

## Conservation and rational use of the gene pool of mountain horses of Dagestan

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### ABSTRACT

The research was carried out to study the population of mountain horses in Dagestan. The researchers analyzed measurements, body indices, and exterior structure by points of the horse as well as its adaptive qualities, conditions of keeping, feeding, and types of use. The research results have shown that the Indigenous mountain horses of the Dagestan population have sufficiently balanced indices of physique and structure of the exterior. These parameters differ from the known ones of Caucasus mountain breeds (the Kabarda and the Karachay) and others in Russia and abroad. They are kept in herds throughout the year and are used as working and utility animals. Productive horse breeding is very poorly represented, but its development is a very important task. Mountain horses are the most suitable for equestrian tourism in Dagestan due to their characteristics and price-quality ratio. The analysis of the research results has shown the expediency of proving the homogeneity, distinctiveness, and stability of the Dagestani horse population for further work on its inclusion in the State Register of Breeding Achievements of the Russian Federation as an independent breed or type.

**Keywords:** Gene pool, Mountain horses, Dagestan Republic, Zootechnical indicators, Exterior.

**Article type:** Research Article.

### INTRODUCTION

According to the plan of scientific and technical support for the development of agriculture in Dagestan for 2022-2030, with the support of the Ministry of Agriculture and Food of the Republic of Dagestan, scientists from the Federal State Budgetary Scientific Institution "Federal Agricultural Scientific Centre of the Republic of Dagestan" together with the researchers from Russian State Agrarian University – Moscow Timiryazev Agricultural Academy carried out the research concerning the population of mountain horses in Dagestan for the first time in many years. Scientists have noted that Dagestani mountain horses have a variety of colors, are adapted to mountain conditions, and are robust and undemanding. Such horses have strong, skinny legs, strong hooves, and stable gaits. They move confidently under the rider and pack on mountain trails and rough terrain, capable of overcoming steep ascents and descents (Republican weekly socio-political newspaper "Lezgi Gazeta" 2023). However, there is no record of the Dagestani horse breed in the State Register of Breeding Achievements of the Russian Federation, even though there are a large number of indigenous horses in the Republic and historical evidence that Dagestani horses have been bred here since ancient times. The importance of preserving the gene pool of Indigenous horse breeds, in particular its impact on biodiversity, ecology, preservation of historical traditions, development of the horse breeding industry, and food security, has been the subject of much work carried out by scientists from different countries (Mirzoev 2017; Khaudov *et al.* 2020; Khozhokov & Abdulmuslimov 2022; Sufiyan 2022; Nurmakhanbetov *et al.* 2022; Nimatulaev *et al.* 2023; Mongke *et al.* 2024; Lovász *et al.* 2024, Taylor *et al.* 2024,

