09	13.31	$\hat{F} = 22,1$; $F_{5\%}(1;10) = 4,96$; $F_{1\%}(1;10) = 10,04$; $F_{0,1\%}(1;10) = 21,04$; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>***
Cholesterol (mg/dL)	111.36±10.04	24.61	22.10	164.06±9.41	23.071	14.06	$\hat{F} = 3,39$; $F_{5\%}(1;10) = 4,96$; $\hat{F} < F_{5\%}$ => ns
Triglycerides (mg/dL)	177.36±49.39	120.99	68.21	150.31±6.52	15,98	10.93	$\hat{F} = 0,29$; $F_{5\%}(1;10) = 4,96$; $\hat{F} < F_{5\%}$ => ns
Calcium (mg/dL)	11.64±0.97	2.40	20.60	9.43±0.37	0.91	9.70	$\hat{F} = 4,46$; $F_{5\%}(1;10) = 4,96$; $\hat{F} < F_{5\%}$ => ns
Magnesium (mg/dL)	3.31±0.04	0.10	3.05	5.1±0.55	1.35	26.31	$\hat{F} = 10,97$; $F_{5\%}(1;10) = 4,96$; $F_{1\%}(1;10) = 10,04$; $F_{0,1\%}(1;10) = 21,04$; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>**
ALT (U/I)	16.56±1.72	4.22	25.51	7.1±0.20	0.49	6.97	$\hat{F} = 29,69$; $F_{5\%}(1;10) = 4,96$; $F_{1\%}(1;10) = 10,04$; $F_{0,1\%}(1;10) = 21,04$; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>***
AST (U/I)	1227.26±127.74	312.90	25.496	287.96±7.49	18.36	6.37	$\hat{F} = 53,88$; $F_{5\%}(1;10) = 4,96$; $F_{1\%}(1;10) = 10,04$; $F_{0,1\%}(1;10) = 21,04$; $F_{1\%} < \hat{F} < F_{0,1\%}$ =>***

$\bar{X} \pm s_{\bar{x}}$ = mean ± standard deviation of the mean; s = standard deviation; V% = coefficient of variation

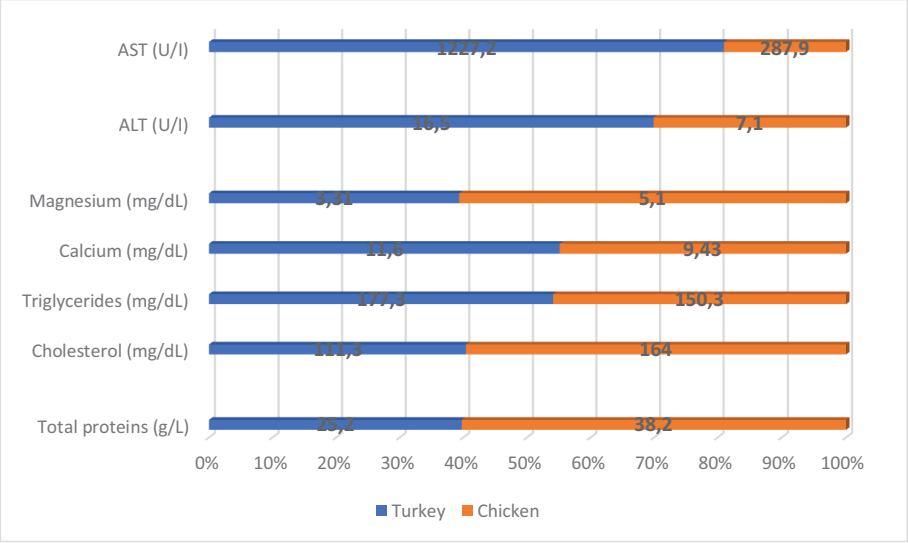

Figure 2. Variation of biochemical values of turkey and chicken

Hypertriglyceridemia together with hypercholesterolemia are independent risk factors for atherosclerotic disease. Also, thetriglyceride level is required for LDL-C calculation.

Calcium is the major mineral component of the bones. 99% of the amount of calcium in the body is found inside the bones and teeth, which represent a huge reservoir for maintaining seric calcium levels, the rest being distributed in biological fluids and soft tissues. Calcium ions play an important role in transmitting nerve impulses, muscle contraction, cardiac function, and coagulation processes.

The hormonal regulation of calcium metabolism as well as for phosphorus is complex. The reciprocal relationships between the small intestine, the skeleton, the kidney and the endocrine system, in particular the parathyroids, maintain the calcium and phosphorus homeostasis. Also, calcitonin, vitamin D, estrogen, androgen are factors that influence calcium levels.

The amount of protein in the blood affects the calcium level, because 45% of the serum calcium is protein-bound. Thus, decreasing serum albumin causes a decrease in total serum calcium. In our research there were no significant differences between the studied individuals.

Magnesium is an element that, although found to be present in small amounts inside the body (0.05% of the total body weight), is of great structural and functional importance.

70% of the total magnesium content of the human body (about 14g) is found inside the bone composition, along with Ca and P, and the rest is distributed in soft tissues (especially skeletal muscles) and various fluids. About 1% is found in plasma, 25% is protein-bound, and the rest remains in the form of ionized Mg^{2+}. Inside erythrocytes there is inappreciable amount of Mg, approx. 5.2 mEq/L. As for the cellular distribution of magnesium, most of it is found inside the mitochondria and nucleus. In addition to its plastic role in bones and soft tissues, Mg performs many functional roles, including activator of some enzymes (over 300 enzymes involved in carbohydrate metabolism, protein and nucleic acid synthesis, the most well-known Na^+/K^+ - ATP-ase). Together with Na^+, K^+ and Ca^{2+} ions, magnesium regulates neuromuscular excitability and coagulation mechanism.

The actions of calcium and magnesium are closely linked, the deficiency of one of these elements significantly affecting the metabolism of the other (magnesium is needed for both intestinal absorption and calcium metabolism). In the muscle cell, magnesium acts as a calcium antagonist. Magnesium deficiency will result in the mobilization of calcium from the bones, with the possibility of abnormal calcifications in the aorta and kidneys. It is therefore advisable to consider the calcium level when assessing the magnesium level. Also, hypomagnesiemia is associated with hypopotasiemia in 60% of cases. Significant magnitude values were recorded in the expression of magnesium, with higher values in the turkey, 5.1 mg/dL, compared with the 3.31 mg/dL value from chickens.

CONCLUSIONS

This paper aims to characterize, through the light of presented data, a control group of females and males, maintained under conditions of microclimate and technological factors. Track parameters underlying the lots referential experimental realization that change lighting system influence on endocrine function is responsible for coordinating epiphyseal metabolisms involved in growth and development.

Hematological and biochemical results fall within the reference values of this two populations and are characterize the normal physiological status of individuals.

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