The Effect of Age on Biochemical Parameters on Horses

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Abstract

The aim of this study was to observe the effect of age on selected biochemical parameters of horses' blood. Horses were divided in four age categories (5, 6, 7 and 9 years old). Blood was collected from 31 horses (Furioso breed). Assessment of biochemical parameters was realized by Randox RX Monza analyzer. Significant differences were observed between different groups in total proteins. Concentrations of calcium, phosphorus, sodium, potassium and chlorides correlate with the age of the animals. Similarly, liver enzyme activities correspond to age groups. In the other monitored biochemical parameters any significant differences between the groups were found. The achieved results confirm the connection between age of horses and values of biochemical parameters.

Keywords: age, biochemical parameters, blood, horse

1. Introduction

Recently, great emphasis has been placed on welfare and health of horses [1, 2].

Monitoring of biochemical blood serum parameters of horses in relation to age is a valuable factor assessing the physical condition of horses [3, 4]. Specific age reference values are needed for the correct interpretation of the results of the biochemical parameters of horses [5].

Depending on the mentioned information, the present study was conducted to evaluate the effects of age on the biochemical parameters (total proteins (TP), glucose, triglycerides (TG), aspartate aminotransferase (AST), alanine amino-transferase (ALT), alkaline phosphatase (ALP) and cholesterol (Chol), calcium, phosphorus, potassium, sodium, chloride ions).

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2. Materials and methods

2.1. Animal management

Blood was collected from adult horse (n=31) from Nitra region. Horses were in age of 5-9 years composed of Furioso breed. Horses divided in four age categories (5, 6, 7 and 9 years old). Horses were stabled in boxes with straw bedding and fed with oat and hay.

2.2. Blood sampling

Blood samples for biochemical assessment were collected by a qualified veterinarian form *vena jugularis* and placed in tubes without additives. For the biochemical analyses the blood samples were centrifuged for 10 min at 3000 x g and blood serum was collected [6].

2.3. Biochemical analyses

Potassium (K), sodium (Na) and chloride ions were measured with an ion-selective electrode [7]. Phosphorus (P), calcium (Ca), total proteins (TP), glucose (Gluc), triglycerides (TG), aspartate aminotransferase (AST), alanine amino-transferase (ALT), alkaline phosphatase (ALP), cholesterol (Chol) were determined using commercial kits DiasSys (Diagnostic Systems GmbH, Holzheim, Germany) on the Randox RXMonza analyzer (Crumlin, United Kingdom) [8].

2.4. Statistical analyses

The significance of differences between the experimental groups was evaluated by Student´s t-test, the Statistical Analyses System (SAS 9.2. using of application Enterprise guide 5.1) was used. All statistical tests were carried out at levels of significance at $^{*}p<0.05$, $^{**}p<0.01$ and $^{***}p<0.001$ and results were interpreted as means.

3. Results and discussion

Concentrations of mineral profile parameters are listed in Table 1. Significant differences between age groups were observed only for potassium ($^{*}p<0.05$).

Results of total proteins and alanine amino transferase showed significant differences ($^{*}p<0.05$). Significant differences between other analyzed biochemical parameters were not observed (Table 2).

Table 1. Concentration of mineral profile parameters in horse blood

Parameter	5 years old			6 years old			7 years old			9 years old		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Ca (mM/L)	3.41	2.70	3.76	3.50	2.84	4.09	3.15	2.12	3.62	3.26	3.19	3.30
P (mM/L)	1.30	1.08	1.65	1.34	1.08	1.61	1.22	0.88	1.76	0.93	0.86	1.00
Na (mM/L)	136.71	134.40	138.30	135.65	134.00	138.30	136.50	133.10	137.50	137.00	135.00	137.40
K (mM/L)	3.81*	2.93	4.78	4.44*	3.45	5.31	4.59*	3.66	5.08	4.19*	3.87	4.46
Cl (mM/L)	99.70	98.00	102.10	98.50	96.00	100.40	98.61	97.10	100.50	99.33	97.10	100.50

All values indicate mean values. The level of significance was set at $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$. Ca-calcium, P-phosphorus, K-potassium, Cl-chloride ions

Table 2. Concentration of selected blood biochemical parameters

Parameter	5 years old			6 years old			7 years old			9 years old		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
TP (g/L)	58.98*	51.29	69.28	59.14*	50.52	73.11	60.63*	52.33	72.38	61.97*	53.45	77.35
Gluc (mM/L)	3.73	3.27	4.24	4.83	2.77	8.76	5.35	4.25	6.92	7.17	5.64	7.98
AST (μkat/L)	4.98	3.61	6.21	4.80	3.65	5.84	3.87	3.39	4.31	3.98	3.26	4.61
ALT (μkat/L)	0.11	0.09	0.14	0.08	0.03	0.13	0.05	0.03	0.07	0.10	0.08	0.14
ALP (μkat/L)	5.55*	4.23	6.64	6.31*	4.65	8.44	4.67*	3.14	6.02	5.69*	4.09	6.55
Chol (mM/L)	2.55	2.14	3.05	2.39	2.05	2.87	2.44	1.96	2.92	1.66	0.11	2.75
TG (mM/L)	0.46	0.36	0.65	0.38	0.27	0.56	0.35	0.26	0.49	0.24	0.20	0.29

All values indicate mean values. The level of significance was set at $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$. AST-aspartate aminotransferase, ALT-alanine aminotransferase, ALP-alkaline phosphatase

The analysis of the biochemical parameters of the blood of horses is a very important factor by which the health of horses can be monitored [9]. When evaluating the mineral profile, the levels of calcium, phosphorus, sodium, potassium and chlorides were measured. Our results of mineral profile parameters are in correspondence with previous study of Galik et al. [10]. Roubies et al. [11] observed that serum macroelements of sheep (Ca and P) were affected by age.

In terms of monitoring, the lowest value of total proteins was in the group of 6-year-old horses (50.52 g/L). The highest measured value was 77.35 g/L and the values are characterized by a slight deviation from the reference values given by Vrzgula et al. [12]. Zinkl et al. [13] found that concentrations of total protein increase with rising age in donkeys.

To evaluate the energy profile, glucose and triglycerides were monitored. The minimum value

of glucose was 2.77 mM/L and the maximum value in the group of 6 years old horses was 8.76 mM/L. Our results correlate with reference values given by Rickett et al. [14], only in the group of 9 years old horses higher concentration of glucose compare to reference values was observed. A significant reduction in blood glucose can be caused by a lack of standby energy in the feed ration [10]. An increase in blood glucose is often caused by overfeeding with easily digestive carbohydrates, diabetes, and stress or by great effort [15]. Gurgoze et al. [16] reported that levels of glucose in foals were not significant different compared to levels in adult mares

Ttriglycerides content in blood of horses in our study are in the range of reference values in study of Pritchard et al. [17]. The highest value of AST was in the group of 9-year-old horses. Our values are outside of the reference values given by Rickett et al. [14]. Low value of AST can be caused by hepatitis, cirrhosis [12]. Nakai et al. [18] found decreasing trend in ALP activity with advancing age in cats. Significantly higher ALT activity was observed in adult cats compared with kittens.

4. Conclusions

The results of this study indicate that concentrations of total proteins are in connection with age of horses. Some parameters of the hepatic profile indicate differences between age groups. Differences between age groups in biochemical parameters glucose and triglycerides did not show statistically differences. Only in potassium from parameters of the mineral profile statistically significant differences was observed.

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