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## DAIRY PRODUCTIVITY OF THE KAZAKH HORSE MARES AND THEIR CROSS BREEDS WITH ROADSTERS

**Abstract.** It has been established that the riding-Kazakh cross breeds in live weight (403-410 kg) outperform the local Kazakh horses (395 kg). In height at withers, the English-Kazakh hybrids (148.5±0.7 cm) are greater than the Arab-Kazakh hybrids (141.2 ± 0.5 cm) and local Kazakh (142.7±0.8 cm). In the chest girth, Arab-Kazakh hybrids (175.8±0.8 cm), on the contrary, exceed the Anglo-Kazakh hybrids (171.7±1.1 cm) and local Kazakh (171.1±1.2 cm).

The wide-body index for the English-Kazakh hybrids is 115.62, for the local Kazakh horses - 119.90, for the Arab-Kazakh hybrids - 124.50.

It was established that in riding-Kazakh crossbred mares the daily milk yield for 2-4 months of lactation is 7-10 liters. When transiting mares to 4-5-fold milking from the 2nd month of lactation, foals receive less than 2/3 of their mother's milk or 4-6 liters per day. To replenish this under-received amount of milk and to ensure the increase in live weight, the foals ration is additionally included with concentrated feed, hay and green mass. Habituation of colts to feed started from 1.5 months of age. When they are 2 months of age, young animals already consume feed very good. During the suckling period, the live weight of foals from dairy mares in the first 6 months increased by 3.96 times, and from non-milking mares - by 4.22 times. The decrease in the level of milk nutrition in young stock leads to a decrease in the average daily gain.

It was found that, on average, during the lactation, the density of milk at production from local Kazakh mares was 1.033°A, while the Arab-Kazakh and English-Kazakh had milk density of 1.032°A. The fluctuations in the fat of the mares of the Kazakh breed for six months of lactation were in the range of 1.1-1.9%, while of the Arab-Kazakh and English-Kazakh hybrids, respectively, 1.3-2.0% and 1.4-2.2 %. That is, the bloodiness of horses does not have a significant impact on the indicators of the chemical composition of the mares' milk.

**Key words:** Kazakh horse, riding-Kazakh hybrids, milk, milk yield, early ripeness of foals, growth and development, foals.

**Introduction.** The upcoming entry of Kazakhstan into the WTO imposes special requirements on the competitiveness of domestic agricultural products. Therefore, it is necessary in the future to pay special attention to the industrialization of agricultural production through the implementation of cluster initiatives in the production and processing of agricultural raw materials. It is here that the attention of the private sector should be attracted, including in line with the agrarian-industrial policy [1].

The value of horse breeding in the republic is preserved even now. With the acquisition of sovereignty, great opportunities are opening up for the wide spread of equestrian sports, tourism, national sports game and the development of horse breeding as a branch of productive livestock farming.

The possibility of activating the adaptive processes and increasing the resistance of the organism of such animals under the influence of these biostimulators to low temperatures of the habitat for protein-

carbohydrate-vitamin metabolism, the function of the hematopoietic organs and the buffer system is established [2].

Of all the agricultural units operating in Kazakhstan, more than 80% are peasant farms and households. They contain 95.5% of the livestock of horses and produce more than 90% of production. Around the major cities and industrial centers, there are many peasant horse farms for growing sports horses. Horses of local Kazakh breeds are mainly bred in these farms and they are mixed with roadster breeds, in which, along with getting young stock, it is possible to organize seasonal production of koumiss. The production of koumiss in combination with the growth of young stock for sports is of great importance in increasing the profitability of horse breeding in the conditions of peasant farms [3].

The increased interest in the development of dairy horse breeding is due to the fact that horses, being the most unpretentious animals, are able to use natural steppe, mountain and other pastures that are difficult for other farm animals to access. At the same time, the demand for koumiss, which has not only dietary and nutritional, but also antibiotic and healing properties, is constantly increasing.

Beginning from the 1950s, these purebred riding and Arabian horses were imported for crossing with local Kazakh horses under these soil-climatic and fodder conditions.

In the late 90s of the last century, the Sarsebek farm was established in the Talgar district of the Almaty region, which was formed with Kazakh horses and their crossbreeds of roadster breeds from the former Degeres stud farm. Currently, in the herd, there are horses with the blood of Arab and purebred roadster breeds.

With the organization of the production of milk and koumiss, the need for feed increases significantly, and the system for keeping horses changes. In the peasant farms that have feeding grounds, the stalled-pasture system for keeping horses is the most widespread, at which in the stall period animals are in the premises, and in the pasture period - on artificial or natural pastures..

In farms engaged in breeding of roadster breeds and their hybrids with Kazakh horses, the stall-camp or stall housing system is practiced. In the stall-camp system, in the pasture period, the horses are maintained in summer camps, which are equipped with light shelters and milking areas.

Stall-camp maintenance has a beneficial effect on animals and allows to conduct regular training work, as well as timely preventive and veterinary-sanitary measures.

In recent years, in the conditions of the south-east Kazakhstan, horses of riding breeds have positively recommended themselves in the sporting direction. Stallions of this breed are used in crossing with local Kazakh mares and other breeds of Almaty region.

Of great importance is the study of the economically useful traits of local Kazakh horses and their hybrids with roadsters and the development of an effective technology for the production of mare's milk in peasant farms. The importance of solving this problem determines the relevance of the research.

The technology of dairy production is a set of systems and methods of maintenance, feeding, milking, using animals, organizing labor, ensuring the production of the final (milk, meat, wool) or intermediate (replacements) products [4].

