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INFLUENCE OF PHYSICAL AND EMOTIONAL LOADINGS ON DYNAMICS OF BIOCHEMICAL INDICATORS OF BLOOD SERUM OF RACE HORSES OF GROUP OF UNIVERSAL USE

Bayeva T. I., Zhegunov G. F.
Kharkiv State Zooveterinary Academy, Kharkiv, Ukraine, e-mail: tendalsi@mail.ru

Summary. The dates concerning dynamics of level of biochemical indicators of the blood serum of race horses of group of universal use of the Ukrainian riding breed are given in the article. Clinically healthy horses were an object of a research. The samples of blood were taken from the jugular vein to get serum and for further biochemical research. The blood was taken in the condition of relative rest, immediately after ordinary training and after emotional stress during the entertaining performance with participation of a large number of people and loud music. In blood serum the following biochemical indicators were defined: total protein, urea, creatinine, uric acid, total bilirubin and its fractions, glucose, cholesterol, triglycerides, Calcium, Iron, lactate, pyruvate, activity of the ALT, AST, GGT, LDH, ALP. It is established that during training and psycho-emotional loadings of race horses of the Ukrainian riding breed multidirectional changes of level of biochemical indicators in the blood serum were observed that testify the tension of metabolic processes in the animal organism. Emotional loading is the more strong stress factor that causes negative changes in the level of metabolic profile indicators.

Keywords: race horses, biochemical indicators, blood serum, training, stress

Introduction. In recent years the attention to equestrian sport has increased. Experts have complicated challenges: to keep efficiency of animals, to increase their sports longevity, to promote adaptation of a horse to conditions of training process at most, to correct a physiological condition of horses adequately and in time, to avoid an overtraining, to minimize a psychological and physiological stress (Borodkina, 2008; Gorbunova 2009; Mansurova 2009; Polozkov, 1985).

Biochemical methods give a chance to estimate adaptation potential of horses in the conditions of various loadings and to estimate effectively the state of health of horses and their training opportunities (Tkhinvaleli, 2011).

The purpose of the research — to establish the influence of physical and emotional loadings on biochemical indicators of blood serum of horses of the Ukrainian riding breed of group of universal use.

Materials and methods. Twelve race horses of the Ukrainian riding breed were selected for the research. Animals were at the same time used in various performances (show jumping, dressage, horse theater) so horses were brought together in separate group of universal use. All animals were clinically healthy. The samples of blood were taken from the jugular vein to get serum and for further biochemical research. The blood was taken in the condition of relative rest, immediately after physical loading and emotional loading (stress) during entertaining performance with participation of a large number of people and loud music. In blood serum the following biochemical indicators were defined: total protein, urea, creatinine, uric acid, total bilirubin and its fractions, glucose, cholesterol, triglycerides, Calcium, Iron, lactate, pyruvate, activity of the ALT, AST, GGT, LDH, ALP. Defining of biochemical indicators were made according to common used methods.

Calculations of the received results were carried out on the personal computer by means of the statistical program Statistica 7.0 (StatSoft, USA).

Results of research. Dynamic of biochemical indicators of blood serum of race horses of universal group of use with different options of stress loading is given in Tables 1–4.

As it is specified in Table 1, in blood serum of horses changes of level of the total protein with both options of loading are not observed.

It corresponds to absence of changes of urea content after physical loading and to its insignificant reduction after emotional pressure. Obviously, these loadings do not significantly influence the ability of a liver to synthesize proteins of blood serum of race horses of group of universal use adapted to different options of loadings. Concentration of creatinine increases by 21.0% ($p \leq 0.001$) after physical loading of animals while at emotional pressure the indicator increases only by 7.4% ($p \leq 0.001$). Obviously, such distinction is caused by more active participation of muscular system of animals in the conditions of the increased physical activity. However, these fluctuations of concentration of creatinine do not exceed the limit of reference norm for horses and have functional character. The most essential distinctions are established in the analysis of changes of content of uric acid in blood serum of horses in both groups. So at a physical loading concentration of uric acid has increased

by 27.0% (p≤0.05) while at an emotional loading for 74.2% (p≤0.001). Uric acid is a biomarker of an oxidative stress that indicates stronger stressful effect of emotional loading on horses in comparison with physical loading.

