DETERMINATION OF HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERES IN HENS AT DIFFERENT STAGES OF THE EGG FORMATION

DETERMINAREA UNOR PARAMETRII HEMATOLOGICI ŞI BIOCHIMICI LA GAINI IN DIFERITE STADII DE FORMARE ALE OULUI

ALINA GHISE¹, LILIANA CARPINISAN¹, OLGA RADA², RODICA ZEHAN², GHISE GH.

¹Faculty of Veterinary Medicine, Timișoara, Romania,
²Faculty of Agriculture, Timișoara, Romania

10 hybrid ISA Brown hens, 50 weeks old, hold single in cages and fed with combined granulated forage, were monitored for a period of 3 weeks. They were divided into 4 groups depending on the stages of the egg formation. When 53 weeks old, the blood samples were prevailed and thereafter prepared to determine the haematological parameters and the calcemia and phosphoremia.

The values of haematological parameters (the eritrocytes sedimentation rate, the haemoglobine content, the haematocrit and the leukocitar formula) are within the normal limits and that no variations appear depending on the egg position in the oviduct.

The calcemia values are within the normal limits (20-35 mg%) for hens during their laying period. The mean value is 34.19±0.96 mg%. The statistical processing of the data does not reveal significant differences (p>0.05) among the calcemia values, irrespective of the egg formation stage.

The phosphoremia values show significant modifications during the 24-25 hours necessary for the egg formation: at 30 minutes postoviposition the mean value of the phosphoremia represented 4.86±0.14 mg%, and at 22-23 hours postoviposition the level of the blood phosphorous represented 4.64±0.10 mg%, while at 10-12 hours postoviposition the registered mean value was 6.79±0.07 mg% phosphrous.

Keywords: laying fowl, haematological parameters, calcemia, phosphoremia.
Introduction

The egg formation is a very complex process that takes place in the left ovary and oviduct.

The mineral shell is formed through implantation and growth mechanisms of the calcite crystals that are covered up by calcium salts. These processes imply some complex mechanisms that ensure the large quantity of calcium necessary for both the calcification and maintaining the mineral homeostatic balance.

Materials and Methods

10 hybrid ISA Brown hens, 50 weeks old, hold single in cages and fed with combined granulated forage, were monitored for a period of 3 weeks. They were divided into 4 groups depending on the stages of the egg formation and slaughtered at 53 weeks old:

- I- slaughtered at 30 minutes after oviposition, when no egg in the oviduct
- II- slaughtered at 2-2.5 hours after oviposition, when egg was in the magnum
- III- slaughtered at 10-12 hours after oviposition, with egg in the uterus with formed shell membranes, with a fine calcium carbonate layer
- IV - slaughtered at 22-23 hours after oviposition, with egg in the uterus with nonpigmented completely formed shell, with a fine calcium carbonate layer

Before the slaughtering, the blood samples were prevailed and thereafter prepared to determine the haematological parameters (the eritrocytes sedimentation rate, the haemoglobin content, the haematocrit and the leukocitar formula) and the calcemia and phosphoremia by usual methods.

Results and Discussion

Determination of the haematological parameters

The determined haematological parameters were: the eritrocytes sedimentation rate, the haemoglobin content, the haematocrit and the leukocitar formula. The values of these blood parameters are presented in table 1.

The analysis of the results points out that the values of these parameters are within the normal limits (1, 5) and that no variations appear depending on the egg position in the oviduct.
Table 1

The values of haematological parameters (mean values) in hens at different stages of the egg formation

<table>
<thead>
<tr>
<th>Batch</th>
<th>Eritrocytes sedimentation rate</th>
<th>Hb</th>
<th>Ht (%)</th>
<th>NL/m³</th>
<th>Leucocitar formula</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30'</td>
<td>60'</td>
<td>90'</td>
<td>Sbly</td>
<td>g/100 ml</td>
</tr>
<tr>
<td>I</td>
<td>1.50±0.71</td>
<td>4.50±0.71</td>
<td>7.50±0.71</td>
<td>40.00±4.24</td>
<td>6.35±0.75</td>
</tr>
<tr>
<td>II</td>
<td>1.00±0.00</td>
<td>4.50±0.71</td>
<td>7.50±0.71</td>
<td>41.50±7.78</td>
<td>6.44±1.24</td>
</tr>
<tr>
<td>III</td>
<td>1.00±0.00</td>
<td>3.50±0.71</td>
<td>7.50±0.71</td>
<td>41.00±7.07</td>
<td>5.96±1.98</td>
</tr>
<tr>
<td>IV</td>
<td>1.00±0.00</td>
<td>2.50±0.71</td>
<td>8.00±0.00</td>
<td>41.00±1.41</td>
<td>6.56±0.23</td>
</tr>
</tbody>
</table>

The determination of the calcemia and the phosphoremia

The determined biochemical blood parameters of this experiment were the calcemia and the phosphoremia. Their values are represented in table 2

Table 2

The calcemia and phosphoremia values (mg/100ml) in hens at different stages of the egg formation