When breeding horses of sports direction of productivity with the simultaneous production of milk is very important to determine the method of keeping mares. When choosing a method of keeping, it is assumed that by applying various methods to reduce labor costs per unit of production, to achieve a reduction in the cost of milk and at the same time to increase the dairy productivity of mares while reducing the cost of fodder per unit of production.

The system of keeping farm animals implies a certain order of interdependent production operations and work processes that ensure the most rational and favorable conditions for the life and exploitation of animals.

A.G. Shamsiev [5], V.I. Fisinin, I.A.Egorov, I.F. Draganov [6] note that feeding of horses should be based on the modern achievements of the physiology and biochemistry of food, feed production and fodder preparation. In this regard, an important problem should be the development of the theory and practice of a complete and balanced feeding of horses of different ages, breeds and economic use directions.

Full feeding of dairy mares is one of the main factors providing high dairy productivity, which affects the growth and development of foals [7]. It is based on the knowledge of the body need for energy, nutrients necessary for the implementation of life processes [8]. A horse's need for nutrition depends on the

nature of its use, live weight, breed, and physiological condition. Compared to other types of animals, horses are the most demanding on feed quality. They are worse than ruminants digest fiber, so for them, it is necessary to allocate good meadow, steppe, alfalfa hay, and from cereals - oats, corn and barley, from bran - wheat [9].

In contrast to herd horse breeding, where horses are kept on pasture all year round, horses of sporting direction are mainly maintained by stable or stable pasture methods [10].

The practice of advanced horse farms of the Russian Federation, the Baltic republics and Northern regions of Kazakhstan, where there is enough rainfall in summer, shows that long-term pastures, if used correctly, provide 3000-4000 feeding units from 1 hectare, and during irrigation - 6000-7000 feeding units. In recent years, the creation of long-term cultivated pastures with irrigation has been given with great importance both in areas of sufficient moisture and in areas with limited rainfall [1].

Many years of experience in using paddocks (cultivated pastures) under conditions of stud farms showed their positive aspects. The use of advanced agricultural techniques based on the regular use of fertilizers, irrigation, the use of high-yielding varieties of perennial grasses allow to receive yields of grass at 70-90 centners of dry weight, or 60-70 centners of feed units per hectare. Paddocks are used not only for pasturing horses, but also for stocking up hay, haylage, grass cutting and flour

**The aim of research.** Comparative study of the technology of seasonal milk production with stable and pasture maintenance of local Kazakh breed mares and their hybrids with roadster breed in the conditions of the south-east of Kazakhstan.

**Materials and methods of research.** Experimental studies were carried out on the Sarsebek horse farm of the Talgar district, Almaty region, on mares of the local Kazakh breed and their mixtures with roadster breeds.

The formation of groups of animals was carried out according to the method of pairs-analogues taking into account the breed, sex, age, live weight, physiological state (lactation period) [11-14].

To carry out scientific and economic experience, 3 groups of animals were formed, the I group included mares of the local Kazakh breed that were kept on natural pastures, and in the II and III groups there were mares of Arab-Kazakh and English-Kazakh cross breeds mares that were in conditions of stable and pasture maintenance.

The study of the age dynamics of live weight of young horses was carried out on the basis of data of individual weighing and determination of live weight at birth, at 6, 12, 18, 24 and 30 months of age.

In the experiment, high-Kazakh crossbred foals and purebred Kazakh foals were taken (5 heads). The latter served as a control, on which it is more obvious to reveal the characteristic features of the growth and development of crossbred horses.

The exterior and constitution of animals were studied by eye-evaluation of the articles of body measurements and the general development of the organism on the scale of the Instructions for bonitation of breeding local horses followed by taking 4 main body measurements, on the basis of which the main body indexes were calculated at the age of 6, 12, 18, 24, 30 months.

Group	Mare's breed	Conditions of maintenance
I	Local Kazakh	Pasture
II	Arab-Kazakh cross breeds	Stable and pasture
III	English-Kazakh cross breeds	Stable and pasture

Figure 1 – Experimental design

The commodity yield of mares was studied during the seasonal production of koumiss (from April to September 2018), i.e. within 6 months by the method of control milkings once a month for two adjacent days. Dairy productivity, which is made up of actually received milk and sucked by a foal milk, was calculated by the I.A. Saigin formula [11].

$$Y_c = \frac{Y\phi * 24}{B},$$

where  $Y_c$  - daily productivity, l.;  $Y\phi$  - actually received milk, l.;  $B$  - time of mares stay in milking, h.; 24 - number of hours per day.

Chemical analysis of milk was carried out in the laboratory of milk and dairy products of the Kazakh Scientific Research Institute of Animal Breeding and Fodder Production LLP.

The chemical composition of milk was studied monthly. Milk samples for general chemical analysis were taken once a month for two adjacent days, in proportion to milk yield. In the mares' milk sample, the content of fat, total protein, milk sugar, dry matter, calcium, phosphorus, density, and acidity were determined by standard methods [12-15].

The dairy productivity of mares was estimated by the gross milk yield obtained by summing up the milk yield and the amount of milk sucked by the foal.

Biometric processing of digital material of the experiments was carried out according to the standard methods. [15].

### Results of research.

*Commodity and gross yield of mares.* The dairy productivity of mares depends on genotypic and phenotypic factors, among which the breed, the duration of lactation, the conditions of keeping and the level of feeding have a great influence [16-19].