Zhang *et al.* 2024). In this regard, it is essential to research the authenticity of the Dagestani horse, its breed distinctiveness, homogeneity, and stability for further work on its inclusion in the State Register of Breeding Achievements of the Russian Federation as an independent breed or type. Trukhachev *et al.* (2016) pointed out that the state and development of agriculture depend on the peculiarities of the regions, which include a combination of natural factors and the content of state management. If these funds are used correctly, they bring profit. Dagestan is located in the southernmost part of the Russian Federation. With just over 50,000 km<sup>2</sup>, it is the largest region in the North Caucasus. The territory of the Republic, with its outstanding ecological and cultural sites, is of great value to the country's population in terms of recreational and health-promoting use. Modern authors point out the tourist potential of the Republic, including the use of horse breeding resources. For instance, Magomedov (2023) believes that pastoralism in Dagestan contributes to solving the problem of rural tourism in the mountainous and semi-mountainous areas of the Republic. The indigenous horses of Dagestan are well suited for this purpose. Eldarov (2022) writes that equestrian and tourist bases have great potential for promoting a respectful attitude to nature and patriotic education among young people. In addition to unfavorable areas for land cultivation, the Republic also has areas with fertile moist soils, which create good conditions for the development of agriculture, plant growing, and animal husbandry. Scientists estimate that more than 53.0% of the total gross output of agricultural production comes from livestock. As mentioned above, the problem of preserving the gene pool of farm animals is urgent worldwide. In addition to the above-mentioned reasons, the loss of indigenous animal breeds threatens humanity with the permanent loss of genes that determine many valuable traits, such as adaptability, fertility, undemanding demeanor, disease resistance, and physical strength. Therefore, it is very important to preserve local breeds with unique biological qualities (Nimatulaev *et al.* 2023). Dagestan is leading in the Russian Federation regarding goat and sheep herding. Cattle breeding, poultry farming, and dairy farming are well-developed (Khozhokov & Abdulmuslimov 2022). There is an increase in the efficiency of agriculture in the south of Russia, and support of the state generates good conditions for the agricultural business (Trukhachev *et al.* 2016). The results of analytical work have demonstrated the reasonable possibility of obtaining high-quality products in Russia, which, according to the main parameters, correspond to the highest gradations of the world quality standards (Trukhachev *et al.* 2015). Noteworthy, horse breeding has great potential. The total number of horses in the Republic is about 40,000. Most of them are indigenous horses capable of successfully grazing on pastures unsuitable for other animals. There are rich historical roots of horse breeding in Dagestan. Several authors attest to the ancient human presence in the Caspian territories (modern-day Dagestan). For example, Kandyba & Rybalko (2022), Ramazanova (2019), and Taymazov (2019) pointed out that the Caucasus was inhabited as early as the Paleolithic Age, the first period of the Stone Age. By the beginning of the 6<sup>th</sup> millennium BCE, the Chokh settlement kept domestic sheep and goats. Later, cattle and, even later, horses were bred. On the territory of Dagestan, 41 sites of rock and cave drawings have been discovered, with about 7,000 images of people and animals, including horses (Amirkhanov 2023). Almost all peoples of the Caucasus and pre-Caucasus honored the horse as an indispensable animal in human life. Burkov (2019) writes that the population formed a cult of the horse. Excavations in Southern Dagestan provide evidence of a burial tradition that existed at the turn of the 2<sup>nd</sup> and 1<sup>st</sup> millennia BCE and included horse bones and some items of its harnesses. A group of sculptural images embedded in the walls of houses and other images from the 1<sup>st</sup> millennium CE discovered by Endoltseva (2023) are animal heads, mostly horse heads made of stone. For instance, horse heads were found in the foundations of former residential buildings and the foundation of the bridge wall in the village of Khveredzh (Kurakhsky district, Republic of Dagestan). Kaziev & Karpeev (2003), as well as Tornau (2008), mention that horses influenced horse breeding in Dagestan from neighboring areas, such as the "Tramov breed" of horses, which was highly valued for its qualities. The Karachay and Balkar horses were also influential, and their exterior and measurements are presented in papers by Demin & Tsyganok (2019, 2021, 2022). Kabarda horses had a great impact on the formation of Caucasian horse breeds. Their description and characteristics are given in the works of Khaudov *et al.* (2020) and Mirzoev (2017). The blood of horses from Kalmykia, Chechnya, Azerbaijan, Georgia, Armenia, and Iran has also been introduced. Iranian horse breeding is of interest as the famous Persian horse has been making its way to the territory of Dagestan since the early days of Media (Musaeva 2019). Trends that came to the Caucasus from Iran as early as the 9<sup>th</sup> century BCE can be seen, for example, in paired images of horses [Kertseva (Volnaya) 2022]. In her article, Kovalevskaya (2020) states that ancient Nisean horses greatly influenced breeding. It is extremely difficult to trace the influence of one breed or another on the Dagestani horse. However, the main driving force behind the development of the Dagestani horse, apart from folk breeding, was

