HORSE WELFARE ASSESMENT ON THE BASIS OF PHYSIOLOGICAL, HEMATOLOGICAL AND ETHOLOGICAL DATA UNDER DIFFERENT FARMING SYSTEMS

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Abstract: the physiological hematological and ethological indices were used to assess the welfare level of Trakennen horses under different farming systems. It was established that all year round keeping of horses in summer sheds contributed to the development of physiological adaptations, stress resistance and improved animals ' beha\'iour. It was concluded that the level of horse welfare was higher in summer sheds rather than in traditional stables.

Key words: horse, welfare, behaviour, adaptation, homeostasis, physiological and hematological data

Today's market requirements put livestock in harsh conditions that dictate the use of modem technologies, focused only on profit not considering animal welfare, which affects the state of the individual and their ability to adapt to the environment. In production, sports and decorative animal husbandry, animals with low welfare levels cannot fully realize their genetic potential. Ultimately, these animals do not only serve as a psychologically traumatizing factor for people, but also bring direct financial losses to the farmers. A solution to this issue is reflected in the «European Convention for the Protection of Productive Animals» adopted in 1976 in Strasbourg. The current EU «Instructions» require a strict satisfaction of animal rights and needs. Livestock producers who do not follow these instructions are being convicted and penalized by subsequent economic sanctions by the competent international organizations [1,9].

In modem animal husbandry, farmers began to apply welfare technologies which take into account the animal individual, the degree to which the animals' needs are met and the absence of discomfort. Welfare-based technologies follow the rule of "five freedoms''. In determining the level of animal welfare, the following criteria are used: physiological and biochemical parameters, animal behavior, the level of productivity and quality of production [3].

Animal welfare issues are acute and sore subjects in livestock industries with high exploitation intensity of animals, such as poultry, swine and beef cattle husbandry.

However, many problems of animal welfare are found in the nonproductive animal husbandry, such as horse breeding [9]. Horse population is constantly increasing all over the world. In Russia, the population of horses in 2009 was around 1375.3 thousand [5]. More and more animals are involved in various activities associated with humans': in the field of sports, in recreation programmes and just in horse-man communication for the aesthetic pleasure [2]. Thus, a study of horse welfare in modem conditions is an urgent task.

Materials and methods

The aim of this work was to study the influence of farming technologies on the horse welfare level. The experiment was conducted from November 2009 to February 2010 inclusive, on Trakennen mares at a private horse farm «Askania» located in Yegoryevsk district of Moscow region.

The horses of the control group were kept at traditional stables - the most common way of horse keeping in the central part of Russia - while the horses of the experimental group were were kept in the open-range outdoor sheds and boxes with a roof but with no heat insulation all the year round.

The main differences of the horse-keeping methods in the autumn-winter period are presented in Table 1.

Tablel

Differences in horse-keeping methods

Parameters	Farming technology	
	Traditional stables	Open-range sheds
Air temperature	Unheated location with minimal temperature +6°C	Minimal temperature -6°C and outdoor priority location for horses
Illumination, daylight time duration	Artificial photoperiod, 14-hour daylight	Natural photoperiod, 8-to 10-hour daylight
Informational area	Limited by the stable area	Extended informational field
Social activities	Contacts with conspecifics available during limited walks and foraging on pasture	Permanent social contacts
Active motion	2-3 hrs a day	9-10 hrs a day

Horses ofboth groups received a standard diet and age-appropriate training throughout the experiment. The horses of both groups went through an assessment of physiological parameters: heart rate (HR), respiratory rate (RR), blood tests; their behavioural peculiarities were registered. Ethological studies included the identification of problem behaviors and assesement of the animals' stress-resistance by the «stimulus-response» test with a specially designed scale for ethological data digitation.

Animals were affected by three types of stimuli addressed to auditory, visual and olfactory systems. The estimates of the stress-resistanse in the horses were calculated with the help of a specially designed digital scale. According to this scale, 36 points was the maximum value, 0 points corresponding to the minimum value. The horses with the lowest scores were categorized as stress-resistant animals.