Gross productivity is an indicator of the physiological capacity of an animal, depending primarily on such genotypic factors as breed, individual characteristics, etc. The commodity productivity depends not only on genotypic, but also on phenotypic factors, such as technology, mode and frequency of milking [20-23].

In the farm "Sarsebek" mares massively foaled in the second half of March and in the first half of April. Milking of mares started in May, that is, a month after the colting.

It was established that the riding-Kazakh cross breeds (403-410 kg) exceed the local Kazakh breed in live weight (395 kg) (table 1).

Table 1 – Zootechnic characteristics of dairy mares by live weight and main body measurements (n = 4 heads in each)

Indicator	Local Kazakh		English-Kazakh cross breeds		Arab-Kazakh cross breeds	
	M±m	Cv %	M±m	Cv %	M±m	Cv %
Live weight, kg	395±3.2	1.62	410±5.1	2.49	403±4.3	2.13
Measurements, cm:						
Height at the withers	142.7±0.8	1.12	148.5±0.7	0.94	141.2±0.5	0.71
Oblique body length	153.8±0.6	0.78	153.4±0.5	0.65	152.2±0.3	0.39
Chest girth	171.1±1.2	1.40	171.7±1.1	1.28	175.8±0.8	0.91
Meta carpus girth	18.0±0.3	3.33	18.1±0.2	2.21	18.5±0.3	3.24

In height at withers, the English-Kazakh cross breeds (148.5±0.7 cm) outperform the Arab-Kazakh cross breeds (141.2 ± 0.5 cm) and local Kazakh cross breeds (142.7±0.8 cm). In the chest girth, Arab-Kazakh cross breeds (175.8±0.8 cm), on the contrary, exceed the English-Kazakh cross breeds (171.7±1.1 cm) and local Kazakh (171.1±1.2 cm).

To fully characterize the features of the constitution of local Kazakh mares and their crossbreeds, based on absolute indicators of body measurements, the main body indices were calculated: of format, of wide body, of compactness, of bone and of massiveness (table 2).

Table 2 – Indices of body built of in-milk mares (n = 4 heads in each)

Index, %	Local Kazakh, M±m	English-Kazakh cross breeds, M±m	Arab-Kazakh cross breeds, M±m
Format	107.78±0.5	103.3±0.5	107.79±0.5
Wide body	119.90±0.6	115.62±0.6	124.50±0.6
Compactness	111.25±0.5	111.93±0.5	115.51±0.5
Bone	12.61 ±0.2	12.19±0.2	13.10±0.2
Massiveness	136.21±0.7	125.38±0.7	143.42±0.7

The indices of body built characterize the experimental mares of the Anglo-Kazakh cross breed as shallow-bodied, rather lightweight animals, with a wide-body index of 115.62, while the local Kazakh horses have 119.90, and the Arab-Kazakh cross breeds have 124.50.

All mares had a strong type of constitution, a well-developed chest, an extended body. A strong constitution can be judged by the development of the skeleton [29, 30, 31]. Thus, the bone index was as follows: among local Kazakh - 12.61, and among riding-Kazakh - 12.19 - 13.10. It has been established that mares of shallow-bodied, dense types of constitution are distinguished by their greatest adaptability to stall-stable conditions, which must be taken into account when organizing koumiss farms. Therefore, in the zone of cultural and pasture horse breeding, it is advisable to form groups of in-milk mares taking into account the characteristics of types.

The overall dairy production of mares is directly dependent on the duration of lactation, as well as on the nature of the lactation curve. In many horse farms, milking of mares is seasonal in nature and is limited to the period from May to September.

It was found that mares of the local Kazakh breed were distinguished by the highest dairy productivity throughout the entire lactation period.

So, for 2018, their dairy productivity was 1,549 liters, and for riding-Kazakh crossbred mares - 1,364 liters and 1,431 liters (or 7-12%) lower. The lactation curve in mares does not always change in the same way. In mares kept in the stables, lactation curves differ significantly from those of pasture mares. This difference lies in the higher elevation of the apex of the lactation curve of the mares contained in the stables compared with the mares that are kept on pasture.

Studies have shown that in the same herd, there are animals with high, medium and low levels of dairy productivity. Based on the analysis and individual milkings for three months of milking (2-4 months of lactation), three groups of mares were separated for dairy productivity of high-Kazakh cross breeds in peasant farm conditions: high-milk (5 heads), in which, on average, 907 liters of milk, with fluctuations from 820 to 915 liters, medium-milk (4 heads) - 615 liters with fluctuations from 565 to 668 liters, low-milk (2 heads) - 320 liters. The coefficient of variability ( $C_v$ ) ranged from 22.6% to 37.8%. That is, the dairy productivity of mares is over a wide range.

For some mares, dairy productivity during the first 4-5 months of lactation remains almost at the same level, while for others it drops sharply from 2-3 months. For example, we give the daily productivity of two mares, who were in the same conditions. The yield for May was determined by the foal growth. At the same time, it was estimated that 10 l of milk are consumed per 1 kg of growth (table 3).

Table 3 – Milk yield of English-Kazakh crossbred mares

Individual number	Average daily milk yield by lactation months, l					
	1	2	3	4	5	6
35	6.1	6.5	6.2	5.8	5.3	3.4
17	5.4	4.8	3.9	3.0	1.8	0.9

The established individual characteristics of animals should be necessarily taken into account in breeding and technological work, giving preference to those individuals that stably maintain the milk yield for a long time.