natural selection. Only the most adapted animals could survive the peculiar conditions of the Caspian Sea region, the mountain climate. As a result, a separate population of horses with distinctive features was formed (Karayev 2003). The economic disparity between nationalities in the past also played a part in developing distinctive horse types. In the middle of the 20<sup>th</sup> century, quite serious research on the study of Dagestani horses was carried out. For example, an article entitled “Horses of the Dagestani ASSR” by Voityatsky (1939) is included in the well-known work *Horse Resources of the USSR*. The article was based on a survey by the genetic department of the USSR Academy of Sciences and the All-Union Academy of Agricultural Sciences named after V.I. Lenin. The scientist identified different types of horses depending on the place they were bred (Voityatsky, B 1939, ‘Horses of the Dagestani ASSR’, in *Horse Resources of the USSR*, Selkhozgiz, Moscow, pp. 255-269 [in Russ.]). In Sultanov’s work “Economic characteristics and some morpho-physiological features of the highland Dagestani horses” (1965), it is stated that horses in the Republic were bred following such methods as pure pasture (without additional feeding in mountainous and high-altitude areas), improved pasture (with additional feeding in foothill areas), and stable-pasture (in flat areas). Sultanov’s research showed that the oxidative potential of red blood is higher in mountain horses than in lowland horses. The author notes that the share of horse meat in the total balance of meat production in the republic was extremely low (0.3%; Sultanov, L 1965, *Economic characteristics and some morpho-physiological features of the highland horses of Dagestan*, Moscow, p.18 [in Russ.]). There is much information about the benefits of horse meat. A recent study by Yakut scientists showed that one of the factors of Yakut longevity is the consumption of young horse meat (Suknyova *et al.* 2019). The region is of great interest due to the advantages of horse meat and favorable conditions for its reproduction. Developing horse breeding for meat production is Dagestan's perspective and urgent task. The analysis of publications showed that horse breeding in Dagestan was historically well-developed. For several reasons, the horses of Dagestan were not included in the State Register of Breeding Achievements of the Russian Federation. The main reason is the lack of large farms breeding local horses in Soviet times. The policy of animal husbandry at that time was to “improve” native breeds with artificially-bred species. By the end of the 1980s, this practice was found to be unjustified. It is now recognized that the gene pool of indigenous breeds needs to be preserved as carefully as possible. This is in line with the worldwide practice of preserving the biodiversity and valuable genetic material of native horse breeds. The special qualities of Dagestani mountain horses, described in historical and modern literature, are valuable for the use of horses in the national economy of the Republic today. The utilization of horses is diverse, mainly equestrian tourism, productive horse breeding, and utilization as riding and pack animals. It is pertinent to ascertain the extent to which the population of native horses has retained its original characteristics in the present era. This became the objective of our research project.

## **MATERIALS AND METHODS**

In the period from 24<sup>th</sup> to 28<sup>th</sup> April 2023, an expedition to the Republic of Dagestan was carried out to determine the first stage of the horse population survey by the provisions of Agreement No. 31/23 of 19<sup>th</sup> April 2023 on the subject “Primary zootechnical survey and selection of horse breeding farms of the Republic of Dagestan for a comprehensive assessment of livestock in 2023”. The agreement was signed between the Federal State Budgetary Scientific Institution “Federal Agrarian Research Centre of the Republic of Dagestan” and the Russian State Agrarian University – Moscow Timiryazev Agricultural Academy. Following the agreement, four farms were surveyed for 605 animals, of which 569 were mares, and 36 were stallions (Table 1). The farms’ stock was examined as a whole, then animals with a more correct structure and “mountain type” were selected to describe their exterior and take measurements, including 108 horses (99 mares and 9 stallions). The exterior's most common features and defects were meticulously noted based on a comprehensive visual examination of the animals. In addition to the exterior structure, the color, overgrowth, density of mane and feathering, and the size of chestnuts were described in detail. According to the rigorous methods in animal husbandry, measurements of the height at the withers, oblique length of the trunk, chest girth, and metacarpal girth were carried out; indices of body measurements relative to the height at the withers were calculated. For taking measurements, horses were fixed in a race. The age of the horses was determined according to the information given by the owners and specified by the dental condition of the horses. According to the data provided by the horse owners, the conditions of maintenance, feeding, adaptive qualities, indicators of labor productivity, and the use of horses were described. Familiarization with the primary zootechnical records on farms was carried out. According to the records and other information given by the horse owners, their origin, breed, and place of birth were indicated.