Results and discussion

Analysis of the results of the experiment show that when the air temperature in the stables was within the range of+12 °C to +6 °C, the heart rate of horses in the control group slightly increased throughout the experimental period. At the same time, in December (daily temperatures decreased by 11°C from +6 °C to -5 °C compared with November), the animals of the experimental group showed significant increase in HR (Table 2).

Table 2

Physiological parameters of horses

Group of horses	Period of assessment					
	November		December		February	
	HR	RR	HR	RR	HR	RR
Control	51±2.0	15±0.9	53±1.8	16±0.8	55±2.1	17±0.9
Experimental	51±2.0	18±0.9*	63±1.9*	19±0.7*	58±2.1	19±0.7

Hereinafter: the differences are significant between groups when * $p < 0.05$, * *$p < 0.01$, *** $p < 0.001$

The observed phenomenon was caused by the process of physiological adaptation of thermal homeostasis of animals. The increasing level of metabolic activity for heat production in the horse body secured subsequent maintenance of the body heat balance. This phenomenon has been well studied in animals of other species and is perfectly described in available literature [7].

The frequency of respiratory movements positively correlated with HR in mares. Comparing HR in horses of the control and experimental groups, we recorded a significant difference between the animals ($p < 0.05$) in December, when a sharp decline in average daily temperatures occurred. No significant differences in HR between groups of horses was observed in February due to the successful adaptation of the experimental group of animals to low environmental air temperatures.

The frequency of respiratory movements in the control group horses was within the physiological range throughout the experiment. However, this physiological parameter was higher in the control horses compared to that in the experimental group. Moreover, in November and December, the group difference was significant at $p < 0.01$, which also indicated the intensity of metabolism in animals of the experimental group who were able to adapt to permanent low temperatures in their environment.

The blood cell count is highly informative for the assessment of the animals' physiological condition [6]. The results of hematological studies indicate that erythron homeostasis in horses changes as a result of adaption to low ambient temperature ranges within the reference values.

Under the experimental conditions, red blood cell count and hemoglobin concentration in the blood of horses of both groups had a tendency to increase in December as opposed to November measurements (Table 3). In February, there was a significant decrease in red blood cell number and hemoglobin concentration in the horses of both control and experimental groups.

Table 3

Red cell counts and hemoglobin concentration in horse blood

Parameters	Control group			Experimental group		
	November	December	February	November	December	February
Erythrocytes, 10^{12} /l	9.2±0.36	9.7±0.37	8.9±0.01**	10.3±0.40	10.8±0.45	9.5±0.27*
Hemoglobin, g /l	155±8	163±8	145±2**	169±7	182±5	161±2*

Studies have shown that indices of hemoglobin concentration and red blood cell counts in horses of the experimental group were higher than those in horses of the control group throughout the entire observation period. These differences are due to the fact that a higher red blood cell number ensures higher oxygen-binding capacity of the blood [4]. Such a reaction of horse blood erythron helps the animals to adapt to low temperatures by involving additional energy compounds in the process of heat production for body temperature stabilisation.

The immunological status of the animal is a reliable indicator of the animals' adaptive response to environmental factors. In the long run, it reflects the level of animal well-being [10]. The immunological response to an unfavorable environmental factor is performed through the activities of white blood cells.

In our experiment, horses of both groups had their white blood cell counts within the physiological range throughout the experiment (Table 4). However, animals of the experimental group, demonstrated significantly higher lymphocyte counts ($p < 0.05$). The difference between groups was most clearly manifested in December - in the period of significant decline of average daily temperatures. Lymphocytes, which play a major role in the specific defense reactions - the formation of cellular and humoral immunity - promote further adaptation of animals to minor and short-term stress. Brief stressors are the coaching factor and are in charge of increasing non-specific resistance of animals, improving the immune adaptability of the whole animal body [8].