The further analysis of results of a research (Table 2) has confirmed this conclusion as the majority of the studied indicators in blood serum of horses of this group after physical loading authentically did not differ from indicators in a condition of relative rest. It concerns such tests as the general bilirubin and its fractions, activity of ALT, AST, GGT. After emotional loading significant increase in the general bilirubin by 105.4% (p≤0.001) at the expense of both of its fractions, and also activity of ALP (p≤0.05) for 28.6% was observed that indicates the stagnation in external bile-excreting channels. Most likely it happens because of spasm after the emotional loading caused by a big congestion of people and loud music. More often it happens with animals which are not adapted to such conditions. At the same time activity of GGT in serum of blood of horses after an emotional loading has gone down for 13.1% (p≤0.01) that does not go beyond reference norm for horses. It is known that increase in serum of blood of this enzyme allows to establish stagnation in the intra hepatic bilious ways and definition of ALP has limited diagnostic value for horses. Therefore it is possible to come to a conclusion that hyperbilirubinemia that was determined in the research is temporary and does not confirm pathological changes of hyperbiliar system after emotional loading.

Table 1 – Indicators of protein metabolism of blood serum of horses in a condition of relative rest, after physical and emotional loadings (n=12)

Indicators		Conditions of relative rest	Conditions after physical loading	Conditions after emotional loading
Total protein, g/liter	M±m	60.2±1.06	67.6±3.04	57.9±0.80
	Lim	54.7–66.4	54.5–81.6	52.8–61.6
Urea, mmol/liter	M±m	7.2±0.17	7.0±0.37	5.8±0.08**
	Lim	6.1–7.9	4.3–8.6	5.3–6.2
Creatinine, μmol/liter	M±m	115.0±1.22	139.2±4.28***	123.6±1.67*
	Lim	106.5–120.6	116.2–156.1	115.3–131.4
Uric acid, μmol/liter	M±m	43.2±3.06	55.0±1.51*	75.3±2.53***
	Lim	25.2–54.1	44.3–61.5	60.6–85.4

Note: * — p≤0.05, ** — p≤0.01, *** — p≤0.001 — in comparison with conditions of relative rest

Table 2 – Indicators of activity of enzymes in blood serum of horses in a condition of relative rest, after physical and emotional loadings (n=12)

Indicators		Conditions of relative rest	Conditions after physical loading	Conditions after emotional loading
Total bilirubin, μmol/liter	M±m	16.7±1.78	14.4±1.23	34.3±0.95***
	Lim	6.5–24.1	8.9–20.5	29.9–39.8
Conjugated bilirubin, μmol/liter	M±m	7.9±1.00	7.2±0.71	16.5±0.63***
	Lim	2.2–11.3	4.2–10.2	11.3–18.8
Unconjugated bilirubin, μmol/liter	M±m	8.8±0.83	7.1±0.63	17.8±0.87***
	Lim	4.3–14.0	4.6–10.3	13.4–23.1
ALT, U/liter	M±m	14.0±0.57	18.9±1.83	13.3±0.20
	Lim	10.4–17.1	10.2–26.0	11.8–14.2

AST, U/liter	M±m	340.4±4.48	320.3±18.96	351.0±7.64
	Lim	315.4–372.6	244.3–399.4	324.5–398.1
ALP, U/liter	M±m	143.8±11.73	167.7±13.92	185.0±7.42*
	Lim	104.6–211.1	83.4–216.9	143.1–215.4
GGT, U/liter	M±m	49.0±0.87	47.1±2.69	42.6±0.74**
	Lim	44.3–53.8	28.5–55.6	38.4–47.1

Note: * — p≤0.05, ** — p≤0.01, *** — p≤0.001 — in comparison with conditions of relative rest

Table 3 – Indicators of carbohydronic and lipidic exchanges in serum of blood of horses in a condition of relative rest, after physical and emotional loadings (n=12)

