Application of Environmentally Safe Bioelectrical Parameterization for the Assessment of Potential Multiple Pregnancy of Sheep and Offspring Growing Capacity

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Abstract. Functional state of the reproductive system of ewes, which determines their multiple pregnancy, is closely related to homeostatic processes, which can be assessed by the level of bioelectric potential of superficially localized biologically active centers (LBP of SLBACs). The purpose of the work is to develop a method for early diagnostics of multiple pregnancies in ewes, by studying the LBP of the SLBACs of ewes and their reproduction rate - multiple pregnancies, as well as studying the growing capacity of offsprings of young animals obtained from experienced ewes. The object of the study was ewes of the Romanov breed. As a result of the research and analysis of the data obtained, a straight-line relationship between the LBP of the SLBACs of ewes and their multiple pregnancies was established. The results of the control young sheep breeding of the Romanov breed obtained from the ewes with different LBP of SLBACs showed that the lambs obtained from the ewes with a low LBP of the SLBACs had the highest growing capacity. However, the ewes with a high biopotential level produce significantly more offspring, which allows increasing the level of mutton production and the profitability of the industry. On the basis of the data obtained, a method for early diagnosis of multiple pregnancies in sheep according to the LBP of the SLBACs of ewes before the mating campaign was developed.

1. Introduction

The basis of any agro-industrial production in a market economy is the economic profitability of manufactured products. In sheep breeding selection work and the improvement of various technological processes are also directed to an increasing the economic efficiency of the industry. To increase the profitability of sheep breeding it first of all is necessary to increase the number of sheep, thereby to achieve an increase in the production of wool and lamb, and this is possible due to an increase in the multiplicity of sheep. The animals ability to produce certain amount of animal yield typical for each species is determined by the concept of fertileness. In sheep, it is determined by the number of all received lambs per 100 ewes for one lambing.

2. Relevance

There are numerous reports in the literature indicating that within each breed there are individuals with high fertileness [3,4,7]. Fertileness as a qualitative indicator is subject to great genetic variability, and therefore the differences in it between the breeds can vary greatly from 105 to 300 lambs per hundred
of ewes, and the breeding practice of many sheep breeds confirms the effectiveness of selection according to this feature [1,2,8].

At present, world sheep breeding has accumulated a great experience, indicating the reasonableness of increasing multiple pregnancies of sheep. Primarily it is due to an increase in the meat - mutton and raw materials - wool production. The ways to solve this problem are multifaceted and have their own peculiarities in each case. Thus, it is known that improved feeding conditions increase sheep fertility by 8-10%. Multiple pregnancies are directly related to the type of ewes' and rams' births. It is a proved fact that the cases with multiple pregnancies increase when one or both parents are twins [1,7,9,16,17]. In recent decades the use of hormonal preparations, stimulating reproductive cycle of ewes, has been considered to be a more progressive element of obtaining densified lambing. However, considering modern trends in the development of the agro-industrial complex aimed at the production and increase of environmentally safe products of sheep breeding, hormonal drugs and long-term selection methods that allow densified lambing are replaced by the new ones leading to early diagnostics of ewes for multiple pregnancies. In this regard, the study and use of compensatory-adaptive reactions of a living organism through special formations on the surface of the animal's skin - superficially localized biologically active centers (SLBACs), which are elements involved in the implementation of homeostatic reactions of the organism, deserve special attention [7, 8, 14].

3. Problem Statement

3.1. The development of the method for early diagnostics of multiple pregnancy in ewes, by studying the LBP of the SLBACs of ewes and the indicator of their reproduction - multiple pregnancy, as well as studying the growing capacity of young animals obtained from the experimental ewes.

The research was carried out on ewes of the Romanov breed on the farms of the Orel region.

For the research SLBACs No. 13, 15, 64, 65, 80 were selected.

The studies previously conducted by Mamaev A.V., Samusenko L.D. and other scientists (2011, 2012, 2013, 2014, 2016) proved that the architectonics of the biologically active centers of animals was characterized by the presence of a large number of nerve-branches originating from different parts of the spinal cord, passing in the places of localization of these biologically active centers, and their direct connection through afferent ends of the nerve with the brain [10,11,12].