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Hen</th>
<th>Calcium</th>
<th>Phosphorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 min postoviposition</td>
<td>G1</td>
<td>34.59</td>
<td>4.96</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>34.41</td>
<td>4.76</td>
</tr>
<tr>
<td></td>
<td>Mean value</td>
<td>34.65±0.33</td>
<td>4.86±0.14</td>
</tr>
<tr>
<td>2-2.5 hours postoviposition</td>
<td>G3</td>
<td>34.52</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>G4</td>
<td>33.95</td>
<td>5.52</td>
</tr>
<tr>
<td></td>
<td>Mean value</td>
<td>34.23±0.40</td>
<td>5.31±0.29</td>
</tr>
<tr>
<td>10-12 hours postoviposition</td>
<td>G5</td>
<td>33.81</td>
<td>6.71</td>
</tr>
<tr>
<td></td>
<td>G6</td>
<td>33.8</td>
<td>6.82</td>
</tr>
<tr>
<td></td>
<td>G7</td>
<td>33.93</td>
<td>6.85</td>
</tr>
<tr>
<td></td>
<td>Mean value</td>
<td>3.58±0.32</td>
<td>6.79±0.07</td>
</tr>
<tr>
<td>22-23 hours postoviposition</td>
<td>G8</td>
<td>34.32</td>
<td>4.55</td>
</tr>
<tr>
<td></td>
<td>G9</td>
<td>34.15</td>
<td>4.63</td>
</tr>
<tr>
<td></td>
<td>G10</td>
<td>34.4</td>
<td>4.75</td>
</tr>
<tr>
<td></td>
<td>Mean value</td>
<td>3.29±0.12</td>
<td>4.64±0.10</td>
</tr>
</tbody>
</table>

As the analysis of the data shows the calcemia values are within the normal limits (20-35 mg%) for hens during their laying period (5). The mean value is 34.19±0.96 mg%.

The statistical processing of the data by means of the ANOVA test does not reveal significant differences (p>0.05) among the calcemia values, irrespective of the egg formation stage.
The phosphoremia values show significant modifications during the 24-25 hours necessary for the egg formation.

At 30 minutes postoviposition the mean value of the phosphoremia represented 4.86±0.14 mg%, and at 22-23 hours postoviposition the level of the blood phosphorous represented 4.64±0.10 mg%, while at 10-12 hours postoviposition the registered mean value was 6.79±0.07 mg% phosphorous.

The analysis of the factorial variance carried out by means of the ANOVA test shows that there are significant differences (p=0.000) for the phosphoremia values among the four batches. The post-hoc analysis carried out by means of the Tukey test shows that the level of the blood phosphorous rises significantly at the hens slaughtered at 10-12 hours postoviposition as compared with the hens slaughtered at 30 minutes postoviposition (p =0.000) and at 2-2.5 hours postoviposition (p=0.000).

These variations of the phosphoremia values are correlated to the presence, position of the egg in the oviduct, and the stage of its formation.

At 30 minutes (when there is no egg in the oviduct) and at 22-23 hours (egg with formed shell) no eggshell calcification processes take place in the oviduct, but during this time bone remodelling processes, and calcium regeneration processes of the medullary bone take place.

Bone remodelling is carried out by calcium deposition under the form of tricalcic phosphate that leads to phosphoremia reduction. The growth with 28.3% of the phosphoremia values at 10-12 hours postoviposition, during the process of the shell calcification, is the result of the medullary bone resorption through which the calcium is eliminated alongside with the phosphorous.

Our experiment reveals that the phosphoremia fluctuations are not accompanied by the calcemia fluctuations (fig. 1). The calcemia is kept at constant values even when shell calcification processes through two important mechanisms take place: intestinal absorption and bone resorption. These mechanisms are capable to maintain the calcium homeostasis in the conditions of a corresponding diet (6).

Unbalanced calcium diets lead to hypocalcemia and to intensified bone resorption processes, which in time affect both the cortical and the medullary bones leading thus to osteoporosis and to the diminishing or total absence of egg production 6).

At the laying hens the calcemia value represents approximately 20-35 mg/100 ml, twice as high as at a chick. (4). In order to form the egg shell 100-150 mg of calcium are transported per hour from the blood and if calcium is not rapidly renewed by intestinal absorption or medullary bone mobilisation, the calcemia would decrease to zero in 10-12 minutes. If the diet assures a calcium level of 3.5% (or more) then most of the mobilized calcium for the egg shell formation comes from the intestinal absorption. If the diet assures less than 1.95% of calcium then the medullary bone will furnish 30-40% of the calcium needed for the egg shell formation. If the diet contains no calcium, then the necessary calcium amount for
the egg shell formation is delivered by the medullary bone. The consequence is that after a short period of time the egg laying stops (2, 3)

![Graph showing calcemia and phosphoremia values in hens at different stages of egg formation.](image)

**Fig. 1.** The calcemia and phosphoremia values (mg/100ml) in hens at different stages of the egg formation.

The calcium and seric phosphorous variations during the egg formation (24 hours) take place after the following pattern:

- 2/3 of the time (~18 hours) – bone resorption processes in the medullary bone take place with the release of calcium and phosphorous
  - calcium – used for the egg shell calcification at a corresponding diet, constant blood level is maintained
  - phosphorous – is not used for egg shell formation, as a consequence its blood level rises
- 1/3 of the time (~6 hours) - the calcium and phosphorous are used for the re mineralization of the medullary bone. As a consequence the level of the seric phosphorous falls significantly
  - the seric level of the calcium is not modified significantly because of the intestinal absorption rise.

**Conclusions**

The haematological parameters are within the normal limits without modifications induced by the stages of the egg formation.

In conditions of a corresponding diet, due to the intestinal absorption and the bone resorption, the blood level of the calcium is not modified significantly, depending on the stage of the egg formation.

The blood level of the phosphorous is modified significantly (p= 0.000) during the egg formation as a result of the bone dynamics.

The level of the blood phosphorous grows significantly at 10-12 hours postoviposition, during the egg shell mineralization process, as compared to the hens slaughtered at 30 minutes postoviposition (p= 0.000), when there is no egg in the oviduct, and at 2-2.5 hours postoviposition, when the egg is in the uterus and the egg shell mineralization process starts.
References