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ABOUT NON-TRADITIONAL FEED ADDITIVES INFLUENCE ON SAFETY OF THE YAKUT BREED HORSES LIVE WEIGHT

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Horse breeding is one of the rapidly developing branches of animal husbandry in Yakutia. Horses of the Yakut breed are only type of farm animals that are kept year-round in harsh conditions of the sharply continental climate of Yakutia. In winter, animals experience a significant lack of nutrients and minerals. This is due to fact that basic diet consists of natural feed winter pasture and hay. Therefore, the goal was to study the effect of complex feed additives from local natural raw materials on the change in live weight and biochemical composition of the blood of animals. This study used standard animal research methods. The use of non-traditional feed additives in feeding of horses contributed to an increase in the supply of nutrients and minerals to the rations. Improving feeding conditions affected the live weight of horses (live weight loss was 5.75 % u 5.45 %). The change caused by inclusion of non-traditional feed additives in the diets of horses had a positive effect on the morphological and biochemical composition of the blood animals. In horses from the experimental groups, an increase was found in the blood in total protein by 0.50 % and 0.30 %, albumin by 0.36 and 0.20 %, globulin by 0.13 and 0.10 %, hemoglobin by 2.91 and 1.33 %, calcium by 3.56 and 1.29%, phosphorus by 5.71 and 1.90 %. Thus, use of experimental non-traditional feed additives in feeding horses in winter contributes to the best preservation of live weight. This is due to the improvement of mineral and vitamin nutrition in a difficult period of deficiency of macro- and microelements, vitamins in the diets of horses. This improves metabolism, which is reflected in the morphological and biochemical composition of blood of horses.

Keywords: horses; metabolism; feeding; feed additives; resource

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Научная статья | Животноводство

ВЛИЯНИЕ НЕТРАДИЦИОННЫХ КОРМОВЫХ ДОБАВОК НА СОХРАННОСТЬ ЖИВОЙ МАССЫ ЛОШАДЕЙ ЯКУТСКОЙ ПОРОДЫ

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Коневодство является одной из стремительно развивающихся отраслей животноводства Якутии. Лошади якутской породы являются единственным видом сельскохозяйственных животных, которые содержатся круглогодично в суровых условиях резкоконтинентального климата Якутии. В зимнее время животные испытывают значительный недостаток в питательных и минеральных веществах. Это объясняется тем, что основной рацион состоит из подножного корма и сена. Поэтому целью данного исследования являлось изучение влияния комплексных кормовых добавок из местного природного сырья на изменение живой массы и биохимического состава крови животных. В данном исследовании использовались стандартные методы исследования в животноводстве. Использование местных нетрадиционных кормовых добавок в кормлении лошадей способствовало повышению обеспеченности питательными и минеральными веществами рационов. Улучшение условий кормления сказалось на показателях сохранности живой массы лошадей (потери живой массы составили 5,75 % и 5,45 %). Изменения, вызванные включением местных нетрадиционных кормовых добавок в рационы лошадей, положительно сказались на морфологическом и биохимическом составе крови. У лошадей из опытных групп в крови установлено повышение общего белка на 0,50 % и 0,30 %, альбумина на 0,36 и 0,20 %, глобулина на 0,13 и 0,10 %, гемоглобина на 2,91 и 1,33 %, кальция на 3,56 и 1,29 %, фосфора на 5,71 и 1,90 %. Таким образом использование местных экспериментальных нетрадиционных кормовых добавок в кормлении лошадей зимой способствует наиболее лучшему сохранению живой массы. Прежде всего это происходит за счет улучшения минерального и витаминного питания в сложный период дефицита макро- и микроэлементов, витаминов в рационах лошадей. При этом улучшается обмен веществ, что отражается на морфологическом и биохимическом составе крови лошадей.

Ключевые слова: лошади; обмен веществ; кормление; кормовые добавки; ресурс

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Introduction

Yakut horses are traditionally kept in a group assigned to one stallion. Each group of horses has certain routes for feeding and keeping in the natural pastures. Starting from the end of spring and the beginning of summer, animals move to pasture summer keeping, where they intensively recover after a long, hard winter. For grazing - from middle of May to end of October – the beginning of November. In a short period of favorable time (from August to the end of October) animals are well gaining live weight and restore their fatness for the transition to the winter period. Therefore, it is believed that autumn season is the best period for feeding horses, when animals are allowed on grasslands, at this time ambient temperature is more optimal. In winter, individual severely malnourished animals are separated from the main group in a timely manner and fed with hay and oats until necessary fatness is restored. The corral of animals to the base is organized in spring, with aim of effective foaling of mares [1, 3].

