SERUM GLUCOSE AND ALT CONCENTRATIONS DURING DIFFERENT LEVELS OF TRAINING IN HORSES

SVATAVA HUEBEROVA¹, STANISLAV NAVRATIL², ALES PAVLIK³
¹Department of Animal Nutrition and Forage Production
²Department of Animal Breeding
³Department of Animal Morphology, Physiology and Genetics
Mendel University in Brno
Zemedelska 1, 613 00 Brno
CZECH REPUBLIC
xhuebero@mendelu.cz

Abstract: This work is targeted on influence of various factors on biochemical blood parameters of horses, especially physical activity, or stress. The main goal is to evaluate knowledge about blood content and use of biochemical indicators in horse diagnostics. Sixteen Czech Warmblood horses were used in experiment. All of this horses were stallions in age 3 years. They were divided on the basis of their stabling and training status. Group A, free range stabled, trained only easily before the blood sampling, and group B, in a box stabled, with intensive training, jumping and dressage six times in a week. Lower glucose and Alanine Aminotransferase (ALT) levels were determined in blood of easily trained horses (group A). Differences between the observed groups were significant only for glucose. The moderate negative correlation between ALT and glucose was found in group B (r = -0.405). This correlation was very low in group A.

Key Words: horse, glucose, ALT, stress, biochemical parameters

INTRODUCTION

The information about biochemical response of horses submitted to physical exercise such as dressage and jumping is limited and controversial. The training of horse involves periodic exercises that cause structural, functional and behavioral changes (Lindner 2000). These exercises prepare horses for the competitions. High performance of the athlete horse is determined by many complicated interdependent physiological and hematological processes (Warwick 2004). Analyzes and study the modifications of blood parameters is very important for understanding of horse physiology, function and types of energy utilized (De Miranda et al. 2009). Biochemical and hematological parameters have been studied during different kinds of physical effort, such as trot races (Piccione et al. 2009), or 130 km long endurance ride (Noleto 2016). After the warm up the glucose values showed a significant decrease and a significant increase after the show jumping test (Fazio et al. 2014). Glucose significantly decreased also during endurance race for 120 km in Scandinavian studies (Larsson et al. 2013).

Alanine Aminotransferase (ALT), formerly known as glutamic pyruvic transminase is not specific to liver. Increases in ALT may be caused by acute liver failor, but also by myositis; therefore ALT is not useful for predicting liver diseases of horses. (Reeder et al. 2009). Normal range of ALT is between 0.08–0.25 µkat/l (Inlab Medical 2001).

The aim of the study was to evaluate glucose and ALT concentration in blood of horses with different training levels. And to determine whether there is a correlation between concentration of ALT and glucoses of low and high intensity training horses.

MATERIALS AND METHODS

Animals and breeding conditions

Sixteen Czech Warmblood horses (stallions) in age 3 years were used in this experiment. Two groups were formed, eight horses each. This division was based on stabling and training status: group
A, free range stabled, trained only easily before the blood sampling, and group B, in a box stabled, with intensive training, jumping and dressage six times in a week.

All horses were stabled in Provincial Stud Farm Tlumačov. The area was located in altitude 200 meters above sea level. During the experiment was average air temperature 7.6 °C.

**Collection of blood samples**

Blood was sampled from *vena jugularis externa*. During sampling there was effort of avoiding horse excessive excitation. ALT and glucose was analysed from blood serum spectrophotometrically using XT20i automatic analyser (Thermo Fisher Scientific, Finland). Currently available commercial kits by Biovendor-laboratory medicine were used for analysis.

**Statistical evaluation**

The data were expressed as means ± SEM. For comparisons Student's t-test was used. Statistica 8.0 statistical software (StatSoft Inc., Tulsa, USA) was used to analyse all data from this experiment. The level of statistical significance was defined as P= 0.05. Correlations among the glucose and ALT concentration of the animal’s blood were evaluated by means of the correlation coefficient at the level of probability (P=0.05).

**RESULT AND DISCUSSION**

Lower glucose and ALT levels were determined in blood of horses easily trained (5.74 ± 0.23 mmol/l and 0.19 ± 0.02 µkat/l) compared with intensive trained horses (7.51 ± 0.22 mmol/l and 0.21 ± 0.02 µkat/l). Based on the statistical analysis, differences between the observed groups were significant with glucose (p = 0.00002), but not significant with ALT (p = 0.50851).

<table>
<thead>
<tr>
<th>Table 1 glucose level in blood of both groups (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
</tr>
<tr>
<td>Group A</td>
</tr>
<tr>
<td>Group B</td>
</tr>
</tbody>
</table>

Table 2 ALT level in blood of both groups (µkat/l)

<table>
<thead>
<tr>
<th>Table 2 ALT level in blood of both groups (µkat/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
</tr>
<tr>
<td>Group A</td>
</tr>
<tr>
<td>Group B</td>
</tr>
</tbody>
</table>

The correlation between Glucose and ALT in the group of easily trained horses was not existent (r = 0.067) as can be seen on Figure 1. Very low correlation was determined in the group of intensive trained horses (r = -0.405) as can be seen on Figure 2.

Hanák and Olehla (2010) claimed, that training of young horses caused glucose increase in blood. This statement agrees with result of this work. Ferraz (2010) also proved, that concentration of glucose was raised with intensive training and higher glucose concentration could be an indicator of performance and readiness for the competition. Malinowski (2004) reported, that higher glucose level may also be an indicator of horse stress. Cortisol, glucocorticoid of the adrenal gland, acts to assist the animal in relieving stress by increasing glucose to provide energy which enables the horse to escape from the stressor.

Results of ALT agree with normal reference ranges for horses as same as concentration of glucose (Cit VFU 2007, Cal Vet 2013, Laboklin 2016, Inlab Medical 2001). Higher ALT levels in blood of intensive trained horses compared with easily trained horses corresponds to the results of the study made by Larson (2013) The possible explanation of this increase would be the greater muscle growth which is related to more intensive cell changes.

In the Gudasheva (2016) study, it was found that jumping exercise induce changes not only in ALT but also increases of biochemical parameters: creatin kinase (CK), aspartate aminotransferase (AST), triacylglycerols, total cholesterol and creatinine within the reference ranges. Gudasheva (2016)
claimed, that changes in these parameters reflects the changes in skeletal muscle and kidney functions as well as alterations in the type of used energy.

Figure 1 The correlation between the concentration of blood glucose and ALT in the group of easily trained horses

CONCLUSION

Lower glucose and ALT levels were determined in blood of easily trained horses, than in blood of intensive trained horses. Differences between the observed groups was significant for glucose but...
was not significant for ALT. In of intensive trained horses, there was found very low correlation between ALT and glucose ($r = -0.405$). This correlation was not found in of easily trained horses.

**ACKNOWLEDGEMENT**
The study was supported by the grant project IGA IP 7/2017.

**REFERENCES**


Malinowski, K. 2004. Stress management for equine athletes.*Rutgers New Jersey Agricultural Experiment Station* [Online]. Available at: https://njaes.rutgers.edu/pubs/publication.asp?pid=FS716 [2017-10-09].