*The impact of milking on the growth and development of foals.* It has been established that in riding-Kazakh crossbred mares the daily milk yield for 2-4 months of lactation is 7-10 liters. When transferring them to 4-5-fold milking from the 2nd month of lactation, foals receive less than 2/3 of their mother's milk or 4-6 liters per day. To replenish this under-received amount of milk and to ensure the increase in live weight, the daily ration of foals additionally includes concentrated feed, hay and green mass. To habituate foals to feed started from 1.5 months of age. When they reach 2 months of age, young animals already consume feed very good. The amount of vegetable feed increases as it grows and the dairy productivity of mares decreases.

The lactation period for mares lasts up to 9 months, of which the milking process is 6 months, since the mares are in the second period of the pregnancy.

In order to study the effect of mares milking on the growth and development of foals during the suckling period, they were weighed and measured at the age of 3 days, 6, 12, 18, and 24 months. The data were compared with indicators of foals, whose mothers had not milked (tables 4, 5).

Table 4 – Age dynamics of live weight (kg) of riding-Kazakh crossbred foals from milking and non-milking mares on koumiss farms (n = 5)

Age of foals, months	From milking mares			From non-milking mares		
	M±m	6	Cv,%	M±m	5	Cv,%
3 days	45.0±0.6	1.3	3.0	45.0±0.4	0.9	2.0
6	168±3.3	7.4	4.4	196±2.0	4.5	2.3
12	245±1.7	3.8	1.6	261±2.6	5.8	2.2
18	281±2.4	5.4	1.9	302±1.8	4.0	1.3
24	290±2.8	6.3	2.2	315±4.3	9.6	3.1

Table 5 – Age changes of the main body measurements in foals from milking and non-milking mares (n = 5)

Age of foals, months	Height at the withers, cm		Oblique body length, cm		Chest girth, cm		Meta carpus girth, cm	
	M±m	Cv,%	M±m	Cv,%	M±m	Cv,%	M±m	Cv,%
From milking mares								
3 days	95±50.3	0.7	70±0.4	1.3	78±0.3	0.8	11.5±0.2	3.8
6	124±0.4	0.7	104±0.4	0.9	124±0.6	1.1	15.1±0.2	2.9
12	128±0.5	0.9	125±0.2	0.4	136±0.4	0.7	16.0±0.3	4.2
18	137±1.1	1.8	141±0.3	0.5	145±0.5	0.8	16.8±0.2	2.6
24	142±1.5	2.4	145±0.5	0.8	155±0.6	0.9	17.5±0.3	3.8
From non-milking mares								
3 days	95±0.3	0.7	70±0.4	1.3	78±0.2	0.6	11.4±0.2	3.9
6	128±0.5	0.9	110±0.5	1.0	135±0.5	0.8	16.0±0.3	4.2
12	130±0.4	0.7	130±0.3	0.5	141±0.3	0.5	16.7±0.2	2.6
18	140±1.3	2.1	145±0.2	0.3	152±0.4	0.6	17.4±0.2	2.5
24	144±1.7	2.6	148±0.8	1.2	160±0.8	1.1	18.0±0.4	4.9

During the suckling period, the live weight of foals from milking mares in the first 6 months increased by 3.96 times, and from non-milking mares - by 4.22 times. The decrease in the level of milk nutrition in young stock leads to a decrease in the average daily gain.

As can be seen from table 5, in foals of both groups, the main body measurements before the start of mares milking were the same. By 6 months of age, foals from milking mares lagged behind foals along with their mothers in height at withers by 4 cm, body length by 6 cm, chest girth by 11 cm. Finding of foals together with mothers had a positive effect on their growth and development.

*The chemical composition of mare's milk.* Mare's milk has a pure white color with a bluish tint, sweetish, somewhat astringent flavor, due to the high sugar content, liquid consistency.

The chemical and physical properties of milk were determined by the following indicators: density, acidity, dry matter, protein, fat, sugar and minerals.

Milk density is one of the most important indicators of its naturalness, it is determined by the content of its constituent parts, and proteins, carbohydrates, as well as minerals raise the density, while fat reduces.

Indicators of the density of milk mares, depending on the breed are given in table 6.

It was established that, on average, during lactation, the density of milk at production from local Kazakh mares was 1.033°A, while in Arab-Kazakh and English-Kazakh mares, the milk density was 1.032°A. By the sixth month of lactation, it decreased by 1°A. This decrease is due to the increased fat content in milk by the end of lactation.

Table 6 – Density of mares milk depending on the breed (°A)

Month of lactation	Breed		
	Kazakh, M±m	Arab-Kazakh cross breeds, M±m	English-Kazakh cross breeds, M±m
1	1.034±0.001	1.033±0.002	1.033±0.001
2	1.033±0.002	1.033±0.002	1.032±0.001
3	1.034±0.002	1.032±0.002	1.033±0.002
4	1.033±0.001	1.032±0.001	1.032±0.001
5	1.033±0.001	1.031±0.001	1.031±0.001
6	1.031±0.002	1.030±0.002	1.031±0.001
On average for 6 months of lactation	1.033±0.002	1.032±0.002	1.032±0.001

Natural fresh mare's milk has low acidity. According to our data, the acidity of fresh milk (two hours after milking) was 5-8°T with fluctuations from 4 to 12°T (table 7).

