

# Haematological Characterization of Reproductive Status at Laying Hens by Age

P. C. Boisteanu, M. G. Usturoi, Roxana Lazar, B. V. Avarvarei

**Abstract**—Physiological activity of the pineal gland with specific responses in the reproductive territory may be interpreted by monitoring the process parameters used in poultry practice in different age batches of laying hens. As biological material were used 105 laying hens, clinically healthy, belonging to ALBO SL-2000 hybrid, raised on ground, from which blood samples were taken at the age of 12 and 28 weeks. The haematological examinations were concerned to obtain the total number of erythrocytes and leukocytes and the main erythrocyte constant (RBC, PCV, MCV, MCH, MCHC and WBC). The results allow the interpretation of the reproductive status through the dynamics of the presented values.

**Keywords**—laying hens, haematology, reproductive status,

## I. INTRODUCTION

THE secretor function of pineal gland is reflecting in the explaining of some important physiological functionality as part of the process of coordination and integration of the organism in the environment.

Numerous studies on the physiological implication of the pineal gland in the balance of body homeostasis demonstrated that it is an endocrine organ with multiple and varied implications especially in the coordination of circadian and seasonal rhythms [1, 3].

Pineal at birds has been shown to occur in regulation of the reproductive status [6]. Reproduction at birds is being characterized by the fact that the development of the ovulatory cycle is limited to several hours. Unlike mammals, only the ovary and the left oviduct are functional. The production of Müllerien inhibitory substance by the ovary determines the regression of the right duct, provided with a smaller number of specific receptors for estrogens hormones than the left duct. Suppressing the negative action of the Müllerien inhibitory substance, the estrogens promotes the predominant development of the ovary and left oviduct [5]. It differs morphologically from that of mammals because the 4-6 pre-ovulatory follicles are arranged in a distinct hierarchy and attached to the ovarian surface through follicle rods.

P. C. Boisteanu is with the University of Agricultural Sciences and Veterinary Medicine, Iasi-700489, Romania, Faculty of Animal Sciences (phone: 0040232407402; fax: 0040232260650; E-mail: paulb@uaiasi.ro).

M. G. Usturoi is with the University of Agricultural Sciences and Veterinary Medicine, Iasi-700489, Romania, Faculty of Animal Sciences (E-mail: umg@uaiasi.ro).

Roxana Lazar is with the University of Agricultural Sciences and Veterinary Medicine, Ia i-700489, Romania, Faculty of Veterinary Medicine (E-mail: lazarrxn@yahoo.com).

B. V. Avarvarei is with the University of Agricultural Sciences and Veterinary Medicine, Iasi-700489, Romania, Faculty of Animal Sciences (E-mail: bogdanavarvarei@yahoo.com).

The physiological activity of the pineal gland with specific responses in reproductive territory may be interpreted by monitoring the process parameters used in poultry practice in different age batches of laying hens [2, 4].

The measurement of haematological values made on lots of laying hens of different ages were taken to reflect the health status and body homeostasis during the laying cycle, knowing the fact that erythrocytes are involved in the characterization of estrogens hormone level caused by the hypothalamic–pituitary–epiphysis–gonads complex of laying birds.

The assessment of haematological status enables the interpretation of the influence of the maintenance conditions through the variations that they provide in poultry practice (food, parameters of microclimate and light regime).

## II. MATERIAL AND METHOD

*Birds*: 105 laying hens were taken in study, clinically healthy, belonging to ALBO SL-2000 hybrid, raised on ground, from which blood samples were gathered at the age of 12 and 28 weeks. Birds were batched into 7 batches of 15 individuals in each batch, identified by attaching different coloured rings, being maintained in similar conditions, the food administration was done *ad libitum*.

The microclimate parameters were insured according to the growth guide specific for the used hybrid.

*Working procedure*: the blood samples were gathered from brachial vein using 21G 1½" needles in vacuum system in 2 ml cuvette using the K3EK3EDTA anticoagulant.