**Table 1.** The stock surveyed on the farms.

Name of the farm	Examined horses, heads			Measurements and description of exterior, heads		
	Total	Mares	Stallions	Total	Mares	Stallions
Farm "Agrofirma Chokh"	157	150	7	34	31	3
Sole trader Chokusulov R.S.	34	32	2	8	7	1
Agricultural production cooperative "Salta"	162	137	25	31	28	3
Peasant household "Rassvet"	252	250	2	35	33	2
Total	605	569	36	108	99	9

## RESULTS AND DISCUSSION

The results of the visual inspection of the entire herd, taking measurements, describing the exterior, and considering other indicators for the selected horses are of significant importance. The main measurements, body indices, and ages of the horses examined are shown in Table 2. At the same time as the analysis of measurements and body indices, we described the visual appearance of the horses, the stables, the breed, the maintenance conditions, and the use of the horses. As can be seen from Table 2, the mares on the farm "Agrofirma Chokh" were distinguished by medium-sized growth ( $149.5 \pm 0.65$  cm), rather lean build, had a strong constitution with elements of robustness. The elongation of the body was small ( $101.6 \pm 0.34\%$ ), the horses were of medium massiveness ( $118.7 \pm 2.19\%$ ), and the backbone was well developed ( $12.6 \pm 0.09\%$ ). The stallions' physique indices in this farm had lower values in terms of massiveness ( $111.9 \pm 0.58$ ) and elongation ( $100.2 \pm 0.07\%$ ) compared to mares, which was due to their young age, on average 4 years with an individual discrepancy of 3-5 years. A statistical analysis of the distribution of equine stables on the Agrofirma Chokh farm revealed that most horses (60.5%) exhibited a bay coloration ranging from light to dark bay. The remaining 33.3% of horses were identified as chestnut, displaying a range of shades within this category. Additionally, 5.1% of horses exhibited grey coloration, while 1.1% light bay coloration. In many horses, lighter pigmentation was observed at the end of the muzzle, abdomen, chest near the elbows, groin, and back of the loins. All the bay and chestnut horses that went through the race had a dark stripe on their backs. Many horses had dark spots on their body. The mane, the tail, and the feathering were not thick. Chestnuts were small, especially on the hind limbs, and sometimes hardly noticeable. Most horses had elongated ears compared to other horse breeds. Many representatives had different body structures. Most horses (78%) exhibited a large or relatively large head with a well-developed, wide jaw, a straight profile, an average-length or relatively short neck, and an ewe neck. The withers were smooth, while the dorsal and lumbar regions were relatively elongated. The rib cage had sufficient width and average depth, exhibiting well-developed vertebral ribs. The scapula was relatively straight in all horses, while the croup was steep. The front legs were slightly drawn together and tucked beneath the body, with occurrences of splay feet. The hind legs were crooked, and some horses exhibited an X-shaped hindquarters position. According to the owner's verbal testimony and available records, all the mares examined in the race were derived from homebred Dagestani stallions. The current population of stallions comprises both homebred and purchased sires, representing a range of breeds, including Dagestani and other breeds. One stallion was identified as having  $\frac{1}{4}$  Arabian blood, while a Karachay breed stallion was used in a herd of colts intended for commercial purposes (i.e., non-breeding). Some mares might be suitable for breeding, provided their traits align with the farm's objectives. Horses were used for riding, herding, and breeding for sale, including tourism. Less frequently, horses were also used as meat animals. They were typically kept in herds on pastures without additional feeding. The mares from the farm of sole trader Chokusulov R.S. ( $142.0 \pm 1.51$  cm) were significantly smaller than those from the Agrofirma Chokh farm ( $149.5 \pm 0.65$  cm), as shown in Table 2. Most of the animals examined (90%+) were chestnut in color, with 60% exhibiting a golden hue. In addition to their smaller height, the mares from this farm exhibited other distinctive physical characteristics, including a leaner and lighter body. Additionally, the animals exhibited greater elongation ( $105.4 \pm 1.77$  cm) and reduced mass ( $114.3 \pm 1.97\%$ ) with well-developed bone density ( $12.0 \pm 0.21\%$ ). Nevertheless, the observed differences in body indices between horses from these farms were not statistically significant.