Table 7 – Acidity of mares milk depending on the breed (°T)

Month of lactation	Breed		
	Kazakh	Arab-Kazakh cross breeds	English-Kazakh cross breeds
1	7.5±0.01	8.2±0.02	8.0±0.02
2	7.1±0.02	7.7±0.01	7.8±0.01
3	6.9±0.01	7.3±0.02	7.5±0.01
4	7.4±0.02	8.0±0.01	8.3±0.02
5	6.5±0.02	7.6±0.01	7.8±0.01
6	6.0±0.01	7.2±0.01	7.7±0.01
On average for 6 months of lactation	6.9±0.01	7.7±0.01	7.9±0.01

It was found that the acidity of milk of riding-Kazakh crossbred mares is higher in comparison with the milk of Kazakh breed mares. By the end of lactation, the acidity of milk in all groups significantly decreases in comparison with the beginning of the lactation period. The acidity of milk is caused by the presence of phosphate salts, proteins, carbon dioxide and microflora of milk.

The amount of dry matters during lactation varies on average between 9.0 and 11.4% (table 8).

Table 8 – The dry matter content of milk depending on the breed, %

Month of lactation	Breed		
	Kazakh	Arab-Kazakh cross breeds	English-Kazakh cross breeds
1	10.8±0.03	12.0±0.02	11.4±0.02
2	11.5±0.02	11.8±0.03	11.2±0.01
3	11.0±0.02	11.8±0.02	10.8±0.03
4	10.7±0.01	11.2±0.01	10.8±0.02
5	10.2±0.02	10.9±0.02	10.5±0.01
6	9.8±0.01	10.7±0.02	10.2±0.02
On average for 6 months of lactation	10.7±0.02	11.4±0.02	10.9±0.02

It has been established that the milk content of Arab-Kazakh mares has a dry matter content higher than that of peers of the Kazakh breed and its cross breed with the English. By the end of the lactation period, a decrease in the dry matter content in milk is observed in all groups.

Along with the lactation period, these changes are influenced by the quality of the used feed and biological factors (development of fetal in the mare's body). These factors affect the whole body,

including the composition and properties of milk. According to the change in dry matters, the water content in milk also changed.

The results of studies on the fat content in the milk of mares of different breeds are shown in table 9.

Table 9 – Fat content in the mares milk of different breeds, %

Month of lactation	Breed		
	Kazakh	Arab-Kazakh cross breeds	English-Kazakh cross breeds
1	1.6±0.2	1.5±0.1	1.5±0.2
2	1.3±0.2	1.3±0.2	1.4±0.1
3	1.4±0.1	1.2±0.1	1.8±0.2
4	1.3±0.2	1.6±0.2	1.9±0.1
5	1.6±0.1	1.9±0.1	2.1 ±0.2
6	1.8±0.2	2.0±0.1	2.2±0.2
On average for 6 months of lactation	1.50±0.2	1.58±0.1	1.82±0.2

The fluctuations in the milk fat of the Kazakh breed mares for six months of lactation were in the range of 1.1-1.9%, while of the Arab-Kazakh and English-Kazakh cross breeds, respectively, 1.3-2.0% and 1.4-2.2 %.

High-milk mares, as a rule, are less fat-milk (1.2% of fat per lactation on average), and milk of medium-milk mares has a higher fat content (1.6%). The maximum daily fat content of milk - 2.2% was noted in October in the English-Kazakh crossbred mare (No. 32), the minimum of 1.1% - in May in the Kazakh breed mare (No. 21).

Table 10 shows the chemical composition of milk. The content of total protein, casein, albumin and globulin in the milk of mares, depending on the breed, is given in table 11.

Table 10 – The chemical composition of the mares milk depending on the breed, %

Indicator	Breed		
	Kazakh	Arab-Kazakh cross breeds	English-Kazakh cross breeds
Dry matter	10.7±0.02	11.4±0.02	10.9±0.02
Fat	1.50±0.2	1.58±0.1	1.82±0.2
Protein	1.98±0.05	1.89±0.05	2.00±0.06
Lactose	6.4±0.04	6.6±0.04	6.9±0.05
Density, A	1.033	1.032	1.032
Acidity, T	6.9±0.01	7.7±0.01	7.9±0.01
Ash	0.3±20.03	0.34±0.02	0.35±0.02
Ca	0.17±0.02	0.18±0.02	0.18±0.01
P	0.09±0.03	0.10±0.03	0.09±0.02

The content of total protein, casein, albumin, globulin and non-protein nitrogen in mares of all groups was virtually the same on average per lactation. An increase in the content of total protein and casein before the 4 month of lactation was noted, then their decrease before the 6 month of lactation.

Alongside the change in the total protein content of milk, the ratio of its fractions also changed. In particular, as our data showed, the content of whey proteins (albumin + globulin) in mares' milk reaches 46.0-49.5%. Its high content has a significant impact on the physico-chemical properties of milk, which play an important role as carriers of immune properties that are transmitted from mother's milk to the newborn.

When fermenting mare's milk, casein settles in the form of small, delicate flakes, which almost do not change the consistency of milk.

A positive correlation was found between the fat and protein content in milk. In mares of all experimental groups, it ranged from  $r = +0.53-0.57$ .