When preparing fodder for the maintenance of one animal, an average of up to 0.7 tons of hay of medium quality is planned, depending on productivity of the hayfields. The stock of hay is enough not only to support life of emaciated animals, but also for period of mass foaling. An important feature of the Yakut breed of horses is ability to quickly fatten and gain live weight. These qualities of animals in winter help them successfully overcome the harsh natural and climatic conditions of Yakutia [1, 3].

Scientific novelty. As a solution to improve the nutrition of farm animals, various non-traditional feed additives are included in their diets [4, 10, 11, 13, 14].

The use of various non-traditional feed additives in feeding of farm animals can improve the physiological state, productivity and economic efficiency of production [5, 6, 9, 12, 15, 16, 17, 18, 19, 20].

The most effective feed additives in conditions of Yakutia include spropels, coniferous flour, zeolite of Khongurinsky deposit and Kempendyay salt [7, 8] and etc.

In this regard, a scientific and practical experiment was carried out to determine the effectiveness of non-traditional feed additives from local natural raw materials on the safety of live weight of Yakut horse breed.

Material and research methods

Scientific and practical experience was carried out on the basis of farm Rumyantsev S.I. Ust-Aldan district of the Republic of Sakha (Yakutia). For the experiment, 3 groups of horses were formed, which were divided into equal groups (n=10). The research was carried out from November to March. The conditions of detention for all experimental animals were same. In accordance with the research program, horses from experimental groups additionally received non-traditional feed additives. Horses of the control group were kept on basic diet, II and III experimental groups received in addition to the main diet 80 and 120 g of coniferous flour together with zeolite-hongurin 0.5 and 0.4 g per kg of live weight with 29 g of Kempendyai salt.

The processing of experimental data was carried out in accordance with the instructions [2].

Coniferous flour contains carbohydrates - 33.3 %, crude protein - 7.8 %, crude fiber - 11.0 %, crude fat - 10.5 %, organic acids - 8.9 %, other substances - 1.1 %, raw ash - 6.2 mg %, Ca - 0.4%, P - 0.3 %, K - 2.5 %, Mg - 0.2 %, Fe - 168 mg, Cu - 13.8 mg, Mn - 221 mg, carotene - 173 mg, vitamin E - 217 mg, vitamin C - 124.0 mg, vitamin B - 7.4 mg%, vitamin P - 28.1 mg.

Zeolite-khongurin contains 75-84 % clinoptilite, up to 10 % montmorillonite, 8-9 % mica and hydromica, up to 4 % quartz. The composition includes SiO_2 - 65,79 %, Al_2O_3 - 12,20 %, NaO - 3,73 %, MgO - 1,15 %, Fe_2O_3 - 1,04 %, K_2O - 1,11 %, CaO - 0,32 %, TiO_2 - 0,19 %.

Kempendyai salt contains NaCl and impurities KCl, CaSO_4 , MgCl_2 .

The results and discussion

In the summer season, horses consumed pasture grass on average 35.0 kg. The summer diet of horses contained metabolic energy - 98.0 MJ, dry matter - 11.73 kg, digestible protein - 733.21 g, crude protein - 1470.38 g, crude fiber - 3570.29 g, calcium - 74.46 g, phosphorus - 52.54 g, magnesium - 24.43 g, iron - 1377.07 mg, copper - 115.19 mg, zinc - 455.55 mg, cobalt - 7.0 mg, manganese - 560.26 mg, iodine - 8.4 mg, carotene - 597.94 mg, vitamin D - 6.53 thousand IU, vitamin E - 594.90 mg, vitamin B₁ - 57.30 mg, vitamin B₂ - 44.47 mg, vitamin B₃ - 83.7 mg, vitamin B₄ - 5650.10 mg, vitamin PP - 280.39 mg.

In the summer season, feeding horses fully meets requirements of feeding standards for nutrients, minerals and biologically active substances. An analysis of the winter diets of horses showed that there is a deficit in some normalized indicators (Table 1).

Table 1.

