Diagnostics of the manifestation of biological laws in animals

Nikolay Shulga¹, Natalia Trush¹*, Irina Sayapina¹, and Lyudmila Bugaeva¹
¹Far Eastern State Agrarian University, 86, Politekhnicheskaya str., 675005, Blagoveshchensk, Russia

Abstract. