Aspects of metabolic disorders in pigs fed exclusively with barley

Dr. Rădoi Ion 1, Dr. Tudoran Cristina* 2

1Veterinary Medicine University, 050557, Bucharest, Romania
2Institute of Diagnosis and Animal Health, 050557, Bucharest, Romania
*Corresponding author: tudoran.cristina@idah.ro

Abstract
Nutritional surveillance on pig herds, represents the main way to increase the pig production and eventually to obtain a high quality meat production.

Alimentary stress caused in pigs fed exclusively with barley, induce serious health problems, affecting productive performance, such as daily consume, daily average output, conversion rate. Our research establish the variation of some biochemical and hematological values such as erythrocytes and leukocytes number, albumins, total globulins, glucose, total cholesterol, total lipids, gamma globulins, ser iron, ceruloplasmine, CPK, A and E vitamins, PT, Hemoglobin, HCT, MCHC..

The stress produced in pigs fed exclusively with barley, increase the level of metabolic disorders, the values obtained showing progressive hypoglycemia, a lack of vitamin A and E, leukocytosis, hyperlipemia and hypercholesterolemia progressive, enzymatic disorders(hypoceruloplasminemia, hypercreatine phosphokinazemia), in anemia context.

Introduction
This research emphasizes the main aspects of the metabolic profile in pigs fed exclusively with barley, in order to ensure the most efficient monitoring of the pig populations in farms and to avoid nutritional/metabolic disorders induced by the alimentary stress.

The results of this research are intended to help in several areas: establishing the therapeutic and prophylactic measures necessary to obtain high quality pork, leveraging the fodder reserves with an average daily gain, etc.

Materials and methods
The research is conducted in a pig farm during July – August 2005, on two groups of animals with 25 members each and with the same age, one fed with mixed fodder and the other experimentally fed only with barley.

The experimental group comprises 25 pigs, age 90 days, fed exclusively with barley ground for 20 days, the whole experiment period.

The control group comprises 25 pigs, age 90 days, fed with mixed fodder, recipe 02, for 20 days with the following ingredients: barley 32.6%, wheat 36%, soybean groats 24%, meat and bone flour 3.8%, mineral and vitamin supplements 3.6%.

Results
Blood samples taken at the moments T0, T1 (after 10 days), and T2 (after 20 days) from the piglets in both groups, are analyzed statistically (the average and the standard deviation) and compared with the reference values for the species and the category, as systematized in the table below:

<table>
<thead>
<tr>
<th>Investigated parameters</th>
<th>Measuring unit</th>
<th>Barley diet group at T1</th>
<th>Barley diet group at T2</th>
<th>Control group at T1</th>
<th>Control group at T2</th>
<th>Reference Values</th>
<th>Momentary Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total lipids</td>
<td>mg/dl</td>
<td>401±24,9</td>
<td>287±34,9</td>
<td>199±27,9</td>
<td>236±19,9</td>
<td>235±19,9</td>
<td>257±34,8</td>
</tr>
<tr>
<td>Total globulins</td>
<td>g/dl</td>
<td>3.70±0.82</td>
<td>3.03±0.41</td>
<td>3.08±1.1</td>
<td>3.10±0.15</td>
<td>3±0.4</td>
<td>2.92±0.6</td>
</tr>
<tr>
<td>Total protein</td>
<td>g/dl</td>
<td>5.50±0.60</td>
<td>4.53±0.27</td>
<td>5.75±0.7</td>
<td>5.60±0.4</td>
<td>5.40±0.4</td>
<td>5.45±0.8</td>
</tr>
<tr>
<td>Albumins</td>
<td>g/dl</td>
<td>1.60±0.01</td>
<td>1.44±0.06</td>
<td>2.8±0.70</td>
<td>2.30±0.12</td>
<td>3.2±0.6</td>
<td>2.75±0.4</td>
</tr>
</tbody>
</table>
Discussion

The main biochemical blood parameters are analyzed (total globulins, gamma globulins, total proteins, albumins, total lipids, total cholesterol, serum iron, ceruloplasmin, creatine phosphokinase, vitamin A, vitamin E), as well as the main hematological parameters (hemoglobin, hematocrit, mean corpuscular hemoglobin concentration, number of erythrocytes and leukocytes).

The number of leukocytes at T1 and T2 in pigs fed only with barley is significantly higher than the reference values and the values of the control group. These increased values draw an ascending curve, implying that high leukocyte numbers are a hematological stress reaction, accentuated in pigs fed exclusively with barley.

![Figure 1](image-url)

**Figure 1.** The increase of leukocytes number in experimental group compared with the reference, momentary and control group values

In the experimental group, the values of gamma globulins and albumins at T2 are much lower than the values of the control group and the reference values, showing a severe disorder of the protein metabolism, closely related with the iron deficiency confirmed in pigs fed exclusively with barley.

The energetic deficiency of the exclusive barley diet induces severe hypoglycemia in the pigs in the experimental group, unlike the control group and the references values.
Figure 2. Compared aspects of lipids and glucose values in the two groups of pigs

The total cholesterol values are significantly higher at T1 and T2 in relation to T0, for the pigs fed with barley, as compared with the references values and the values of the control group. These results, together with the increased level of total lipids for this group, show not only a hepatic disorder, but also a mobilization of stored lipids, a typical aspect for stress situations.

The decrease of the iron levels in pigs fed with barley, as compared with the reference values and the control group values, explains the subsequent anemia, closely related with the low values of ceruloplasmin, the enzyme responsible for the oxidation of ferrous iron.

The increase values of creatine phosphokinase in pigs fed with barley illustrate the effect of stress on the muscular mass. These values correlate with the aggressive behavior present during certain stages of the stress syndrome (characteristic for starvation).

Figure 3. The increased values of creatine phosphokinase in experimental group compared with the reference, momentary and control group values

Determining the creatine phosphokinase values is essential since, together with GOT values, they are important factors in monitoring the pork quality.

In pigs fed only with barley ground, the lower ceruloplasmin levels and the higher creatine phosphokinase levels induce a stress syndrome, expressed by tissue autophagy, poor administration of energy resources or their poor conversion.

The significantly low values of vitamin A and E, caused by the low supply of retinol and tocopherol, together with the high values of creatine phosphokinase, induce a myopathy distinguished by the low pork quality.
Figure 4. The decreased ceruloplasmin values in experimental group compared with the reference, momentary and control group values.

Conclusions
The conclusions obtained in the end of this experiment are the following:
1. An exclusive barley diet in pigs induces severe metabolic disorders that can lead to severe illness, since the immune system is also impaired.
2. Enzymatic disorders lead to low quality pork with stress muscular mass (PSE), because of the subsequent anemia and the lack of antioxidants (vitamin A and E).
3. Starvation stress induced by an unhealthy and uneconomic diet (barley ground only) leads to severe energy disorders caused by the low blood values of lipids and glucose and the high cholesterol value.
4. The high leukocyte values in pigs fed exclusively with barley ground shows that this type of feeding is an alimentary stress, inducing nutritional anemia as well as vitamin, mineral and protein deficiency.

References
6. RĂDOI ION, LEAU S., BONECEA I., -Animals metabolism, nutrition and adaptation diseases, Ed. Printech, Bucharest., 2003