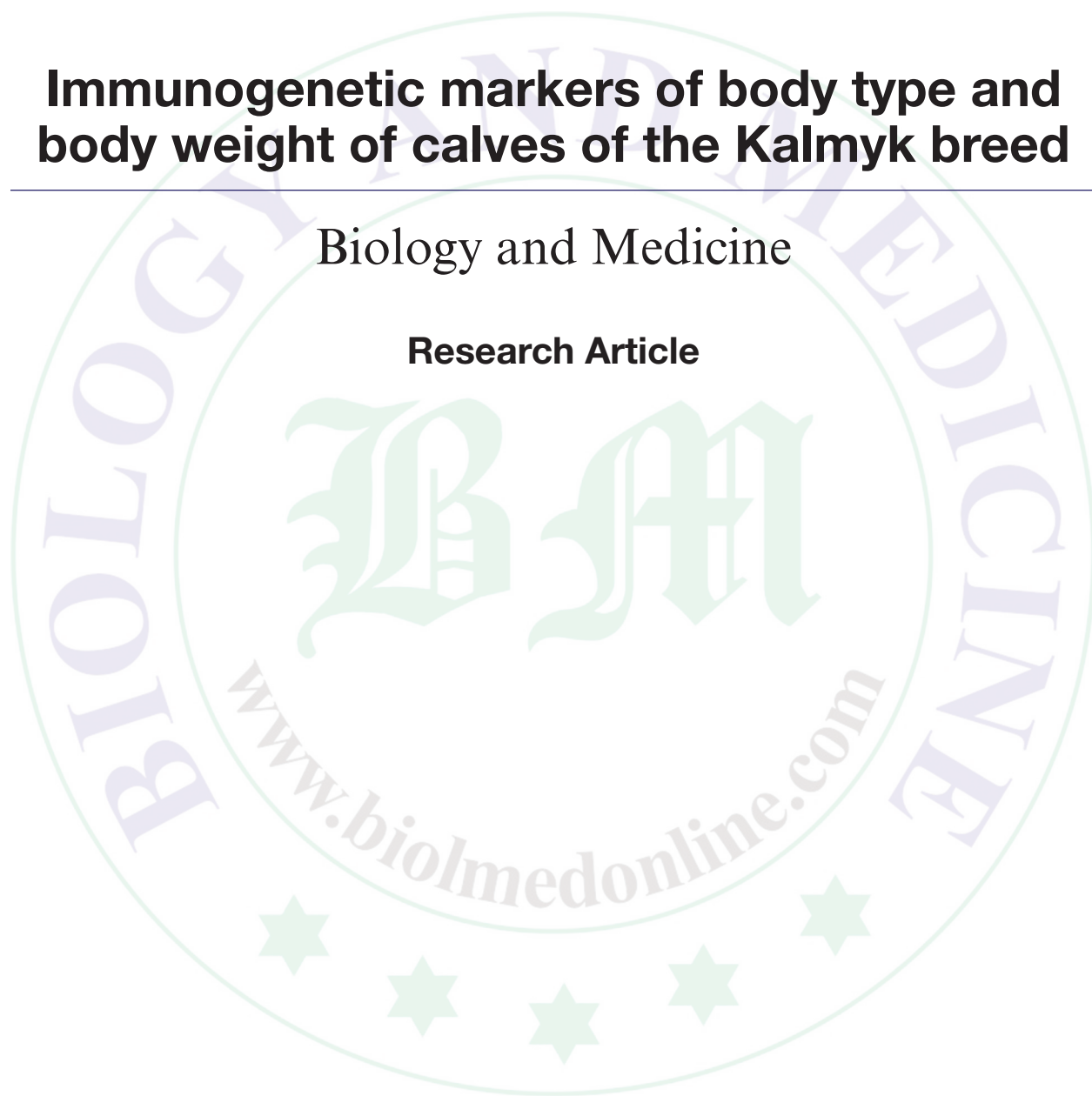


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Immunogenetic markers of body type and body weight of calves of the Kalmyk breed

Lyudmila Guchaevna Moiseikina*, Alexander Jalmtaevich Gendzhiev,
Nadezhda Vasilyevna Chimidova, Olga Bekyaevna Gendzhieva

Kalmyk State University, 11 Pushkin Street, 358000, Elista City, Republic Kalmykia, Russia.

*Corresponding author

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Abstract

Calves of the Kalmyk breed that are higher in withers and in rump differed by their blood antigenic composition, and at the age of 18 months weighed by 22.6 kg more. Antigens G2, B', E', R2 are markers of I tall type and live weight at the age of 18 months. Calves from the Orenburg region at the age of 8 and 18 months have a higher body weight than calves of both types of the Kalmykia breed. An experiment has been made for distribution of calves of the Kalmyk breed with various body types associated with different frequencies of antigens occurrence. Markers of live weight productivity for various body types have been identified. Comparative analysis of measurements, live weight, and growth of calves of the Orenburg and Kalmykia breeds has been made.