**Table 2.** Basic measurements of the body, physique indices, and age of the horses examined.

Name of the farm	Parameters	Age (year)	Measurements (cm)				Physique indices (%)		
			height at the withers	length of the body	chest girth	metacarpal girth	length of the body	chest girth	metacarpal girth
Farm "Agrofirma Chokh"	Mares (n = 31)								
	M	<b>7.8</b>	<b>149.5</b>	<b>151.9</b>	<b>177.1</b>	<b>18.9</b>	<b>101.6</b>	<b>118.7</b>	<b>12.6</b>
	m	0.68	0.65	0.51	2.75	0.10	0.34	2.19	0.09
	Cv (%)	48.1	2.4	1.9	8.6	2.9	1.9	10.3	4.2
	Stallions (n = 3)								
	M	<b>4.0</b>	<b>148.7</b>	<b>149.0</b>	<b>166.3</b>	<b>19.3</b>	<b>100.2</b>	<b>111.9</b>	<b>13.0</b>
	m	0.18	0.94	0.84	1.55	0.21	0.07	0.58	0.07
	Cv (%)	25.0	3.5	3.1	5.1	6.0	0.40	2.8	2.9
	Mares (n = 7)								
Sole trader Chokusulov R.S.	M	<b>6.7</b>	<b>142.0</b>	<b>149.6</b>	<b>162.3</b>	<b>17.1</b>	<b>105.4</b>	<b>114.3</b>	<b>12.0</b>
	m	0.81	1.51	1.25	2.57	0.30	1.77	1.97	0.21
	Cv (%)	31.8	2.8	2.2	4.2	4.6	4.4	4.6	4.6
Stallion (n = 1)									
-	<b>5</b>	<b>144</b>	<b>145</b>	<b>159</b>	<b>18</b>	<b>100.7</b>	<b>115.3</b>	<b>12.8</b>	
Mares (n = 28)									
Agricultural production cooperative "Salta"	M	<b>6.1</b>	<b>143.7</b>	<b>147.3</b>	<b>169.0</b>	<b>18.1</b>	<b>102.5</b>	<b>117.7</b>	<b>12.6</b>
	m	0.27	0.73	0.93	1.19	0.16	0.39	0.94	0.15
	Cv (%)	23.7	2.7	3.3	3.7	4.8	2.0	4.2	6.3
Stallions (n = 3)									
Peasant household "Rassvet"	M	<b>5.3</b>	<b>145.3</b>	<b>148.0</b>	<b>170.0</b>	<b>18.5</b>	<b>101.8</b>	<b>114.9</b>	<b>12.6</b>
	m	0.26	0.88	2.52	2.31	0.29	1.13	0.39	0.17
	Cv (%)	28.6	1.1	2.9	2.4	2.70	1.9	0.6	2.3
Mares (n = 33)									
Peasant household "Rassvet"	M	<b>7.4</b>	<b>139.2</b>	<b>141.7</b>	<b>163.9</b>	<b>17.2</b>	<b>101.8</b>	<b>117.8</b>	<b>12.4</b>
	m	0.35	0.50	0.44	0.71	0.09	0.16	0.45	0.06
	Cv (%)	26.7	2.1	1.8	2.5	2.9	0.9	2.2	2.6
Stallions (n = 2)									
Mares (n = 99)	M	<b>7.0</b>	<b>143.5</b>	<b>149.5</b>	<b>165.0</b>	<b>18.0</b>	<b>104.2</b>	<b>114.9</b>	<b>13.5</b>
	m	0.0	0.50	0.5	0.00	0.00	0.01	0.40	0.50
	Cv (%)	0.0	0.5	0.5	0.0	0.0	0.0	0.49	0.5
On average (n = 108)									
Mares (n = 99)	<b>M</b>	<b>7.0</b>	<b>143.6</b>	<b>147.6</b>	<b>168.1</b>	<b>17.8</b>	<b>102.8</b>	<b>117.1</b>	<b>12.4</b>
	m	0.38	2.17	2.19	3.33	0.42	0.88	0.97	0.14
	Cv (%)	10.8	3.0	3.0	4.0	4.7	1.7	1.7	2.3
Stallions (n = 9)	<b>M</b>	<b>5.3</b>	<b>145.4</b>	<b>147.9</b>	<b>165.1</b>	<b>18.2</b>	<b>101.7</b>	<b>114.3</b>	<b>13.0</b>
	m	0.60	1.17	1.01	2.29	0.48	0.89	0.79	0.19
	Cv (%)	23.4	1.6	1.4	2.8	5.3	1.8	1.4	3.0