Table 11 – The content of total protein, casein, albumin and globulin in mares milk depending on the breed, %

Month of lactation	Total protein	Casein	Albumin± globulin	Non-protein nitrogen
Kazakh breed mares				
1	1.74±0.08	0.72±0.02	0.85±0.03	0.17±0.01
2	1.77±0.07	0.73±0.04	0.87±0.05	0.14±0.01
3	2.12±0.03	0.94±0.05	0.93±0.03	0.25±0.02
4	2.15±0.02	0.86±0.06	1.17±0.04	0.12±0.01
5	2.20±0.03	0.95±0.03	1.10±0.05	0.15±0.02
6	1.93±0.05	0.77±0.04	0.98±0.03	0.18±0.01
On average for 6 months of lactation	1.98±0.05	0.82±0.04	0.98±0.04	0.11±0.01
Arab-Kazakh cross breeds				
1	1.84±0.06	0.61±0.03	0.98±0.04	0.25±0.01
2	1.76±0.08	0.66±0.02	0.89±0.03	0.21±0.02
3	1.94±0.05	0.87±0.01	0.90±0.03	0.17±0.03
4	2.05±0.04	0.98±0.04	0.79±0.02	0.28±0.04
5	1.97±0.03	0.91±0.03	0.87±0.02	0.19±0.03
6	1.76±0.04	0.82±0.02	0.81±0.02	0.13±0.01
On average for 6 months of lactation	1.89±0.05	0.81±0.03	0.87±0.03	0.21±0.02
English-Kazakh cross breeds				
1	1.97±0.05	0.75±0.04	0.94±0.05	0.28±0.02
2	1.91±0.04	0.81±0.05	0.84±0.03	0.26±0.03
3	2.05±0.08	0.97±0.07	0.89±0.04	0.19±0.04
4	2.01±0.07	1.06±0.05	0.70±0.03	0.25±0.06
5	2.08±0.08	1.05±0.06	1.03±0.05	0.28±0.05
6	1.95±0.04	0.92±0.03	0.90±0.04	0.13±0.02
On average for 6 months of lactation	2.00±0.06	0.93±0.05	0.88±0.04	0.23±0.03

Milk sugar is an essential part of milk, having a specific effect on the body as a source of energy. During lactation, it is the most stable part of the mares' milk, changing only slightly - within 6.2-7.3%. In the study of milk the change in this indicator depending on the breed of mares was studied (table 12).

Table 12 – The content of milk sugar in the mares' milk by breeds, %

Month of lactation	Breed		
	Kazakh	Arab-Kazakh cross breeds	English-Kazakh cross breeds
1	6.2±0.07	6.4±0.05	6.5±0.04
2	6.4±0.03	6.8±0.04	6.8±0.05
3	6.7±0.03	6.8±0.03	7.0±0.04
4	6.5±0.04	6.7±0.04	7.3±0.05
5	6.2±0.03	6.4±0.03	7.0±0.04
6	6.2±0.04	6.3±0.04	6.8±0.05
On average for 6 months of lactation	6.4±0.04	6.6±0.04	6.9±0.05

It has been established that, in terms of the content of milk sugar in milk, riding-Kazakh crossbred mares outperform their purebred Kazakh peers by 0.2-0.5% or 3.1-7.8%. It was not possible to establish any definite pattern in the change in the amount of milk sugar by the months of lactation.

Studies of the mineral composition of the mares' milk improved by Roadster breeds are of particular interest not least because this issue is far from being fully covered in the literature (table 13).

Table 13 – The content of minerals in the mares' milk by breed, %

Month of lactation	Ash	Calcium	Phosphorus	Phosphorustocalciumratio
Kazakh				
1	0.41±0.03	0.18±0.02	0.10±0.03	0.56
2	0.36±0.02	0.21±0.03	0.12±0.04	0.57
3	0.28±0.04	0.17±0.02	0.09±0.02	0.53
4	0.29±0.03	0.17±0.02	0.10±0.02	0.59
5	0.27±0.04	0.15±0.03	0.08±0.03	0.53
6	0.28±0.03	0.15±0.03	0.08±0.03	0.53
On average for 6 months of lactation	0.32±0.03	0.17±0.02	0.09±0.03	0.53
Arab-Kazakh cross breeds				
1	0.46±0.02	0.20±0.02	0.12±0.03	0.60
2	0.40±0.03	0.22±0.03	0.12±0.04	0.55
3	0.31 ±0.04	0.19±0.02	0.10±0.02	0.53
4	0.30±0.03	0.17±0.03	0.09±0.03	0.53
5	0.28±0.01	0.17±0.02	0.09±0.02	0.53
6	0.28±0.02	0.15±0.03	0.08±0.02	0.53
On average for 6 months of lactation	0.34±0.02	0.18±0.02	0.10±0.03	0.56
English-Kazakh cross breeds				
1	0.47±0.02	0.20±0.02	0.11±0.02	0.55
2	0.40±0.02	0.21±0.02	0.11 ±0.02	0.52
3	0.35±0.03	0.20±0.01	0.10±0.01	0.50
4	0.31±0.03	0.17±0.02	0.08±0.02	0.47
5	0.30±0.02	0.17±0.01	0.08±0.02	0.47
6	0.28±0.01	0.16±0.01	0.07±0.01	0.44
On average for 6 months of lactation	0.35±0.02	0.18±0.01	0.09±0.02	0.50

Based on the obtained data, it can be concluded that the pedigree of horses does not have a significant effect on the indicators of the chemical composition of the mares' milk. The earlier opinion in the literature on the best suitability of steppe mares' milk for koumiss, due to the fact that it supposedly has more sugar and less fat, is not supported by our research. On the contrary, the milk of the steppe (Kazakh) breeds contains the same amount of fat, protein, and there is less milk sugar in it than in the milk of the riding-Kazakh crossbred mares.

According to the available literature data, and on the basis of the results of our research, it was confirmed that milk sugar is the only component of mare's milk that did not undergo drastic changes during lactation [29].