*Blood tests*: the blood determinations were concerned to obtain the total number of erythrocytes and leucocytes and the main erythrocyte constant (RBC, PCV, MCV, MCH, MCHC, WBC), with automatic analyzer ABX Micros ABC VET.

## III. RESULTS AND DISCUSSIONS

The obtained values for the analyzed parameters are presented as the average of batches formed by experimental protocol.

The number of erythrocytes is influenced by sex, hormones, hypoxia and other factors. Erythrocytes have a short life (28-35 days) compared with human erythrocytes (50-60 days), due to high body temperature and metabolic rate.

At the first three lots the erythrocytes showed a declining path, starting from an average value, of  $2.19 \times 10^6/\text{mm}^3$  and ending with the lower limit of the obtained values respectively  $2.04 \times 10^6/\text{mm}^3$ . The maximum value ( $2.73 \times 10^6/\text{mm}^3$ ) has been recorded at the batch six being a  $0.69 \times 10^6/\text{mm}^3$  difference between the two extreme values, while the average value of all

results was  $2.26 \times 10^6/\text{mm}^3$ , value which coincided with the values obtained at the seventh lot.

TABLE I  
HAEMATOLOGICAL VALUES OBTAINED AT 12 WEEKS

Nr	RBC ( $10^6/\text{mm}^3$ )	PCV (%)	MCV ( $\mu\text{m}^3$ )	MCH (pg)	MCHC (g/100ml)	WBC ( $10^3/\text{mm}^3$ )
1	2.19	28.6	120.4	39.9	23.4	20.4
2	2.14	28.28	132.3	57.1	43.2	20.0
3	2.04	27.43	132.2	58.1	42.3	20.6
4	2.21	28.20	144.2	61.5	25.7	20.5
5	2.29	29.5	118.0	35.9	44.8	21.8
6	2.73	28.75	125.6	56.32	42.6	20.3
7	2.26	27.58	132.0	56.57	42.3	21.9

RBC – Erythrocyte number  $\times 10^6/\text{mm}^3$

PCV – Hematocrit;

MCV – Erythrocyte average volume;

MCH – Average quantity of erythrocyte haemoglobin;

MCHC – Average concentration of erythrocyte haemoglobin;

WBC – Total number of white cells.

The hematocrit values were within the area bounded by the value of the lower limit of 28.28 %, registered at batch 2 and the one of the upper limit, 29.5 % to batch 5. It has been pointed out that the limit values, both lower and upper have been recorded at batch 2 and 5.

Erythrocyte average volume showed a notable difference between the minimum ( $120.4 \mu\text{m}^3$ ) and maximum ( $144.2 \mu\text{m}^3$ ) of the determined values,  $23.8 \mu\text{m}^3$ , while for batches 2 and 3 these values were relatively constant,  $132.3 \mu\text{m}^3$  respectively  $132.2 \mu\text{m}^3$ .

The values determined for the average quantity of erythrocyte haemoglobin were within the minimum 39.9 pg at fifth batch, and a maximum 61.5 pg at batch 4, the area outlined by these extreme values is characterized by an average 52.19 pg for MCH.

Regarding the values for the mean concentration of erythrocyte haemoglobin, there was a variation in parameter values between the minimum of 23.4 g/100ml for batch 1 and a maximum of 44.8 g/100ml at batch 5. The values between 6<sup>th</sup> and 7<sup>th</sup> batches were similar, the difference was 0.3 g/100ml for the first, also being observed the superiority of the difference between consecutive values of batch 5 and 6 (2.2 g/100ml) than batches number 2 and 3 (0.9 g/100ml).

Leucocytes showed a mean value of  $20.78 \times 10^3/\text{mm}^3$ , at the experimental batches being recorded the minimum of  $20.0 \times 10^3/\text{mm}^3$  to batch number 2 and maximum of  $21.9 \times 10^3/\text{mm}^3$  at the 6<sup>th</sup> batch.