The stallion examined on this farm exhibited an almost square body shape (100.7%) and massiveness (115.3%), yet demonstrated a slight inferiority in bone index (11.8%) compared to the mares. Additionally, the horses exhibited a lowered neck position and a less pronounced back. A review of the data revealed that 75% (6 out of 8 heads) of the horses exhibited a fold in the neck-withers region, while 25% (2 out of 8 heads) displayed slightly

roached backs and loins, which were not observed in the Agrofirma Chokh sample. A few mares exhibited an elongated (eastern) eye shape with a prominent elongated frontal eminence. The remaining characteristics and defects observed in the horses from sole trader Chokusulov R.S. were comparable to those observed in the horses from the previous farm. The owner provided verbal statements and a limited number of records indicating that all the mares examined in the race were derived from homebred Dagestani stallions. Some stallions, who had already been retired, had bloodlines with Don, Akhal-Teke, and Arabian horses at 1/16 or less. Currently, the owner was utilizing homebred stallions from Dagestani Sires. Additionally, horses were used for riding, herding, and breeding for sale, including tourism. The animals were kept in herds on pasture without additional feeding. The intermediate values of withers height ( $143.7 \pm 0.73$  cm) observed in mares from the agricultural production cooperative Salta were comparable to the measurements of the body points of animals from the Agrofirma Chokh farm and sole trader Chokusulov R.S. However, these values were significantly smaller than those observed in mares from Agrofirma Chokh ( $149.5 \pm 0.65$  cm). No significant differences were found between the Salta mares and the sole trader dams. Concerning body build indices, no significant differences were observed in the animals from the agricultural production cooperative Salta compared to those from Agrofirma Chokh and sole trader Chokusulov R.S. (Table 2). The color of 41.9% (13 horses out of 31) of the horses examined at the agricultural production cooperative Salta was bay, with various shades, 45.2% were chestnut, and 12.9% of the animals were grey, dark chestnut, dark brown, light bay and other colors. Horses with chestnut and bay colors exhibited a dark stripe down the back, as did the animals on the aforementioned farms. Notably, a considerable proportion (19.2%) of the horses observed on this farm exhibited a dark chestnut coloration, with some also displaying light chestnut characteristics, including a lighter mane, tail, and feathering. Most chestnut horses exhibited lighter pigmentation in their lower legs, which was visible as a distinct “sock” effect. All horses on this farm exhibited the same external characteristics as previously described. All animals displayed a lean, strong constitution and a slightly robust build. The available records and the owner’s verbal statements indicated that all the mares examined were derived from Dagestani stallions and stallions with an admixture of Akhal-Teke blood at 1/16 to 1/8. Both homebred and purchased sires from the mountains were used on the farm. The horses were utilized and maintained consistent with that observed on previous farms. The smallest horses were observed at peasant household Rassvet, with the height of mares being  $139.2 \pm 0.50$  cm. The observed wither height index was significantly less than the height of horses from all the examined farms, except the animals belonging to sole trader Chokusulov R.S. ( $142.0 \pm 1.51$  cm), for which the difference was not statistically significant. However, regarding body build indices, no relevant differences were observed in the horses compared to the other farms. The exterior features were approximately similar to those observed on the aforementioned farms. Notably, a higher percentage of cases (36.4%) exhibited roached backs and loins. Additionally, noteworthy the animals on this farm exhibited a more pronounced leanness and a reduced hair coat. One mare exhibited what is colloquially referred to as a “hunter’s bump” in the croup region. A greater diversity of colours was observed at the peasant household Rassvet. In addition to the colors observed on other farms, one horse was bay roan and one was light palomino. The horses were used and kept similarly to those on the previous farms. The horses examined on the studied farms unquestionably demonstrate the transmission of traits through inheritance. This was substantiated by probands and offspring exhibiting analogous traits within the selected cohort. The sires on each of the farms were younger than the breeding stock. The phenomenon of sexual dimorphism was evident. Even though stallions (mean age 5.3 years) were average younger than mares (7.0 years). They exhibited gender-specific structural characteristics. These included a larger head size, thicker neck with a small crest, and a more compact and shorter body than mares, but with a more pronounced bone structure. The massiveness of stallions was less pronounced than that of mares, which could be attributed to their younger age and the presence of foaling mares in the examined herd. In the majority of cases, both stallions and mares exhibited measurement and index values that varied by up to 3% (rarely up to 5%), with only one instance (10.6% for chest girth index in mares on farm Agrofirma Chokh) exceeding this threshold. This could be attributed to the presence of pregnant and post-foaling mares, indicating that the horse population examined exhibited sufficient uniformity in terms of exterior parameters. Horses were relatively homogeneous, and the offspring consistently exhibited traits inherited from their parents. Our studies, which describe exterior features, measurements, and body indices, corroborate the findings of other authors whose data have been referenced in our theoretical framework. These include Voytyatsky (1939), Glebov (1949), and Sultanov (1965a, 1965b). Notably, on average, horses became larger. In this regard, Voytyatsky (1939) observed that horses in mountainous areas averaged 130.9 cm in height at the withers, while those in flat areas averaged 143.4 cm. During