The content of minerals in the milk of mares by the end of lactation was less than at the beginning, and is 0.28%. The highest calcium content in milk was observed in the first months of lactation. Changes in the phosphorus content in milk during lactation were similar to changes in calcium. The ratio of phosphorus and calcium in milk was relatively constant during lactation.

Currently, much attention is paid to the quality of the products, as in some cases it is impossible to produce a high-quality dairy product - koumiss, from low-quality milk [30].

In this regard, in order to increase the quality of the obtained dairy products, it is advisable on koumiss farms 1 -2 times per lactation to individually determine the quality of the mares' milk according to 4 indicators: acidity, density, fat and protein content. It is reasonable to determine the quality of milk from these indicators more often, especially in connection with the transition of milking mares to pasture-stall maintenance.

*Setup for milk production.* In order to develop an optimal operation mode in the peasant farm, we conducted the timekeeping of daily operations on milking mares. At the same time, it has been established that it takes 7-10 hours to graze mares, 4-6 hours of which are between milkings, 3-4 hours after the last milking (table 14).

Table 14 – The optimal daily routine on the koumiss farm of the Sarsebek farm (hours, min.)

Type of activity	Start	Finish	Duration
In the 1st half of lactation			
Weaning offfoals	5-00	5-30	0-30
First milking	8-00	8-30	0-30
Second milking	10-30	11-00	0-30
Third milking	13-00	13-30	0-30
Fourth milking	15-30	16-00	0-30
Fifth milking	18-00	18-30	0-30
Grazing on natural pastures and watering between milkings	8-30	18-30	8-00
Distribution of mowing and concentrated feed to foals between the milkings	8-30	16-00	5-30
Grazing of mares with foals and watering of foals	18-30	21-30	3-00
Distribution of concentrated feed for mares and foals for the night	21-30	21-45	0-15
Nightrest	22-00	5-00	7-00
Workinghours			8-00
In the 2nd half of lactation			
Weaning offfoals	6-00	6-30	0-30
First milking	9-00	9-30	0-30
Second milking	12-00	12-30	0-30
Third milking	15-00	15-30	0-30
Fourth milking	18-00	18-30	0-30
Pasture on levades and watering between the milkings	9-30	18-00	7-00
Distribution of mowing and concentrated feed to foals between the milkings	9-30	16-00	4-30
Grazing of mares with foals on levadas and watering of foals	18-30	21-00	2-30
Distribution of concentrated feed to mares and foals for the night	21-00	21-15	0-15
Nightrest	22-00	6-00	8-00
Workinghours			8-00

While developing this daily routine, the time of milking, feeding, watering and resting of horses was foreseen. In order to avoid gastrointestinal diseases in early spring, horses were fed with hay before being released into pasture. During the summer, milking mares and suckling foals were kept most of the day naturally and artificially grazing. In the hot hours of the day they were driven into the premises.

The materials of our observations in the farm indicate that the single-shift 2-cyclic operational mode with four and five times milking of mares with stable pasturing maintenance and division of labor (milkmaid, herdsman) is the most optimal.

The preferable interval between milkings of mares should be no more than 2-2.5 hours.

When concentration in a group is up to 12-15 milking mares, they are kept on the milking area for 30 minutes for each milking, as a result, there is 1 hour of time between the milkings. Therefore, it is important to conduct milking in a clear and orderly manner, strictly according to the daily routine.

Observations on the pasture of suckling mares showed that animals actively graze in one place. In spring and in the first half of summer, horses are grazed on natural pastures at a distance of 1-1.5 km from the farm, and in the second half of lactation due to the deterioration of natural pastures, they are kept on cultural pastures (levada).

Such a flexible daily routine better meets the biological characteristics of the mammary gland of Kazakh breed mares and their cross breeds with roadster horses, optimizes the work of the koumiss farm and is convenient for the staff. Milking of riding-Kazakh crossbred mares for the purpose of obtaining marketable milk is an additional reserve for increasing the production of koumiss and increasing the profitability of any horse-breeding farm. The production of mare's milk is beneficial for farms with highly productive natural and artificial pastures.

**Conclusions.** For the horses of the foothill zone of the south-east of Kazakhstan (purebred mares of the local Kazakh breed and their cross breeds with the roadster breeds) are there are recommended technologies that ensure the production of marketable milk and koumiss: milking of mares 1 month after the colting; weaning of foals for the night with 5 times milking of mares in the 1st half of lactation with an interval between milkings of 2 hours, and in the 2nd half of lactation- 4 times milking of mares with an interval between milkings of 2.5 hours.

In the conditions of peasant farms in the south-east of Kazakhstan, when organizing the stable-grazing maintenance of mares of the local Kazakh breed and their cross breeds with roadsters on a farm with grazing on the levadas in summer, there is an opportunity for seasonal production of koumiss. At the same time, for 6 months of lactation, the milk production of Kazakh breed mares is 1,549 liters, the commodity yield is 920 liters, and for the Arab-Kazakh and English-Kazakh cross breeds, these figures are 1,431 and 850 liters; 1364 and 815 liters respectively.

Growing of foals up to 6 month-age on cultivated pasture (levada) increases their live weight compared with stall feeding by 8.7% and allows to get 861 g of average daily gain due to maximum use of green fodder rich in valuable nutrients.

The English-Kazakh crossbred mares exceeded the mares of the local Kazakh breed in terms of fat content by 0.32 or 21.3%, protein by 0.17 or 8.9%. The dry matter content ranges from 10.7 to 11.4%. A negative correlation  $r = -0.28-0.31$  was found between the fat content in milk and milk yield.