The composition and nutritional value of average daily diet of horses in winter

Indicators	Standard	Groups		
		I - control	II - experi- mental	III - experi- mental
Natural feed winter pasture, kg		19	19	19
Oats, kg		3.5	3.5	3.5
the ration contains:				
Exchange energy, MJ	93.8	95.8	95.8	95.8
Dry matter, kg	11.2	9.44	9.45	9.45
Digestible protein, g	840	907.44	925.88	940.35
Crude protein, g	1230	1172.78	1211.95	1217.37
Crude fiber, g	1900	2184.19	2191.8	2204.41
Calcium, g	37	66.7	68.25	72.66
Phosphorus, g	29	51.62	54.71	56.9
Magnesium, g	15.6	17.63	18.68	19.05
Ferrum, mg	392	1024.06	1189.22	1225.04
Copper, mg	78	93.48	100.62	110.52
Zinc, mg	280	323.85	331.07	333.64
Cobalt, mg	7	3.68	4.12	4.17
Manganese, mg	480	543.03	582.14	596.65
Iodine, mg	7	6.05	6.25	6.29
Carotene, mg	92	98.48	121.55	134.68
Vitamin D, thousand IU	4	2.35	2.49	2.78
Vitamin E, mg	460	308.31	314.05	321.41
Vitamin B ₁ , mg	55	35.04	55.26	58.18
Vitamin B ₂ , mg	35	39.87	45.85	46.21
Vitamin B ₃ , mg	80	68.44	70.43	71.04
Vitamin B ₄ , mg	5458	2189.57	2316.7	2477.42
Vitamin PP, mg	272	159.44	168.49	169.26

In the winter diets of horses, a lack of iodine and cobalt, as well as all normalized vitamins, has been established. The composition and nutritional value of horse rations when fed with hay and oats is presented in Table 2.

Table 2.

**The composition and nutritional value of diet of horses in winter
when fed with hay**

Indicators	Standard	Groups		
		I - control	II - experimental	III - experimental
Meadowhay, kg		9	9	9
Natural feed winter pasture, kg		10	10	10
Oats, kg		2	2	2
the ration contains:				
Exchange energy, MJ	93.8	114.1	114.1	114.1
Dry matter, kg	11.2	12.75	12.76	12.76
Digestible protein, g	840	975.5	992.97	1007.42
Crude protein, g	1230	1198.31	1225.5	1241.92
Crude fiber, g	1900	2729.23	2735.72	2749.4
Calcium, g	37	65.95	66.48	70.88
Phosphorus, g	29	55.68	57.97	60.45
Magnesium, g	15.6	20.21	21.3	21.7
Ferrum, mg	392	1076.58	1239.46	1275.24
Copper, mg	78	92.21	99,3	109.14
Zinc, mg	280	330.24	337.24	339.89
Cobalt, mg	7	4.68	5.14	5.16
Manganese, mg	480	556.26	594.87	606.74
Iodine, mg	7	6.8	7	7.04
Carotene, mg	92	106.55	129.6	139.76
Vitamin D, thousand IU	4	3.3	3.34	3.37
Vitamin E, mg	460	355.61	360.4	367.81
Vitamin B ₁ , mg	55	39.4	59.52	62.43
Vitamin B ₂ , mg	35	41.03	46.2	47.56
Vitamin B ₃ , mg	80	72.6	74.05	75.15
Vitamin B ₄ , mg	5458	2370.24	2501.12	2660.1
Vitamin PP, mg	272	166.86	176.22	177.14

Additional feeding with hay and oats with non-traditional feed additives contributed to improvement of horse rations in terms of the level of provision with mineral and biologically active substances, including vitamins.

Nutrient intake data and analysis of the diets of horses showed the existing deficiency of some trace elements and vitamins depending on season of year. The consumption of feed and nutrients for the maintenance of one horse for the period of experiment is presented in Table 3.

Table 3.

Feed and nutrient requirements for horses

Indicators	Perday, kg	Duration, days	Total feed, kg	Contained	
				Exchange energy, MJ	Digestible protein, kg
Meadowhay	9	120	1080	7452	58.3
Natural feed winter pasture	10	150	1500	4800	49.5
Oats	2,75	150	412,5	4125	33
Total				16377	

Based on above, it can be concluded that the use of non-traditional feed additives from local natural raw materials in feeding horses contributed to improving the provision of diets for nutrients, minerals and biologically active substances.