Keywords: Kalmyk cattle; antigen frequency; productivity; body types; comparative analysis.

Introduction

Immunogenetics studies regularities of antigenic factors inheritance, their distribution in the population, their correlation with body constitution and resistance to diseases (in farm animals and with productivity), tissue incompatibility. It combines methods of immunology, genetics, and molecular biology [1].

Immunogenetics data are used in live-stock breeding for defining animals' origin in case of doubt. Frequency of occurrence of different alleles of blood groups in populations, species, and breed lines is of interest for discovering the origin of species, the degree of genetic similarity and differences in studied groups. In some cases it was possible to establish genetic correlation between blood group alleles and productivity, fertility, viability of animals, the degree of heterosis in cross-breeding [2-4].

Work for identifying productivity markers in calves of the Kalmyk breed has practically never been carried out. The data published in 2008 were obtained on a minor population and are of value only for the farms of the Stavropol Territory. Thus, for the APC BF (agricultural production co-operative breeding farm) named

after Lenin, the desired unit of blood group alleles that determines high energy of growth is A2 X2 Z2; for LLC "Stepnoy Mayak" – A2 B2 C1 WV; for LLC "Turksad" – D2 C1 WV [5,6]. Results of these studies are not fully applicable, since the genetic potential was implemented in conditions of better forage, as compared to those in Kalmykia, and were not related to body type [7].

These publications did not include comparative analysis of measurements and live weight of calves of the Kalmyk breed from various regions [8-11].

Instructions for valuation of meat breeds of cattle included requirements for height at the rump, which was dictated by the need to exclude undersized, more compact animals from breeding [12]. In the studies of Dzhulamanov and Gerasimov, it was found that calves of the Hereford breed of the tall type at the age of 12 months had body weight by 22 kg higher than calves of compact type, and at the age of 15 months by 40.6 kg [13].

Breeding of Kalmyk cattle was performed earlier for the purpose of obtaining a compact fast-gaining type that was considered preferable [14].

Objective of the study was to identify antigens, carriers of which have desired body type and higher productivity. Comparative analysis of the Kalmyk breed of calves in Kalmykia and in the Orenburg region was performed.

Materials and Methods

At the age of 8 months, a scientific and economic experiment was performed in the "50 years of October" nucleus of the Republic of Kalmykia. Calves were arbitrarily divided into two groups according to height at withers and at rump. To the first group, animals with height at rump 112.6 cm were assigned, to the second – 108.1 cm. The difference in measuring sidelong body length and chest circumference at shoulder bones was not significant. 20 bulls were assigned to the first group and 16 – to the second.

The calves were kept in the same conditions adopted at the farm. Growth and development were monitored at the age of 8, 15, and 18 months. Body weight, absolute and average daily gain, basic measurements and physique indicators were determined. In preparation for the experiment, calves were tested for blood groups.

Results and Discussion

Data analysis by frequency of antigen occurrence is given in Table 1.

Analysis of the table shows that in calves of the two types, the frequency of erythrocyte antigens occurrence varies quite significantly.

In the A system, the A1/A2 antigens are most prevalent in type 1 (frequency – 0.40), as compared to type 2 (frequency – 0.063).

In the B system, the highest frequency of antigen occurrence of antigens G2 (0.50), B' (0.60), D' (0.65), E'3 (0.85) in one type than the second – 0.06, 0.25, 0.25, and 0.13, respectively. Remaining alleles of the B-locus (O4, E'1, I') are equally present in both first and second types.

In the C-locus, type 1 has high occurrence of antigens C1 (0.35) C2 (0.55) as compared to type 2 – 0.13 and 0.31, respectively. It should be noted that the R2 antigen is found only in calves of type 1 with frequency of occurrence 0.80. The X2 antigen has high occurrence frequency in calves of both types.

Systems F and Z, frequency of F/V Z antigens was 0.55 for type 1 and 0.25 for type 2. Thus, occurrence of antigens G2, B', D', E'3, R2 varied the most.

As a result of the studies, it was found that various types of calves had veracious difference in height at the withers and at the rump at various ages (Table 2).

Height at the rump in calves of tall type at the age of 18 months was more by 2.5 cm than that in calves of compact type, and height at the withers was more by 2.6 cm. When comparing measurements at the age of 8 and 18 months of the Kalmykia calves with the data obtained by

Table 1: Frequency of red blood cell antigens occurrence in bulls of various types.