Indicators		**Conditions of relative rest**	**Conditions after physical loading**	**Conditions after emotional loading**
Glucose, mmol/liter	M±m	4.4±0.16	4.7±0.17	5.4±0.20**
	Lim	3.7–5.1	4.1–5.7	4.7–6.9
LDH, U/liter	M±m	230.8±8.02	322.0±10.61***	298.9±3.97***
	Lim	194.3–270.3	264.3–383.9	275.9–318.0
Cholesterol, mmol/liter	M±m	1.9±0.05	3.2±0.16***	2.3±0.08**
	Lim	1.6–2.2	2.0–3.8	1.9–2.7
Triglycerides, mmol/liter	M±m	1.34±0.042	1.73±0.238	2.06±0.036***
	Lim	1.18–1.55	0.37–2.63	1.85–2.23
Lactate, mmol/liter	M±m	1.40±0.03	3.43±0.29***	2.2±0.05***
	Lim	1.2–1.6	2.0–4.7	1.9–2.4
Pyruvate, mmol/liter	M±m	0.34±0.015	0.17±0.015***	0.26±0.01***
	Lim	0.27–0.42	0.11–0.31	0.21–0.33

Note: * — p≤0.05, ** — p≤0.01, *** — p≤0.001 — in comparison with conditions of relative rest

The analysis of the dates provided in Table 3 has confirmed that emotional loading leads to reaction of an organism caused by an emotional stress in the form of increase in concentration of glucose for 22.6% (p≤0.001) that is not observed after physical loading.

However after both types of loadings reactions of anaerobic glycolysis were observed, and especially after physical loading that is confirmed by increase of activity of LDH for 40.0% (p≤0.001) while after emotional loading — for 29.5% (p≤0.001) that is connected with smaller participation of muscular system at emotional loading of horses. These results coincide with more substantial increase of concentration of a lactate for 145.0% (p≤0.001) after physical loading in comparison with increase of an indicator for 56.0% (p≤0.001) after emotional loading. Concentration of pyruvate also changed. After physical loading it has decreased by 50.0% (p≤0.001) and after emotional loading — for 24.5% (p≤0.001). After physical loading concentration of cholesterol in the absence of change of concentration of triglycerides increases by 69.0% (p≤0.001) while as a result of emotional loading hyperlipidemia occurs due to increase in concentration of cholesterol for 18.9% (p≤0.01) and triglycerides for 53.0% (p≤0.001) due to strengthening of a lipolysis.

According to data given in the Table 4 concentration of general Calcium and Iron was identical at rest and after physical loading. After emotional stress the level of general Calcium increased by 30.8% (p≤0.001) but did not go beyond standard norms.

Thus, physical loading and an emotional stress during tests cause multidirectional changes of level of biochemical indicators of serum of blood in group of race horses of universal use that testifies to tension of metabolic processes in organisms of animals.

Table 4 – Indicators of Calcium and Iron in serum of blood of horses in a condition of relative rest, after physical and emotional loading (n=12)

Indicators		Conditions of relative rest	Conditions after physical loading	Conditions after emotional loading
Calcium, mmol/liter	M±m	1.8±0.08	2.1±0.11	2.4±0.04***
	Lim	1.5–2.4	1.6–2.7	2.2–2.6
Ferum, μmol/liter	M±m	40.0±1.30	37.0±1.30	40.0±0.50
	Lim	33.0–47.0	31.0–45.0	37.0–43.0

Note: * — p≤0.05, ** — p≤0.01, *** — p≤0.001 — in comparison with conditions of relative rest

Conclusions. After physical tension and emotional loading, unlike a condition of relative rest, sports horses of group of universal use have stable or are slightly changed such indicators of protein metabolism as general protein of serum of blood, creatinine and urea.

Concentration of uric acid which is a biomarker of an oxidative stress increases more after emotional loading in comparison with physical loading.

After emotional loading the content of glucose enlarges with the increase of activity of LDH, the content of lactate and decrease of a pyruvate as an indicator of strengthening of anaerobic glycolysis and gluconeogenesis. Lipolysis also amplifies because of cholesterol and triglycerides. After physical loading these changes are less expressed.

After emotional stress the hyperbilirubinemia is developed at the expense of both fractions of bilirubin which is followed by slight increase of activity of ALP and lack of essential changes of activity of GGT that is caused by stagnation in the external bile-excreting ways, most likely because of a short-term spasm.

The short-term physical and emotional loadings for race horses of group of universal use leads to changes of indicators of a metabolic profile of different degree and orientation depending on character of the operating stressor.

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