

Productivity of cows of the red steppe breed, considering the physique

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Abstract. As a result of a comparative assessment of the qualitative indicators of milk productivity of dairy cows of the red steppe breed of the III lactation, two controlled groups of animals were selected for the study according to two body types. It was found that broad-bodied cows have higher milk yields by 5.91% compared to narrow-bodied animals. Broad-bodied cows also produce more milk fat and protein during the standard lactation period, by an average of 21.36% and 20.5%.

1 Introduction

Dairy cattle breeding is the most important branch of the national agricultural production of Russia, which is among the determining factors of national welfare and food security of the country. Despite the high labor costs in dairy cattle breeding, exceeding by an order of magnitude the same indicator in crop production, milk and dairy products are products of daily consumption, while milk components of milk – fat, protein, lactose are still among the most in demand and allow balancing the diets of the general population [1].

Large-scale breeding in dairy cattle breeding, based on the application of modern advances in biotechnology and genetics, has led to a progressive increase in dairy productivity of cows and has made adjustments to the breed composition of cattle. The so-called dairy breeds of productivity appeared, which include the Holstein breed, as well as the black-and-white breed, in which Holstein bulls are intensively used and, in fact, in Russia, the black-and-white breed almost completely becomes the Holstein breed, due to the absorbing crossing. Nevertheless, not only these high-tech and highly productive breeds of dairy cattle determine the breed composition of the national dairy cattle breeding. In many regions, the genotypes of the red steppe breed have been preserved, despite the difficulties in the breeding system due to the lack of full-fledged breeding bulls evaluated by the quality of offspring and allowing for selective improvement of dairy herds. Nevertheless, herds of animals of the red steppe breed continue to occupy a certain specific weight of up to 10% among animals of other genotypes, the average milk productivity of the red steppe breed herds is in the range of 3.5-4.5 thousand kg of milk from a cow per year, with a fat content of 4.2-4.7% and a milk protein content of 3.3-3.5% [2-6].

The advantage of the red steppe breed in comparison with Holstein and black-and-white cattle is productive longevity, some cows reach the age of 7-9 lactation, which compared

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with 2.0-2.5 lactation in black-and-white and Holstein cattle, it is an important advantage in regions with arid climate and limited forage production.

The purpose of these studies was to conduct a comparative assessment of the exterior characteristics of the red steppe breed cows, as well as an assessment of the productive qualities of animals of different body types.

2 Methods and Materials

Evaluation of cows of the red steppe breed by constitutional type and productive qualities was carried out in the breeding farm of the North Caucasus on animals after 3 calving of the main lactation period, from 30-200 days after calving. According to the results of measurements of line items of cows according to standard zootechnical indicators, two groups of animals of 20 heads per group were identified: narrow-bodied (group I) and broad-bodied (group II) body type.

Dairy productivity of cows was determined by conducting control milking with the involvement of specialists of the assistant service of the Stavropol State Agrarian University. Milk samples taken according to the results of control milking were transported in chilled form to an independent laboratory of milk quality control accredited according to GOST ISO/IEC 17025-2009. The determination of milk fat and protein content was carried out using the CombiFoss 7 DC milk analyzer, of the Danish company FOSS [7].

Statistical processing of the material was carried out using the Excell tabular module, differences in Student coefficient indicators, $p < 0.05$, were considered statistically reliable.

3 Research results

Carrying out linear measurements of cows showed (Table 1) that animals of narrow- and broad-bodied body types were characterized by fairly similar parameters in height at the withers and in the sacrum, the circumference of the pastern, the width of the buttocks in the hips and the width of the udder, since differences in indicators for these traits are statistically unreliable, at $p > 0.05$.

At the same time, group II animals outperformed their peers in terms of chest and trunk parameters by 2.34-22.4%, udders - by 17.73%, the differences between the indicators were statistically significant, with $p < 0.05$.

Animals of group II were characterized by more pronounced latitudinal and volumetric linear body items, which allowed them to have more developed milk qualities, a more elongated body and a more voluminous scar, which in turn was also reflected in the values of the physique indices (Fig. 1).

Table 1. Linear measurements of cows considering body types, cm.

