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.

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 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 cuvete 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 values 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 2.19×10⁶/mm³ and ending with the lower limit of the obtained values respectively 2.04×10⁶/mm³. The maximum value (2.73×10⁶/mm³) has been recorded at the batch six being a 0.69×10⁶/mm³ difference between the two extreme values, while the average value of all
results was $2.26 \times 10^6$/mm$^3$, value which coincided with the values obtained at the seventh lot.

### TABLE I

**HAEMATOLOGICAL VALUES OBTAINED AT 12 WEEKS**

<table>
<thead>
<tr>
<th>Nr</th>
<th>RBC ($10^6$/mm$^3$)</th>
<th>PCV (%)</th>
<th>MCV (µm$^3$)</th>
<th>MCH (pg)</th>
<th>MCHC (g/100ml)</th>
<th>WBC ($10^3$/mm$^3$)</th>
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<tbody>
<tr>
<td>1</td>
<td>2.19</td>
<td>28.6</td>
<td>120.4</td>
<td>39.9</td>
<td>23.4</td>
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<td>2</td>
<td>2.14</td>
<td>28.28</td>
<td>132.3</td>
<td>57.1</td>
<td>43.2</td>
<td>20.0</td>
</tr>
<tr>
<td>3</td>
<td>2.04</td>
<td>27.43</td>
<td>132.2</td>
<td>58.1</td>
<td>42.3</td>
<td>20.6</td>
</tr>
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<td>4</td>
<td>2.21</td>
<td>28.20</td>
<td>144.2</td>
<td>61.5</td>
<td>25.7</td>
<td>20.5</td>
</tr>
<tr>
<td>5</td>
<td>2.29</td>
<td>29.5</td>
<td>118.0</td>
<td>35.9</td>
<td>44.8</td>
<td>21.8</td>
</tr>
<tr>
<td>6</td>
<td>2.73</td>
<td>28.75</td>
<td>125.6</td>
<td>56.32</td>
<td>42.6</td>
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<td>7</td>
<td>2.26</td>
<td>27.58</td>
<td>132.0</td>
<td>56.57</td>
<td>42.3</td>
<td>21.9</td>
</tr>
</tbody>
</table>

- **RBC** – Erythrocyte number ×10$^6$/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 µm$^3$) and maximum (144.2 µm$^3$) of the determined values, 23.8 µm$^3$, while for batches 2 and 3 these values were relatively constant, 132.3 µm$^3$ respectively.

The mean erythrocyte haemoglobin was 43.7 pg, a higher result than 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.

### TABLE II

**HAEMATOLOGICAL VALUES OBTAINED AT 28 WEEKS**

<table>
<thead>
<tr>
<th>Nr</th>
<th>RBC ($10^6$/mm$^3$)</th>
<th>PCV (%)</th>
<th>MCV (µm$^3$)</th>
<th>MCH (pg)</th>
<th>MCHC (g/100ml)</th>
<th>WBC ($10^3$/mm$^3$)</th>
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<td>115.6</td>
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<tr>
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<tr>
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<td>2.4</td>
<td>30.3</td>
<td>127.4</td>
<td>53.5</td>
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<td>27.8</td>
</tr>
</tbody>
</table>

- **RBC** – Erythrocyte number ×10$^6$/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 $2.4 \times 10^6$/mm$^3$ at batch 7 and a maximum of $3.1 \times 10^6$/mm$^3$ for batch 4. The intermediate values of $2.9 \times 10^6$/mm$^3$ and $3.0 \times 10^6$/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 $0.69 \times 10^6$/mm$^3$ at 12 weeks to $0.70 \times 10^6$/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 erythrocyte 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 µm$^3$ for batch 1 and a maximum of 127.4 µm$^3$ at batch 6, the average of all values being 118.2 µm$^3$, the gravitational pole is represented by the value corresponding to the 6th 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 7th batch, followed by a close value, 53.1 pg, corresponding to batch 8.

### 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.
REFERENCES