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#### ҚАЗАҚ ЖЫЛҚЫ ТҰҚЫМЫ БИЕЛЕРІНІҢ ЖӘНЕ ОЛАРДЫҢ САЛТ МІНІСТІ ЖЫЛҚЫЛАРМЕН БУДАНЫНЫҢ СҮТ ӨНІМДІЛІГІ

**Аннотация.** Анықталды, салт міністі-қазақ будандары тірі салмақ бойынша (403-410 кг) жергілікті қазақ жылқыларынан (395 кг) асып түседі. Шоқтық биіктігі бойынша ағылшын-қазақ будандары (148,5±0,7 см) араб-қазақ будандарынан (141,2 ± 0,5 см) және жергілікті қазақ жылқыларынан (142,7 ± 0,8 см) жоғары. Кеуде орамы бойынша араб-қазақ будандары (175,8 ± 0,8 см), керісінше ағылшын-қазақ будандарынан (171,7 ± 1,1 см) және жергілікті қазақ жылқыларынан (171,1 ± 1,2 см) жоғары көрсеткіш көрсетті.

Ағылшын-қазақ будандарының кең денелік индексі - 115,62, жергілікті қазақ жылқылары - 119,90, араб-қазақ будандары - 124,50.

Салт-қазақтың жылқылары жоғары сүттіліктің (лактация) 2-4 айына күнделікті сүт өнімділігі 7-10 литр құрайды деп анықталды. Сүттіліктің (лактацияның) 2-ші айынан 4-5 есеге дейін сүтті емізіп жатқанда, құлындар ана сүтінің 2/3 шамасынан немесе тәулігіне 4-6 литрден төмен сүт емеді. Бұл емілмеген сүт мөлшерін толтыру және тірідей салмақты жоғарылату үшін күнделікті рационның қоспа жем, шөп және көк шөп қамтылды. Құлындарды 1.5 айдан бастап жемге үйретілді. 2 айға жеткенде жас төлдер жемді жақсы жейді. Емізу кезеңінде сүт биелерінен шыққан популяцияның тірі салмағы алғашқы 6 айда 3,96 есеге, ал сауылмаған - 4,22 есе өсті. Жас құлындардың сүтті ему деңгейі төмендеген сайын олардың орташа күнделікті салмағының төмендеуіне әкеледі.

Орта есеппен, сүттілік (лактация) кезінде жергілікті қазақ жылқыларының шыққан сүт тығыздығы 1,033 °А, ал араб-қазақ және англо-қазақ сүтінің тығыздығы 1,032 °А болды. Сүттіліктің (лактацияның) алты айының ішінде қазақ жылқы тұқымының май деңгейінің ауытқуы 1,1-1.9%, ал араб-қазақ және ағылшын-

казак будандары тиісінше 1,3-2,0 және 1,4-2,2%. Яғни, жылқының қандастығы сүттің химиялық құрамы көрсеткіштеріне айтарлықтай әсер етпейді.

**Түйін сөздер:** казак жылқылары, салт міністі - казак будандары, сүт, сүт өнімділігі, құлындардың тез өсуі, өсу және даму, құлындар.

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### **МОЛОЧНАЯ ПРОДУКТИВНОСТЬ КОБЫЛ КАЗАХСКИХ ЛОШАДЕЙ И ИХ ПОМЕСЕЙ С ВЕРХОВЫМИ ПОРОДАМИ**

**Аннотация.** Установлено, что верхово-казахские помеси по живой массе (403-410 кг) превосходят местных казахских лошадей (395 кг). По высоте в холке англо-казахские помеси (148,5±0,7 см) превосходят арабо-казахских помесей (141,2±0,5 см) и местных казахских (142,7±0,8 см). По объёму груди арабо-казахские помеси (175,8±0,8 см) наоборот превосходят англо-казахских помесей (171,7±1,1 см) и местных казахских (171,1±1,2 см).

Индекс широкотелости у англо-казахских помесей составляет 115,62, местных казахских лошадей - 119,90, арабо-казахских помесей - 124,50.

Установлено, что у верхово-казахских помесных кобыл суточная молочная продуктивность на 2-4 месяца лактации составляет 7-10 литров. При переводе кобыл на 4-5- кратную дойку со 2-го месяца лактации жеребята недополучают 2/3 материнского молока или 4-6 литров в сутки. Для восполнения этого недополученного количества молока и для обеспечения прироста живой массы в суточный рацион жеребят дополнительно включали концентрированные корма, сено и зеленую массу. Приучать жеребят к кормам начинали с 1,5-месячного возраста. При достижении 2-х месячного возраста молодняк уже хорошо потребляет корма. В подсосный период живая масса тела жеребят от дойных кобыл в первые 6 месяцев увеличилась в 3,96 раза, а от недойных - в 4,22 раза. Снижение уровня молочного питания молодняка ведет к уменьшению среднесуточного прироста.

Установлено, что в среднем за лактацию плотность молока составляла при продуцировании у местных казахских кобыл - 1,033°А, арабо-казахских и англо-казахских плотность была равной - 1,032°А. Колебания жира у кобыл казахской породы за шесть месяцев лактации находились в пределах 1,1-1,9%, а у арабо-казахских и англо-казахских помесей соответственно - 1,3-2,0 и 1,4-2,2 %. То есть, кровность лошадей не оказывает существенного влияния на показатели химического состава молока кобыл.

**Ключевые слова:** казахская лошадь, верхово-казахские помеси, молоко, удой, скороспелость жеребят, рост и развитие, жеребята.

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