Animal body measurements	Body type	
	narrow-bodied	broad-bodied
Chest girth	176.70±0.44	182.95±0.67*
Chest width	35.65±0.36	43.65±0.42*
Oblique length of the body	145.00±0.34	148.40±0.76*
Chest depth	65.20±0.14	68.50±0.53*
Udder length	27.35±0.45	32.20±0.52*
Oblique loin length	45.60±0.44	49.65±0.33*
Udder width	25.35±0.44	25.15±0.75
Height at the withers	125.15±0.43	126.25±0.49
Width in hips	49.15±0.22	50.50±0.38
Height in the sacrum	130.00±0.40	132.55±0.80

Pastern girth	17.10±0.18	17.10±0.19
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* - statistical significance of differences at $p < 0.05$

The greatest superiority in animals of group II was established by the values of the indices of the pelvic and thoracic, by 13.9% and 9.4%, respectively, these parameters characterize the ratio between latitudinal measurements, reflecting the broad-bodied physique type in these animals.

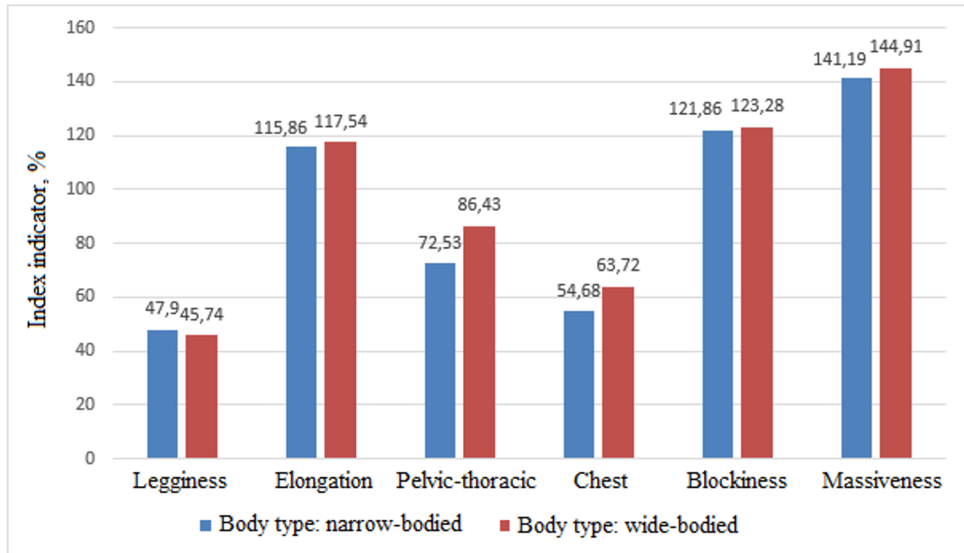


Fig. 1. Physique indices in cows of different body types.

Also, the superiority between the cows of the two groups in the indices of elongation, blockiness, and massiveness was noted, respectively, broad-bodied cows outperform their peers of the narrow-bodied type by 1.68%, 1.42%, and 3.72%. At the same time, narrow-bodied cows have some superiority over broad-bodied animals in terms of legginess index by 2.16%.

Summing up the results of the exterior assessment, it can be noted that cows of group II are characterized by a strong physique and are more developed in such physique items as the chest, pelvis, and lower back, which allows them to show higher indicators of productive qualities (Table 2).

Table 2. The yield of dairy components in cows, considering body types.

Cow productivity parameters	Narrow-bodied type	Broad-bodied type
Fat %	4.02±0.06	4.19±0.05*
Protein %	3.15±0.08	3.42±0.09*
Dairy productivity of cows, kg	3756±25.6	3978±28.9*
Fat produced, kg	154.24±7.85	187.2±9.16*
Protein produced, kg	116.43±5.65	140.3±8.23*

* - statistical significance of differences at $p < 0.05$

Control milking in cows of the experimental groups showed that the milk productivity in cows of the broad-bodied type was 222 kg higher compared with animals of the narrow-bodied type ($p < 0.05$). The superiority in the content of dairy components, milk fat, and protein in the milk of group II cows over their peers of the narrow-bodied type was, respectively, 0.17 abs. percent and 0.27 abs. percent ($p < 0.05$).

Higher concentrations of protein and fat in milk in broad-bodied cows contributed to higher indicators of fat and protein production for 305 days of lactation, respectively, by 32.96 and 23.87 (kg) higher compared to analogues of group I ($p < 0.05$).