our research, the mares at the Rassvet farm, situated at an altitude of 1,400 m above sea level, were found to have an average height of 139.2 cm. In contrast, the average height of the Agrofirma Chokh farm was 149.5 cm. The same trends were observed for chest girth and metacarpal girth. Our results, as well as the results obtained by other authors for exterior traits in comparison with the performance of horses of different breeds (Mirzoev 2017; Khaudov *et al.* 2020; Demin & Tsyganok 2019, 2021, 2022; Demin *et al.* 2021, 2022; Sufiyan 2022; Mongke *et al.* 2024; Mutilod *et al.* 2024; Lovász *et al.* 2024; Taylor *et al.* 2024; Zhang *et al.* 2024) showed that horses of the Dagestani population were distinguishable in exterior from other breeds, particularly from the Karachay and Kabarda breeds, which are larger, more massive, with a deeper chest, and do not have such dense hair covering and variety of coat colors. Dagestani horses are undoubtedly very different from other breeds in Russia and abroad: Altai, Buryat, Arabian, Akhal-Teke, Hutsul, and others. In the course of our research, based on the studied literature and the analysis of the material collected during the expedition, we can conclude that horses of the Dagestani population have significant breed differences from other horse breeds in Russia (Mirzoev 2017; Demin & Tsyganok 2019, 2021, 2022; Khaudov *et al.* 2020; Demin *et al.* 2021, 2022; Nurmakhanbetov *et al.* 2022; Sufiyan 2022; Arefnejad *et al.* 2024; Mongke *et al.* 2024; Lovász *et al.* 2024; Taylor *et al.* 2024; Zhang *et al.* 2024). The horses studied are similar in appearance and quite homogeneous. At the same time, they consistently pass on their qualities to their offspring. They are relatively stunted and have a somewhat elongated body, especially the mares. The body is light, the depth of the chest is average, sometimes insufficient. At the same time, the width and girth of the chest are quite good. The skeleton is well developed with a general impression of fine boning. The head is slightly large, elongated, narrow, and not too heavy. The profile is straight, the muzzle is clean-cut and narrow. The jowls are large, well-defined, and wide apart. The head is lean, the forehead is not broad, the facial part has a sufficient length, and the lips and nostrils are not thick. The nostrils are medium in size. The eyes are rather large, slightly elongated. The eyebrow arches are medium or “oriental”. The ears are usually elongated, medium thick, and clean-cut. The neck is short, medium to low set, and narrow. Many horses have a pronounced skinfold at the withers. In stallions, the ridge is not strongly pronounced. The topline is long, usually straight. The withers are smooth, but long and muscular. The back and loins are roached and less often soft. The back is long, but the loin is rather short. The sacrum is usually without peculiarities. A bump has been observed on one head. The chest is not deep but broad and long with a well-developed false rib. The croup is drooping and oval, well-muscled. It is better developed in width than in length. The tail is set rather low. The scapula and shoulder are straight and muscular, the forelegs are set close together and slightly under the body. The pasterns are of medium length, and elastic. Horses with soft pasterns were observed. The hind legs are almost 100% crooked, often with a narrow stance, less often with an X-shaped stance. The heels and metatarsals are thin but strong and lean, with outlined tendons. The front hooves are flatter than the hind hooves, which are cup-shaped. The chestnuts are less pronounced, especially on the hind legs. The coat on the body appears smooth and is quite soft and silky to the touch. The guard hair (mane, tail, and fetlocks) is of medium thickness. The mane may fall on both sides, but most of the mane falls on one side. The fetlocks are located just behind the knuckle joint and often extend to the middle of the metacarpus and metatarsus, sometimes to the wrist joint or the heel joint, but in a very sparse line; they are quite soft. The data collected through the survey provides insight into indigenous horse breeding in Dagestan, which is in high demand. Horses are kept in herds. According to the owners, the feeding and keeping of the animals is rather strict. Horses are practically not fed, even in winter. They are grazed all year round. The stables have covered areas of limited size, mainly for stallions and workhorses. The rest of the horses are out in the fields. In the spring, herds of mares are formed. A stallion is chosen for each herd. The stallions remain with the herds throughout the breeding season. In the autumn and early winter, the herds are moved from the mountains (if they are kept in the mountains) to the foothills and the plains. Each of the farms surveyed has extensive pens and splits for zoo-veterinary measures. However, the following types of zootechnical documents are not properly presented in the farms: Card of the sire; Card of the mare; Records of fetal activity of the mare; Records of foaling activity of the sire; Records of mating and foaling (horse herding); Records of the selection of sires to mares for the mating campaign of the horse herd; Records of the branding of young stock. There is no branding of horses and no initial description of their characteristics to identify each animal. Records are scarce and it has not been possible to compile inventory reports. However, the stock surveyed is described by colour and markings and the details of each horse are recorded. Developing indigenous horse breeding in Dagestan is well suited to the equestrian tourism industry. Most of the horses used in the existing horse camps in Dagestan have the necessary qualities: they are of good character, obedient, adapted to mountainous conditions. They are