The inclusion of non-traditional feed additives in the daily rations of horses contributed to a significant preservation of live weight in winter season (Table 4).

Table 4.

Change in live weight of horses (M \pm m), kg

Groups	Average live weight		Difference
	start	end	
I - control	434.7 \pm 1.69	408.4 \pm 2.14	-26.3 \pm 0.91
II - experimental	435.0 \pm 1.98	412.5 \pm 1.55	-22.5 \pm 1.00*
III - experimental	434.2 \pm 1.53	410.6 \pm 2.18	-24.6 \pm 0.87

Note: *P>0.95

When comparing the live weight indicators of horses, it was found that, on average, in animals in the control group, loss of live weight was - 26.3 kg or 6.44 % of initial weight. While in the III experimental group this indicator was slightly better and amounted to -24.6 kg (or 5.75 % of initial live weight). Comparatively better results were obtained by animals from the II experimental group, in which loss of live weight was -22.5 kg (or 5.45 % of initial weight).

Thus, the use of complex feed additives in feeding horses contributed to a better preservation of live weight in winter, due to a more intensive metabolism and efficient use of nutrients and feed energy.

To determine the effect of non-traditional feed additives on physiology of horses, a study of the morpho-biochemical composition of blood was carried out (Table 5).

Table 5.

Morpho-biochemical composition of blood of horses(M±m)

Indicators	Standard	Groups		
		I - control	II - experimental	III - experimental
start				
Total protein, %	7-9	8.17±0.26	8.17±0.37	8.07±0.33
Albumin, %	3-5	3.77±0.15	3.8±0.25	3.73±0.15
Globulin, %	3-6	4.4±0.12	4.37±0.15	4.33±0.19
Leukocytes, X10 ⁹ /l	5.2-13.9	7.5±0.06	7.47±0.09	7.53±0.09
Erythrocytes, X10 ¹² /l	6.4-10	7.17±0.09	7.13±0.07	7.1±0.06
Hemoglobin, g/l	110-170	124.67±3.33	123.67±2.4	123.33±2.33
Phosphorus, mmol/l	0.7-1.4	1.04±0.01	1.03±0.01	1.02±0.01
Calcium, mmol/l	2.65-3.25	2.98±0.08	2.94±0.08	2.95±0.09
end				
Total protein, %	7-9	8.33±0.15	8.83±0.09*	8.63±0.09
Albumin, %	3-5	3.87±0.24	4.23±0.18	4.07±0.2
Globulin, %	3-6	4.47±0.12	4.6±0.1	4.57±0.12
Leukocytes, X10 ⁹ /l	5.2-13.9	7.50±0.06	7.1±0.06**	7.37±0.07
Erythrocytes, X10 ¹² /l	6.4-10	7.27±0.09	7.43±0.07	7.3±0.06
Hemoglobin, g/l	110-170	126±4.51	129.67±3.76	127.67±4.63
Phosphorus, mmol/l	0.7-1.4	1.05±0.01	1.11±0.01*	1.07±0.02
Calcium, mmol/l	2.65-3.25	3.09±0.06	3.2±0.04	3.13±0.03

Note: *P>0.95; **P>0.99

At beginning of the experiment, the indicators of biochemical composition of the blood of horses of all groups did not have significant differences. At the end of the accounting period, a trend was established for changes in the content of total protein in blood of experimental horses. Animals of the control group

were inferior to horses from II and III experimental groups in terms of total protein content by 0.50 % ($P>0.95$) and 0.30 %, albumin by 0.36 and 0.20 %, globulin by 0.13 and 0.10 %, hemoglobin by 2.91 and 1.33 %, phosphorus by 5.71% ($P>0.95$) and 1.90 %, calcium by 3.56 and 1.29 %, respectively.

Conclusions

The inclusion of non-traditional feed additives in diets of horses contributed to a better preservation of live weight (of initial weight - 5.75 % and 5.45 %) and stabilization of the blood picture (total protein and fractions, erythrocytes) in the winter period.

Thus, use of non-traditional feed additives from local natural raw materials helps to increase the live weight of horses and improve physiological state. Therefore, the use of non-traditional feed additives in feeding horses in conditions of Yakutia is practical advisable.

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