To measure the bioelectric potential of the SLBACS, an ELAP device was used.

The topographic localization of the SLBACs No.:
13- on the dorsomedial line of the body in the scrobiculus between the spinous process of the last lumbar vertebra and the first sacral vertebra.
15- on the dorsomedial line of the body between the spinous processes of the last sacral and first caudal vertebrae.
38 - bilaterally, parallel to the dorsomedial line of the body and 2-3 finger breaths caudally of BAC 37.
41- bilaterally, one finger breath caudally of BAC 40.
43- bilaterally, 2-3 finger breaths caudally of BAC 41.

In the experiments, two groups of ewes were used. Each group contained five ewes with their live weight ranging from 42 to 47 kg. The bioelectric potential was measured on three adjacent days a week before the intended insemination.

The studies were carried out in natural conditions in the autumn period of the mating campaign. As a result of the studies carried out, the level of bioelectric potential was measured in all the experimental ewes in five SLBAts No. 13, No. 15, No. 38, No. 41, No. 43 and its average values were determined. Guided by the segmental theory of the structure and connections of the neurovegetative system with its metameric structural organization, the experimental ewes were differentiated into two groups: with low and high levels of biopotential of the SLBACs.

The growing capacity of young animals was assessed by the generally accepted method of calculating the average daily live weight gain and the relative growth rate.
Statistical data processing was carried out according to standard biostatistical methods [13, 18].

4. Theoretical part
Reflex elements are a kind of sensors for the exchange of information between the biological system and the environment. The information about the state of the biological system is converted into a form convenient for the transmission and sent in the form of electrical impulses to the control element of the functional system - the central nervous system. This is the fastest way of transmitting information in living organisms [10,11,12,15,19,20]. Therefore, the question of the informativeness of assessing the early diagnostics of multiple pregnancy in ewes and the growing capacity of their offspring is relevant.

A very significant step towards understanding the role of biologically active skin centers in providing important functions is done in the works by G.V. Kazeev. (2000,2013). Based on the data of his investigations and our own research, we analyzed multiple pregnancies of ewes, depending on the level of the bioelectric potential of their SLBACs during the mating campaign.

5. Practical significance, proposals and results of implementations, results of experimental studies
In the own studies, measurements of the level of bioelectric potential of superficially localized biologically active centers No. 13, No. 15, No. 38, No. 41, No. 43 were used as reproductive indicators a week before the intended insemination. During three adjacent days, its average value was determined, and with a value of less than 60.1 μA, single pregnancy was established, and with a value of 60.1 μA and higher, the multiple pregnancy of sheep, which made it possible to quickly and objectively diagnose multiple pregnancy in sheep before the onset of pregnancy.

The analysis of the data obtained by us made it possible to establish a linear relationship between the level of the biopotential of the LBAC in ewes and the indicator of their multiple pregnancy. The data analysis on the multiple pregnancy of the experimental ewes was carried out according to the data of lambing; it was also compared to the measured levels of the bioelectric potentials of the SLBACs. The data on the levels of bioelectric potentials of the superficially localized biologically active centers and the multiple pregnancy of ewes are presented in Table 1.

Table 1. Multiple pregnancies of the experimental ewes with different levels of bioelectric potential of the SLBACs.

| Indicators                  | Experimental group |         |
|----------------------------|--------------------|---------|
|                            | 1 (control)        | 2       |
| Number of animals, units   | 5                  | 5       |
| Average LBP of the SLBACs, μA | 54,03±0,73         | 60,1±0,52*** |
| Live weight of the ewe, kg | 42,0±0,79          | 45,6±0,57* |
| Lambs obtained, units     | 5                  | 11      |
| Fertileness, %             | 100                | 200     |
| Hogg lambs, units          | 5                  | 10      |
| Lamb livability, %         | 100,0              | 90,9    |

The difference is statistically significant: * P <0.05; ** P <0.01.

Table 1 shows that there is a clear direct correlation between the level of the bioelectric potential of the SLBACs and the multiple pregnancy of ewes. So, in ewes with a low biopotential level - 54.03 μA, one lamb was obtained per lambing, in ewes with a high biopotential level - 60.1 μA, 2.2 lambs were obtained per one lambing. According to the results of the biometric data processing, it is a correlation dependent sign.
We also revealed a straight-line correlation between the weight of ewes and the number of offsprings obtained per one lamb. In animals weighing from 42 to 45.6 kg, one lamb was obtained per one lambing, and in animals weighing 45.6 kg or more, 2.2 lambs were obtained.