Table 4

Blood white cell counts of horses

Parameters	Control group			Experimental group		
	November	December	February	November	December	February
Leucocytes, 10^9 /1	8.4±0.3	8.8±0.35	7.5±0.32	9.8±0.41*	10.8±0.52*	8.6±0.27*
Lymphocytes, 10^9 /1	3.5±0.09	3.3±0.08	3.2±0.18	4.1 ±0.11	4.8±0.14	4.1 ±0.16
Monocytes, 10^9/1	0.33±0.01	0.33±0.02	0.28±0.02	0.37±0.01	0.41±0.15	0.25±0.02
Granulocytes, 10^9 /1	4.6±0.12	5.3±0.19	4.1±0.25	5.3±0.21	5.6±0.17	4.2±0.12

Animal behavior is seen as a mechanism for urgent adaptation of animals to changing environmental conditions. On the other hand, the presence of unusual behaviors and motivated ethological manifestations in the behavioral repertoire is one of the criteria for the assessment of an individual's welfare level. The behavioral repertoire analysis and the comparison of the horses' behaviors in the experimental and control groups indicate that methods and technologies of animal husbandry affect the frame of mind and the manifestation of psychomotor reactions. In 67% cases, the horses of the control group had ethological abnormalities, namely excessive timidity, i.e. inadequate responsiveness to external stimuli, and the willingness to «run away» with the saddle and fling the rider off. Horses of the experimental group did not demonstrate abnormal behaviors of this type (Table 5).

Analysis of horses' reaction to stress factors showed that stress levels in both studied groups remained virtually unchanged throughout the study. However, the average amount of points in the control group, obtained through evaluating the animals' responses in the «stimulus-response» test for the whole experimental period equaled

Table 5

Number of horses with behavioral problems, %

Groups	Time of measurements		
	November	December	February
Control group	67	67	67
Experimental group	0	0	0

17 points (Table 6). Horses of the experimental group gained no more than 4.2 points, i.e. four times less ($p<0.001$).

Table 6

Stress resistance of horses

Parameter	Average score, points		
	December	February	April
Control group	16±0.76***	18±0.80***	17±0.69***
Experimental group	4.7±0.15	3.7±0.12	4.2±0.15

Differences in the reactivity of horses from two groups can be explained by the fact that horses kept in summer sheds were exposed to a wider informational field, they had freedom to move and permanent communication with other horses which is important for horses as social animals. As a result, they developed habituation to insignificant stimuli and novelties, which did not occur in animals that spent most of their time confined to the stalls with poor environment and limited social activities. The control group animals considered insignificant but unfamiliar or sudden stimuli or actions as stressors with negative consequences for their psyche and body physiology.

Conclusion

Year-round maintenance of horses in summer sheds promotes their overall nonspecific resistance of animals, strengthens their psychic and physical state, prevents the development of improper behaviour, which in the long run indicates a higher level of animal welfare.

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ОЦЕНКА УРОВНЯ БЛАГОПОЛУЧИЯ ЛОШАДЕЙ ПО ФИЗИОЛОГО-ГЕМАТОЛОГИЧЕСКИМ И ЭТОЛОГИЧЕСКИМ ПОКАЗАТЕЛЯМ ПРИ РАЗНЫХ ТЕХНОЛОГИЯХ СОДЕРЖАНИЯ

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Аннотация: на лошадях тракенеской породы изучали физиолого-гематологические и этологические показатели для оценки уровня благополучия животных при содержании в традиционных конюшнях и летниках. Установлено, что содержание лошадей в летниках приводит к физиологическим адаптациям, повышает стрессоустойчивость и положительно влияет на поведение животных. Было заключено, что уровень благополучия содержащихся в летниках лошадей выше, чем у животных при традиционном содержании.

Ключевые слова: лошади, благополучие, поведение, адаптация, гомеостаз, физиолого-гематологические показатели.

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