4 Conclusion

The choice of the breeding and genetic improvement direction for red steppe cattle in modern economic conditions is of particular importance, because despite the obvious advantage of high-tech Holstein and black-and-white cattle, nevertheless, red steppe cattle have been preserved and developed due to their unpretentiousness to feeding and maintenance conditions, resistance to adverse weather conditions and good reproductive qualities [7-8].

Studies have shown that animals of the broad-bodied type of physique have a more developed and wide chest, a wider pelvis and lower back, their superiority over analogues of the narrow-bodied type was noted, differences in the indices of the physique of the thoracic and pelvic-thoracic by 9.4-13.9%. Cows of group II outperformed their peers of group I in milk yield by 5.91%. Milk of broad-bodied cows is characterized by a better qualitative composition, the fat content of milk is higher by 4.23%, and the protein content is higher by 8.57%.

Due to the better qualitative composition of milk, broad-bodied cows produce more milk fat and protein during the standard lactation period, on average, or by 21.36% and 20.5%. Thus, cows of broad-bodied type of physique most correspond to the modern standard of the red steppe breed, which makes them more in demand for pedigree cattle breeding. Further promising development of the genotypes of red steppe cattle should probably be accompanied by the consolidation of the herd on the basis of broad-bodied type, which will increase the dairy productivity of cows and the quality of dairy raw materials and create herds of genetically safe animals [9-10].

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References

1. V.I. Trukhachev, S.A. Oleinik, N.Z. Zlydnev [et al.] Efficient animal husbandry, **5(171)** 135-139 (2021) DOI 10.24412/cl-33489-2021-5-135-139.
2. Yu.N. Simoshina, N.M. Rudishina, I.S. Kondrashkova, Bulletin of the Altai State Agrarian University, **2(112)**, 88-92 (2014).
3. L.V. Efimova, N.M. Rostovtseva, T.V. Kulakova, O.V. Ivanova, E.A. Ivanov, In the World of Scientific Discoveries, **12(84)**, 92-107 (2016).
4. T.V. Gromova, A.P. Kosarev, P.V. Konorev, Bulletin of the Altai State Agrarian University, **6(152)**, 115-121 (2017).
5. A.M. Ulimbashev, Z.M. Aisanov, M.B. Ulimbashev, Bulletin of the Altai State Agrarian University, **4(150)**, 95-100 (2017).
6. L.N. Zakharova, Measurements and indices of physique indices of the red steppe cattle breed in Yakutia, Actual problems of innovative development of animal husbandry: International Scientific and Practical Conference, Bryansk, May 30-31, 2019 (Bryansk: Bryansk State Agrarian University, 2019) 284-286. – EDN ZVLSQF.

7. V.I. Trukhachev, S.A. Oleinik, M.I. Selionova [et al.], International Agreement on Registration Methods, Guidelines for the registration of the International Committee for the Registration of Animals (ICAR): approved at the General Assembly, Berlin, May, 2014 (Berlin: International Committee for Animal Registration (ICAR), 2014) 630.
8. V.I. Trukhachev, N.Z. Zlydnev, S.A. Oleinik, Business Bulletin of the Agroindustrial Complex. Stavropol Territory, **12**, 57-60 (2015).
9. V.I. Trukhachev, S.A. Oleinik, E.N. Chernobai [et al.] Selected methods of formation desirable phenotype of different sheep breeds, Agriculture for the Next 100 years: Proceedings of the 26th NJF Congress, Kaunas, June 27-29, 2018 (Kaunas: Aleksandras Stulginskis University, 2018) 125-129. – DOI 10.15544/njfcongress.2018.18.
10. V.I. Trukhachev, S.A. Oleinik, N.Z. Zlydnev, Daily dynamics of milk quality indicators, Rural development 2017 Bioeconomy Challenges, Vilnius, November 23-24, 2017 (Vilnius: Aleksandras Stulginskis University, 2017) 158-161.
11. V.I. Trukhachev, S.A. Oleinik, N.Z. Zlydnev, Features of the karyotype of North Caucasus Ayrshire dairy cattle population: defects in reproductive functions, Rural development 2017 Bioeconomy Challenges, Vilnius, November 23-24, 2017 (Vilnius: Aleksandras Stulginskis University, 2017) 162-166.
12. V.I. Trukhachev, S.A. Oleinik, N.Z. Zlydnev [et al.] Cytology and Genetics, **51(4)**, 44-51 (2017).