At the time of weaning at the age of 90 days old, 5 lambs were weaned in ewes with a low level of biopotential the SLBACs, and the survival rate was 100.0%, and in ewes with a high level of biopotential the number of lambs at the time of weaning was 10 units, i.e. 90.9%.

Further, live weight at birth of young animals obtained from the experimental ewes and growing capacity in the periods of rearing were studied. The amount of live weight during the rearing period can be used in the breeding process as a trait predicting the subsequent growth and slaughter qualities of animals (Table 2).

Table 2. Changes in the growing capacity of the experimental young animals depending on the level of the biopotential of the SLBACs of the ewes-mothers.

| Indicators                      | LBP of SLBACs of the ewes-mothers, μA |
|--------------------------------|--------------------------------------|
|                                | Low LBP                              | High LBP                              |
|                                | 54,03±0,73                           | 60,1±0,52***                          |
|                                | control                              | experimental group                    |
|                                | single                               | twinning                              |
| n                              | 5                                    | 10                                    |
| Average live weight at birth, kg| 3,00±0,22                            | 2,24±0,19**                           |
| 3 months old                   | 20,04±0,47                           | 19,74±0,42                            |
| 6 months old                   | 30,86±0,82                           | 28,62±0,56*                           |
| Daily live weight gain, g      |                                       |                                       |
| For 3 months                   | 0,188±0,004                          | 0,193±0,002                           |
| For 6 months                   | 0,118±0,72                           | 0,117±0,017                           |
| Relative gain, %               |                                       |                                       |
| From 3 to 6 months             | 54,17±4,1                            | 45,22±3,6                             |

The difference is statistically significant: * P <0.05; ** P <0.01.

The analysis of the data in Table 2 shows that the average live weight of the lambs obtained from the ewes with a low biopotential level of the SLBACs was 3.0 kg, which exceeded the weight of the lambs obtained from the ewes with a high biopotential level by 25.3%. It confirms the situation - the more lambs are there in the offspring, the less is their weight.

The analysis of the growing capacity of animals by the periods of rearing showed significant differences relatively to the control group. So, at the age of 3 months old, the live weight of lambs in the control group was 20.04 ± 0.47 kg, which is 1.5% more than the weight of animals in the experimental group, with insignificant differences. The average daily live weight gain in the period from birth to 90 days old averaged 0.190 g and also did not have significant differences from the control group.

At the age of six months old, the lambs from the ewes with a low biopotential level had an average live weight of 30.86 ± 0.82 kg, which is fully justified by their higher live weight at birth and high growing capacity - 51.17%. In the youngsters born from the ewes with a high LBP of the SLBACs, the indicators were slightly lower with an insignificant difference to the control group. The results of the experiment indicate that the lambs of the single type of birth obtained from the ewes with a low biopotential level have higher growing capacity. At the same time, the lambs of the ewes with a high level of biopotential of the SLBACs and born with the twin type also show quite good growing capacity.

Nowadays, slaughtering young animals for meat at the age of six months old and obtaining meat with the best quality indicators, are considered to be technologically justified.
In sheep, live weight is closely related to such measurements as oblique body length and chest girth. To a lesser extent, this dependence is expressed in the connection with the height at the withers, width and depth of the chest. For the lifetime assessment of the fleshing, it is most advisable to use the blackness index. This indicator makes it possible to judge about the degree of body development and the possibility of obtaining a sufficient amount of meat products.

6. Conclusions
The results of the control rearing of young sheep of the Romanov breed obtained from the ewes with different levels of biopotential of the SLBACs showed that the lambs obtained from the ewes with a low level of biopotential of the SLBACs have a high growing capacity. However, the ewes with a high level of biopotential of the SLBACs on average give more offsprings, which will increase the level of production and profitability of mutton production in the practical sheep breeding.

On the basis of the obtained data, we have developed a method for early diagnostics of multiple pregnancies in sheep according to the LBP of the SLBACs of ewes before the mating campaign.

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