Biological peculiarities and frequency of erythrocyte antigens occurrence of Trans-Baikal fine-wool breedsheep blood

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Abstract. The research data of modification in physiological and hematological blood indices of Trans-Baikal fine-wool breed sheep depending on the season is given in the article. In winter period the pulse rate rises, quantity of formed elements of blood and hemoglobin increase, the protein content in blood decreases. In summer pulmonary ventilation and body temperature increase and it is connected with animals’ adaptive reaction to environment circumstances. An intensiveness of organism biological process grows; protective power forms. Among animals of different inbreed types of Trans-Baikal breed that differ in wool and meat efficiency manifestation, quite high resemblances of frequency of erythrocyte antigens occurrence has been identified. Reliable differences in concentration of five blood groups: Ab, Bi, Mb, Da and O (P<0.01) have been found, and there in the rest nine groups - Aa, Bb, Bd, Be, Bg, Ca, Cb, Ma and O reliable differences in the frequency of occurrence haven’t been found. Among sheep of Argun meat and wool type Mb and O antigen carriers were identified reliably more often than among animals of other population, and Ab and Da factors carriers were identified less frequently. In sheep population of wool and meat type animals with Bi, Mb and O antigens were met reliably seldom. Ma factor carriers were also defined with less frequency, but the difference was close to reliable. Sheep of wool type were characterized by wider spread of Ma, Da and R blood types (P<0,05; P<0,01) than other types. The sheep of meat and wool type and wool types were the closest in value of genetic distance (d) = 0.01225. The sheep of wool type and meat and wool types had lager genetic distance (0.01695).

1. Introduction
Sheep breeding is historically an integral part and one of the most important sectors of national economy in Russia. One of the most prosperous regions for sheep breeding development is Trans-Baikal. It possesses large number of unique natural resources that provide for sheep breeding industry. The work in sheep breeding is being done in diverse directions. In 1927-1956 Trans-Baikal fine-wool sheep breed was worked out as a result of complex reproductive crossbreeding [1]. Nowadays it is presented by five breed types: Nerchinsk, Buryat, Hangilsk – wool and meat purpose; Argun and Dogoisk – meat and wool purpose. The purpose of our research is to establish and add some biological peculiarities: physiological and hematological blood indices according to a season, inbreed differentiation in sheep blood types depending on productiveness purpose to characteristics of Trans-Baikal breed.
2. Materials and Methods
Research in hematological and clinical indices identification depending on a year season was made with young ewes of Argun meat and wool type of Trans-Baikal breed. Young ewes at the age of 4,5 months with body weight of 23,8-25,8 kg, grown tupping rams, ewes of selective nucleus and also young animals (ewes, rams) at the age of 4,5 and 12 months were the research objectives.

Body temperature was measured through rectum; pulse frequency was measured via phonendoscope. The respiration quantity per a minute was measured by counting of thoracic cage fluctuation (inhalation act) at resting animal state. Hematological and clinical indices of 20 ewes were studied on two adjacent days under good environmental conditions (October) and under extreme conditions (January, July). Animal blood was taken in the morning before feeding and watering out of jugular vein. Erythrocyte and leukocytes content was defined by standard methodic, hemoglobin rate was estimated with the help of ColourDilution Method by H. Sahli. Immunogenetic test was fulfilled with the use of monotypic reagents of immunogenetics and DNA-technologies laboratory bank of All-Russian Scientific and Research Institute of Sheepbreeding and Goatbreeding. The degree of genetic differences between a tupping ram and an ewe (from 0 to 1) was calculated with the use of the program «GenIndex» for a personal computer.

3. Results
Animals productiveness is closely connected with physiological processes intensity that mostly depend on environmental factors. Climatic conditions and technologies influence animal blood content greatly.

As the result of research it was found out that in favourable season (in autumn) the number of inhalation movements of tested ewes was about 29-34, frequency of heartbeat was 79-85, body temperature was 39,2-39,4 degrees Celsius. In winter period frequency of heartbeat increased and was 92-96 beats per minute. In summer period frequency of heartbeat increased up to 101-104 beats per minute, pulmonary ventilation increased 3,1-3,3 times, body temperature increased by 0,3-0,6 degrees Celsius.

Thus, seasonal changes in environment influence the quantity of inhalation and pulse movements per minute and the body temperature.

Hemoglobin content was among 9,55-11,0% in spring and autumn, in winter and summer it increased by 0,65-0,72% ant it was 10,2-11,72%. Under low temperature the quantity of erythrocyte and leukocytes grew and in summer period it significantly reduced so it was among 9,04-9,99 million, 8,83-10,1 thousand. Total protein content in ewes’ blood also changed according to different seasons. The largest quantity rate was in autumn and summer periods (6,51-6,88), it is connected with favourable temperature and food conditions; in winter it reduced by 0,61-0,84%.

