



## Metabolic investigations on pigeons

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**Abstract.** Some biochemical parameters are influenced by diet or food consumption. Increased phosphatemia and potassemia in young's can be a cause of somatotropic hormone secretions and a mobilization of these for the growth of muscle and bone tissue. According to several papers, for the determination of proteinemia (TP), the refractometric method and the biuret method is frequently used. The biuret reaction is a highly specialized method by which peptide linkages react with copper ions, forming measurable color compounds by spectrophotometry at 540 nm. In contrast, determination of total protein by the refractometric method presents a degree of uncertainty due to the presence of high concentrations of refractory compounds such as chromogenes, lipids or glucose. The raw data were statistical processed, by both chemical and microelement analyzes, by showing the mean and dispersion indices represented by: variance ( $s^2$ ), standard deviation (s), coefficient of variation (V%), standard error of mean (sx).

**Key Words:** biochemical investigation, proteinemia, phosphatemia, potassemia.

**Introduction.** Generally, non-protein nitrogen values are lower in young's than in adult individuals because a high nitrogen quantity is consumed by the growth process.

Increased phosphatemia and potassemia in young's can be a cause of somatotropic hormone secretions and a mobilization of these for the growth of muscle and bone tissue (Pusta 2009).

Some biochemical parameters are influenced by diet or food consumption.

In the case of pigeons, it was found that four days of diet did not cause hypoglycemia, but rather a "hunger" hyperglycemia (Heinrich 1992a,b, 2004). Parameters that may show significantly increased post-prandial values are: uric acid and bile acids. In pigeons kept in dieting under natural photoperiodic conditions (16 hours light/day) at a normal circadian rhythm, high blood sugar was observed during photoperiods.

The catabolism of lipid deposits may vary from one breed to another for survival in a harsh period (in the case of competitions) or to facilitate egg incubation.

During competitions that require a long flight, energy consumption may exceed 7 to 10 times the rate of basal metabolism.

Lipid reservoirs in pigeons are stored as triglycerides that have a high caloric density.

Storing these reserves in some cases can double the body mass of an individual.

For the determination of proteinemia (TP), the use of refractometric method and the biuret method is frequently used, as shown by numerous papers in the field (Andreasen et al 1989). The biuret reaction is a highly specialized method by which the peptide bonds react with copper ions to form colorimetric measurable compounds by spectrophotometry at 540 nm. In contrast, determination of total protein by the refractometric method presents a degree of uncertainty due to the presence of high concentrations of refractory compounds such as chromogenes, lipids or glucose.

Ionescu & Oroian (2015) and Ionescu et al (2015) performed studies concerning phenotypic characterization of the "Galați players" pigeon breed which constitutes the present study biological material. Recently Ionescu & Oroian (2019) also performed a study concerning hematological aspects of the same breed.

**Albumin (ALB).** It is one of the main serum proteins that serve as the source of amino acids for the synthesis of tissue proteins during the rapid somatic growth of pigeons. In albumin testing, most determinations are based on the use of the bromocresol green method.

Bromocresol green binds nonspecifically to proteins. Its binding results in a staining of the sample directly proportional to the albumin level.

Heparin causes a false increase in albumin due to fibrinogen binding, which is demonstrated on humans and dogs (Diaconu & Burloi 1975).

**Uric acid (UA).** It is the major excretion compound of nitrogen in the birds organism. There is a hypothesis that this excretion mechanism has evolved due to oviparity. Uric acid is relatively inert and less toxic than ammonia or urea, thus ensuring the viability of the pigeon; it is predominantly produced in the liver by the metabolism of the purines with a relatively reduced synthesis in the kidney tubules. Approximately 90% of uric acid is secreted at the proximal piers of the pigeons. This percentage may be altered by kidney problems. Uric acid is transported to the cloaca where it can be sent to the rectum, where it can be decomposed by bacteria and reabsorbed.

Thus blood sampling for biochemical testing in birds should be performed after a 24-hour diet.

**Glycemia (GLU).** It is the amount of glucose found in the blood. There are numerous methods for determining glucose depending on the equipment used. Blood glucose values may be outside the limits of measurement of certain types of glucose meters. Because of this, most laboratories either dilute the samples or use the hexokinase method; where NAD is measured at a wavelength of 340 nm after two reactions involving hexokinases and glucose-6-phosphate-dehydrogenase.

Excretion of the pancreas induces hypoglycemic seizures in granivores while carnivores induce diabetes. This suggests the predominance of glucagon in granivores and insulin in carnivores.

**Material and Method.** Biochemical investigations provide informations on the functional capacity of organs involved in a particular metabolic pathway.

The biological material consisted of 20 pigeons (5 individuals of each color variety) of "Galați players" breed of different color varieties, namely: blue flacked white, white unicolor, black flacked white, red flacked white.

The harvested blood was stored in the vacutainers with lithium-heparin which was subsequently stored in a cold environment to avoid alteration of the samples.

Blood samples were harvested from each color variety studied; using five pigeons of each variety, from each pigeon 0.5 mL of blood was extracted exclusively from the axillary vein.

Blood samples for biochemical investigations were obtained prior to clinical examination to avoid iatrogenic changes.

**Results and Discussion.** According to the obtained results, presented in Table 1, the total protein level ranged between the minimal 3.26 g/dL measured at the blue flacked white variety and maximal of 4.20 g/dL recorded at the black flacked white color variety.

Concerning the albumin concentration of the blood samples the hierarchy, in increase order was established as: white unicolor (2.33 g/dL), blue flacked white (2.47 g/dL), black flacked white (2.61 g/dL), and red flacked white (2.73 g/dL).