Locus	Antigen	Type 1		Type 2	
		Quantity	Frequency	Quantity	Frequency
EAA	A ₁ /A ₂	8	0.40	1	0.063
EAB	G ₂	10	0.50	1	0.063
	O ₄	15	0.75	9	0.56
	B'	12	0.60	4	0.25
	D'	13	0.65	4	0.25
	E' ₁	6	0.30	2	0.13
	E' ₃	17	0.85	2	0.13
	I'	8	0.40	4	0.25
EAC	C ₁	7	0.35	2	0.13
	C ₂	11	0.55	5	0.31
	R ₂	7	0.35	–	–
	X ₂	16	0.85	12	0.75
EAF/EAZ	F/VZ	20	0.55	16	0.25

Table 2: Measurements of Kalmyk breed calves.

Indicators	Build type						In average for the Orenburg region (According to Eremenko and Kayumov)	
	Type I			Type II				
	Age, months			Age, months			Age, lact.	
	8	15	18	8	15	18	8	18
Height at the withers (cm)	111.2 ± 0.31	122.0 ± 0.50	125.1 ± 0.12	107.0 ± 0.26	118.3 ± 0.48	122.5 ± 0.60	106.7 ± 0.92	123.5 ± 0.91
Height at the rump (cm)	112.6 ± 0.38	123.3 ± 0.56	127.1 ± 0.42	108.1 ± 1.76	120.1 ± 0.51	124.6 ± 0.58	112.3 ± 0.92	128.3 ± 0.81
Sidelong body length (cm)	117.9 ± 0.43	140.8 ± 0.61	144.3 ± 0.59	118.1 ± 0.94	140.1 ± 0.78	143.4 ± 0.41	117.3 ± 1.35	138.3 ± 1.31
Chest circumference behind the shoulders (cm)	149.2 ± 0.51	169.8 ± 0.59	176.6 ± 0.68	149.5 ± 1.12	172.4 ± 0.79	174.9 ± 0.83	149.7 ± 1.62	180.7 ± 1.93

Eremenko and Kayumov (2005), it was found that height at the withers in bulls from the Orenburg region corresponds to type II of Kalmykia calves, height at the rump – to type I at the age of 8 months. This relation is kept at the age of 18 months. Chest circumference behind the shoulders of calves from the Orenburg region was greater than that of both groups from Kalmykia, and sidelong body length was less.

Analysis of the data about live weight and weight gain by calves from the two groups also showed some difference (Table 3).

The table shows that in preparation for the experiment, calves from group II had higher body weight at lower height at the withers and at the rump, i.e., they were more compact. The difference, as compared to the taller group I, was 3.2 kg. At the age of 15 months calves of type I had a 2.2 kg advantage in the live weight, but the difference was not veracious. By 18 months

of age, the advantage in live weight of type I calves was substantial and veracious (22.5 kg with $P > 0.95$).

Analysis of the absolute and the average daily weight gain by calves of the two body types revealed a considerable difference in the period between 15 and 18 months of age, that is, during exactly this period calves of the first type considerably (by 28.4 kg or 227 g per day) increased body weight.

Comparison of live weight of calves showed that at the age of 8 months calves from the Orenburg region were considerably superior to their counterparts from Kalmykia (214.4 kg and 160.6-163.8 kg), due to higher milking capacity of dams.

At the age of 18 months, live weight of both types was lower than that of counterparts from the Orenburg region; animals with greater height at the rump were significantly superior as

Table 3: Live weight and growth of calves of different types at different ages.

Indicators	According to Eremenko and Kayumov	Type I	Type II
Live weight at 8 months	21.4	160.6 ± 1.9	163.8 ± 1.7
Live weight at 15 months	380.2	343.8 ± 3.0	341.6 ± 1.7
Live weight at 18 months	463.0	413.2 ± 3.8	390.6 ± 4.0
Absolute weight gain (kg) for the period: 8-15 months.	165.8	183.2	177.8
15-18 months	82.8	69.4	41.0
8-18 months	248.6	252.6	226.8
Average daily weight gain (g) for the period: 8-15 months.	789.5	870	844
15-18 months	921.1	778	551
8-18 months	820.5	842	782

compared to their counterparts from Kalmykia in the absolute and average daily weight gain – 13.4 to 41.8 kg and 143.1 to 370.1 g, respectively.

However, over a period of 8 to 18 months calves of type I that were grown in Kalmykia had higher absolute gain and average daily gain in body weight, as compared to their counterparts from the Orenburg region.

Conclusion

Thus, calves with higher frequency of antigens G2, B', E'3, R2 occurrence at the age of 18 months outperformed their counterparts in terms of live weight and live weight gain. Therefore, these antigens can be recommended as markers of efficiency for calves of the Kalmyk breed. Calves from the Orenburg region at the age of 8 months significantly outperformed their counterparts of both types from Kalmykia. Their live weight gain between 8 and 18 months of age was somewhat lower than that of calves of type I.

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