Thus, climatic conditions have influence on sheep organisms. In winter period pulse frequency increases, the quantity of formed blood elements and hemoglobin rises, protein content in blood decreases. In summer period pulmonary ventilation and body temperature increase and it is connected with animals’ adaptive reaction to environment circumstances. An intensiveness of organism biological process grows, protective power forms.

The use of blood groups as genetic markers while solving some questions of practical selection rises great interest among scientists and practicians [2,3].

Improvement existing, creation of new selection forms of agricultural animals provides for wide use of units with high genetic potential in agriculture [4,5]. Chance to improve livestock productiveness from generation to generation depends on reliable estimation and strict selection of animals used in production. Discovery of such animals cannot be limited by phenotypic features. Stable genetic improvement of herds can supply for methods of immunogenetic analysis [6]. There are absolutely reliable findings of a large number of researchers in correlation between such genetic parameters as blood group with farming-useful features, physiology-biochemical processes flowing in
animals’ organism. Prospect of purposeful selection by selecting animals with desirable genotypes is reasonably proved [7-10].

Long selection work directed to gaining of the most productive and well adapted to different areas of breeding and economically profitable animals allowed to create five inbreed types of Trans-Baikal sheep breed.

Genetic structure of sheep of Trans-Baikal breed hasn’t been studied till now, so one of the tasks of the research was to study inbreed differentiation on the basis of use of blood group as genetic marker.

Sheep of Trans-Baikal fine-wool bred of three types that are raised in breeding farm of Trans-Baikal region were used in the experiment: Argun meat and wool type, Nurchinskwool and meat type and wool type. Immunogenetic test was fulfilled with the use of monotypic reagents with six blood group systems (A, B, C, D, E, M, R), including 14 erythrocyte factors (Aa, Ab, Bb, Bd, Be, Bg, Bi, Ca, Cb, Da, Ma, Mb and R). The degree of genetic breed differentiation was estimated according to genetic distances [11].

As the result of research by Immunogenetic test of sheep livestock of Argun meat and wool type, Nurchinsk wool and meat type and wool type the peculiarities of allelic spectrum expressed in different frequency of occurrence of erythrocyte antigens factors were established (table 1).

Animals carriers of antigen erythrocyte factors Aa, Bd, Ca, Cb, Ma and R (0.71 . . . 0.84) were the most often met, sheep with blood containing antigen erythrocyte factors Ab, Bb, Be, Bi, Bg (0.41...0.61) were moderately met and animals with Mb and Da blood groups were seldom met (0.29; 0.35).

Among animals of different inbreed types of Trans-Baikal breed differing in expression of wool and meat efficiency quite high resemblances of frequency of erythrocyte antigens occurrence was find out. Out of 14 studied factors reliable distinctions were found only in concentration of five blood groups: Ab, Bi, Mb, Da and O (P<0,01), and other nine groups, they are Aa, Bb, Bd, Be, Bg, Ca, Cb, Ma and O there weren’t any frequency of occurrence.

Among sheep of Argun meat and wool type carriers of Mb and O antigens were found reliably more often than among animals of other populations and carriers of Aband Da factors were met less often.

In sheep population of wool and meat type animals with antigens of Bi, Mb andO were reliably seldom met. Carriers of Ma factor were also found with less frequency but the difference was close to reliable.

Sheep of wool type were characterized by extension of Ma, Da and R blood groups reliably more often than other types (P<0,05; P<0,01).

Based on the blood groups frequency of occurrence indices of genetic resemblance and value of genetic distances were calculated that allow us juggling about genealogical relationship of tested types (table 2).

Sheep of meat and wool type and wool type were the closest in value of genetic distance (d) = 0.01225. Sheep of wool and meat type and wool type had a larger genetic distance (0.01695) the largest cluster showing maximum genetic distance was found while comparing meat and wool type and wool and meat type of population, the index of genetic distance between them was 0.03578.

The genetic affinity of sheep of Argun meat and wool type and wool type are explained by that fact that improvement of those livestock and types creation were held mostly by inbreed selection in the one natural and climate zone. The same climatic conditions provided for genotypes that were mostly adapted to that breeding area.

A bit bigger distance of sheep population of wool and meat type is explained by the fact that initially when creating Nurchinsk type Australian merinos were intensively used. That wasn’t so when breeding of Argun meat and wool type and wool type.

4. Conclusion
Use of different selection methods, approaches to types creation and also peculiarities of natural and climatic breeding zone defined their genetic diversity expressed by the antigen blood spectrum.
Phenotypic and genetic type differences form heterogeneous sheep fund of Trans-Baikal fine wool breed, to our mind it is the necessary condition for its inbreed improvement, on one hand, preservation of high adaptation qualities to severe climatic conditions of Trans-Baikal, on the other hand.