Very high differences was observed in globulin with the lowest value at the red flacked white variety (0.97 g/dL), and the highest value found in the white unicolor variety (1.80 g/dL), which presented a value almost double as the previous mentioned color variety.

Same extreme differences were also found concerning other two parameters, namely: aspartate aminotransferase and creatine phosphokinase, where in some cases the highest value was even twice bigger or more compared to the lowest value.

The values concerning glucose, bile acid, uric acid, calcium, phosphorous and sodium, obtained in all color varieties studied did not showed extreme variations.

Table 1

The average values of the biochemical parameters of the studied color varieties

<i>Varieties</i>	<i>TP</i> (g/dL)	<i>ALB</i> (g/dL)	<i>GLOB</i> (g/dL)	<i>GLU</i> (mg/dL)	<i>AST</i> (U/L)	<i>CK</i> (U/L)	<i>BA</i> ( $\mu$ mol/L)	<i>UA</i> (mg/dL)	<i>CA</i> (mg/dL)	<i>PHOS</i> (mg/dL)	<i>NA<sup>+</sup></i> (mmol/L)
Blue flacked white	3.26	2.47	0.85	220.0	93.2	457.0	3.64	11.18	3.22	147.4	3.72
White unicolor	3.32	2.33	1.80	234.6	93.6	531.0	4.49	9.30	3.71	138.03	4.85
Black flacked white	4.20	2.61	1.19	312.0	58.2	322.0	4.17	10.76	2.70	172.0	3.61
Red flacked white	3.72	2.73	0.97	287.6	40.0	181.4	3.48	8.46	2.80	133.6	5.20

AST - aspartate aminotransferase; BA - bile acid; CK - creatine phosphokinase; UA - uric acid; GLU- glucose; CA - calcium; PHOS - phosphor; TP - total protein; ALB - albumin; GLOB - globulin; NA<sup>+</sup> - sodium.

The catabolism of lipid deposits may vary from one breed to another in harsh survival period (in the case of competitions) or to facilitate egg incubation.

During competitions, which involve long flight, energy consumption may exceed 7 to 10 times the rate of basal metabolism.

Lipid reserves in birds are stored as triglycerides having a high caloric density. Storing these reserves in some cases can double the body mass of the individual.

From a physiological point of view, birds are well equipped to deal with prolonged periods of starvation by lipid metabolism as the primary source of energy; in the case they have sufficient deposits, sufficient essential amino acids and vitamin reserves to facilitate lipid catabolism.

Schleucher & Withers (2002) reported that variability in basal metabolic rate (BMR) for different columbids is primarily determined by body mass, and the phylogeny has a much lesser influence, and is related to at least one aspect of their ecology, climate, with arid species having a low BMR.

## Conclusions

- As a result of the investigations on the total protein level, we obtained higher value in the black flacked white variety.
- The level of albumin is slightly increased in favor of the red flacked white variety against the black flacked white variety and higher than in the case of other two varieties, possibly due to the selective breeding.
- The level of globulin is very high in the white unicolor variety comparing to the other varieties probably due to the fact that this variety is lacking uropigian gland and the high level of globulins denotes a kidney disease.
- The higher level of glucose in black flacked white can be one of the reasons that that gives higher resistance to "play" compared to other color varieties.
- The high level of aspartate aminotransferase of the blue flacked white and white unicolor varieties versus the other two varieties may indicate a higher grade of antibiotics assimilation.
- Higher levels of creatine phosphokinase can be observed in the unicolor white variety, which indicates an intense effort because this increase is due to the fact that it has the longest flight compared to the other varieties.
- The higher amount of phosphorus induces an increased hyperactivity of the black flacked white variety versus the other color varieties.

- From a physiological point of view, birds are well equipped with mechanisms to deal with prolonged periods of starvation, due to their lipid metabolism, as the main source of energy, in case they have sufficient deposits, sufficient essential amino acids and vitamin reserves to facilitate lipid catabolism.

## References

- Andreasen C. B., Latimer K. S., Kricher I. M., Brown G., 1989 Determination of chicken and turkey plasma and serum protein concentration by refractometry and the biuret method. *Avian Diseases* 33:93-96.
- Diaconu P., Burloi G., 1975 *Biologie generala, genetica si ameliorare*. Editura Didactica si Pedagogica Bucuresti Publishing House, pp. 57, 58, 81, 84, 89, 95.
- Heinrich M., 1992a *Rasetauben*. Eugen Ulmer Publisher, Stuttgart, Germany, pp.31–38, 98–102.
- Heinrich M., 1992b *Rasetauben*. Eugen Ulmer Publisher, Stuttgart, Germany, pp. 31–38, 98–102.
- Heinrich M., 2004 *Creșterea porumbeilor*. M.A.S.T. Publishing House, Bucharest, Romania, pp. 116–134.
- Ionescu H., Oroian T. E., 2015 Phenotypic characterization of a population of pigeons, Galati players breed, black flecked white and red flecked white variety. *ABAH Bioflux* 7(2):177-182.
- Ionescu H., Oroian T. E., Botha M., 2015 Phenotypic characterization of a population of Galați players pigeon breed blue flecked white and white unicolor variety. *ABAH Bioflux* 7(2):183-187.
- Ionescu H., Oroian T. E., 2019 Hematological aspects of the Galati players pigeon breed. *ABAH Bioflux* 11(1):21-25.
- Pusta D. L., 2009 *Citogenetica și genetică mendeliana*. Alma Mater Publisher, Cluj-Napoca, Romania.
- Schleucher E., Withers P., 2002 Metabolic and thermal physiology of pigeons and doves. *Physiological and Biochemical Zoology* 75(5):439-50.

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