willingly bought from farms to tourist camps in Dagestan. The price of horses varies from 40-50 to 150 thousand rubles per head, depending on their age. Familiarization with indigenous horse breeding in Dagestan has also shown excellent conditions for large-scale horse meat production as dietary meat. This direction is now an indispensable condition for indigenous herd horse breeding, as the policy of Russian agriculture is implementing the food programme and import substitution.

## CONCLUSION

Based on the results of the expeditionary research, we have drawn up a conclusion and recommendations for production. Despite the noted disadvantages of domestic horse breeding in Dagestan, we have found that mountain horses bred in the republic are suitable for rational use of the mountain horse gene pool in various fields of the national economy, such as working and production, as well as leisure and recreation, which is a developing tourism industry in Dagestan. The price-quality ratio makes local horses an affordable and useful product for developing equestrian tourism. They have a similar body type and appearance and differ in their external characteristics from the well-known Caucasian mountain breeds: Kabarda and Karachay, as well as from other Russian and foreign breeds known to us. Our results indicate that it is advisable to carry out more extensive zootechnical and genetic studies. For this purpose, preparing a production base, which should cover many animals (1000 and more) with population monitoring is necessary. This will provide grounds for justifying the distinctiveness, homogeneity and stability of the Dagestani horse population for its inclusion in the State Register of Breeding Achievements of the Russian Federation as an independent breed or type. The production was given recommendations on improving zootechnical work technologies and further work on preserving and rationally using the gene pool of Dagestani mountain horses.

## RECOMMENDATIONS

To preserve and rationally use the gene pool of mountain horses in Dagestan, it is necessary to keep primary and centralized breeding records of horses on farms. It is necessary to keep zootechnical records properly for compiling zootechnical and breeding documents. Branding horses and describing their marks for clearly identifying each animal is a mandatory requirement. To further determine the breeding status of Dagestani horses, it is necessary to assign groups of the most valuable animals of the offspring-father-mother for genetic confirmation of origin. Developing indigenous horse breeding in Dagestan should be aimed at obtaining a suitable product for equestrian tourism. The breeding work in this direction should solve the reproduction problems of not large good horses adapted to the passage of difficult mountain landscapes and seaside arid steppes. Selective breeding efforts should be made to breed meat horses to obtain horses for the production of dietary horse meat. This direction is an indispensable condition in indigenous herd horse breeding. In order to determine the productive qualities of horses, it is necessary to conduct research into their meat characteristics, in particular to prepare equipment for weighing horses, and then to determine the nutritional value of horse meat. It is also necessary to conduct a comprehensive physical examination of the selected horses to determine their future breeding value.

This study was carried out with the support of the Priority 2030 program

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**ibliographic information of this paper for citing:**

Demin, VA, Tsyganok, IB, Yuldashbayev, YA, Nimatulaev, NM, Khozhokov, AA 2024, Conservation and rational use of the gene pool of mountain horses of Dagestan, *Caspian Journal of Environmental Sciences*, 22: 1065-1074.

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