**Table 1.** Frequency of erythrocyte antigens occurrence between sheep of different in breed types of trans-baikal fine wool breed.

| Breeding Farms | Erythrocyte Antigens | Systems |
|----------------|----------------------|--------|
|                | A  | B  | C  | M  | D  | R-O |
| Argun meat and wool type |     |     |     |     |     |     |
| Tuppingrams (n=89) | 0.7 | 0.1 | 0.2 | 0.6 | 0.6 | 0.3 | 0.6 | 0.8 | 0.8 | 0.7 | 0.3 | 0.2 | 0.5 | 0.6 |
| Ewes (n=436)     | 0.7 | 0.3 | 0.4 | 0.6 | 0.5 | 0.5 | 0.8 | 0.8 | 0.7 | 0.6 | 0.2 | 0.6 | 0.8 |
| Average of livestock (n=525) | 0.7 | 0.2 | 0.3 | 0.6 | 0.5 | 0.5 | 0.8 | 0.8 | 0.7 | 0.5 | 0.2 | 0.6 | 0.8 |
| Nerchinsk wool and meat type |     |     |     |     |     |     |
| Tuppingrams (n=158) | 0.7 | 0.5 | 0.4 | 0.7 | 0.6 | 0.4 | 0.5 | 0.8 | 0.7 | 0.7 | 0.0 | 0.5 | 0.8 | 0.2 |
| Ewes (n=76)      | 0.7 | 0.2 | 0.1 | 0.7 | 0.4 | 0.5 | 0.5 | 0.8 | 0.8 | 0.4 | 0.1 | 0.9 | 0.7 | 0.4 |
| Average of livestock (k=213) | 0.7 | 0.4 | 0.3 | 0.7 | 0.5 | 0.4 | 0.5 | 0.8 | 0.7 | 0.6 | 0.1 | 0.6 | 0.7 | 0.3 |
| Wool type        |     |     |     |     |     |     |
| Tuppingrams (n=99) | 0.7 | 0.2 | 0.2 | 0.6 | 0.5 | 0.5 | 0.4 | 0.8 | 0.7 | 0.9 | 0.1 | 0.6 | 0.7 | 0.3 |
| Ewes (n=346)     | 0.6 | 0.5 | 0.4 | 0.6 | 0.5 | 0.5 | 0.5 | 0.8 | 0.8 | 0.8 | 0.3 | 0.6 | 0.8 | 0.2 |
| Average of livestock (k=445) | 0.6 | 0.4 | 0.3 | 0.6 | 0.5 | 0.5 | 0.5 | 0.8 | 0.8 | 0.8 | 0.3 | 0.6 | 0.8 | 0.2 |
| The whole breed (n=1204) | 0.7 | 0.3 | 0.4 | 0.6 | 0.5 | 0.5 | 0.5 | 0.8 | 0.8 | 0.7 | 0.3 | 0.5 | 0.7 | 0.5 |

**Table 2.** Indices of Genetic Resemblance (ra) and Genetic Distances (d) Between Inbreed Sheep Types of Trans-Baikal Fine Wool Breed.

| Inbreed Types, ra/d | Argun meat and wool | Nerchinsk wool and meat | Wool |
|---------------------|---------------------|-------------------------|------|
| Argun meat and wool | –                   | 0.03578                 | 0.01225 |
| Nerchinsk wool and meat | 0.9648             | –                       | 0.01695 |
| Wool type           | 0.9878              | 0.9831                  | –    |

Considerable variability of frequency of separate antigen factors occurrence was stated: Aa, Bd, Ca, Cb, Ma and R – factors occurred to be the most often met (0.71 – 0.84), Ab, Bb, Be, Bi, Bg factors were less often met (0.41-0.61),Mb and Da factors were the least meat (0.29-0.35).

At the same time 9 (Aa, Bb, Bd, Be, Bg, Ca, Cb, Ma and Ofactors) out of 14 studied factors, i.e. 64, 2% had similar distribution both among sheep of wool and sheep of meat and wool direction of productivity. Reliable distinctions of frequency of factors were stated only for five (Ab, Bi, Mb, Da nO) blood groups (P<0.01).

Received information was the foundations for estimation of generic inbreed and interbreed relations of Trans-Baikal fine wool sheep breed.
On the basis of cluster analysis it was stated that sheep of meat and wool breed and wool breed types were the closest (0.01255), sheep of wool and meat breed and wool breed types were less close (0.01695), sheep of meat and wool breed and wool and meat breed types were the most distant (0.03578). The genetic affinity of sheep of meat and wool breed and wool breed types is explained by the fact that improvement of those livestock and creation of new types were made mostly on account of inbreed selection, on one hand, and location of breed farms were in the same climatic zone, on the other hand. That is a uniform ecological and climatic niche favoured for natural genotype selection more adopted for that area of breeding.

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