TABLE II  
HAEMATOLOGICAL VALUES OBTAINED AT 28 WEEKS

Nr	RBC ( $10^6/\text{mm}^3$ )	PCV (%)	MCV ( $\mu\text{m}^3$ )	MCH (pg)	MCHC (g/100ml)	WBC ( $10^3/\text{mm}^3$ )
1	2.9	32.4	115.6	50.4	43.0	23.8
2	2.9	37.7	127.2	50.7	46.2	23.7
3	2.9	35.7	113.8	51.5	43.9	23.6
4	3.1	35.4	111.8	49.3	44.2	30.1
5	3.0	32.7	113.7	43.7	43.4	29.7
6	3.0	31.2	117.9	53.1	47.2	28.8
7	2.4	30.3	127.4	53.5	44.7	27.8

RBC – Erythrocyte number  $\times 10^6/\text{mm}^3$

PCV – Hematocrit;

MCV – Erythrocyte average volume;

MCH – Average quantity of erythrocyte haemoglobin;

MCHC – Average concentration of erythrocyte haemoglobin;

WBC – Total number of white cells.

The number of erythrocytes ranged from a minimum of  $2.4 \times 10^6/\text{mm}^3$  at batch 7 and a maximum of  $3.1 \times 10^6/\text{mm}^3$  for batch 4. The intermediate values of  $2.9 \times 10^6/\text{mm}^3$  and  $3.0 \times 10^6/\text{mm}^3$ , had a constant evolution between the first three batches and batches 5 and 6. There was a slight increase in the difference between these two limits of the total number of erythrocytes from  $0.69 \times 10^6/\text{mm}^3$  at 12 weeks to  $0.70 \times 10^6/\text{mm}^3$  at 28 weeks.

Comparing the mean hematocrit values at 12 respectively 28 weeks, its superiority was observed for adult birds, being 33.6 % over 28.33 %, result recorded at 12 weeks. The maximum value of 37.7 % recorded for this parameter at batch 2 is followed by a continuous and steady decrease of all values at every experimental lots up to the limit of 30.3 %, corresponding to batch 6, value that represents the lower limit of the determined values.

Overall, the results determined for the mean erythrocytes volume are smaller at 28 weeks compared to the same parameter values determined at 12 weeks. They have ranged between a minimum of  $111.8 \mu\text{m}^3$  for batch 1 and a maximum of  $127.4 \mu\text{m}^3$  at batch 6, the average of all values being  $118.2 \mu\text{m}^3$ , the gravitational pole is represented by the value corresponding to the 6<sup>th</sup> batch.

The lower limit for the values of the average amount of erythrocyte haemoglobin was 43.7 pg, a higher result than the adequate extreme, but determined at 12 weeks. At 28 weeks we can say range field of the values for this parameter is less extensive than the area framed by the values measured at 12 weeks. The maximum (53.5 pg) for MCH occurred at the 7<sup>th</sup> batch, followed by a close value, 53.1 pg, corresponding to batch 8.

Regarding the average concentration of erythrocyte haemoglobin, these have ranged between a minimum of 43 g/100ml at batch 1 and a maximum of 47.2 g/100ml corresponding to the 6<sup>th</sup> batch, showing an average value of all the results, 44.65 g/100ml.

The extensibility of the area defined by the obtained values for the leucocytes at 28 weeks is higher than that of area defined by values of the same parameter, but determined at 12 weeks. The limits of the leucocytes evolve from a lower value of  $23.6 \times 10^3/\text{mm}^3$ , corresponding to batch 3 to a maximum of  $30.1 \times 10^3/\text{mm}^3$  for batch 4, in overall observing a growth of these values at 28 weeks to those obtained at 12 weeks.

#### IV. CONCLUSIONS

The study leads to a characterization from the haematological point of view of hybrid SL-2000 widespread in poultry farms and highlights the differences between categories of age and lets the possibility for reproductive status interpretation by the dynamic of the presented values.

The inclusion of these values in the domain described in the avian physiology justifies the conditions of maintenance and will be the basis for determining the correlation between the hormone levels that characterize a high productive potential and the variation of some microclimate parameters directly involved in the physiological modulation of this bird class.

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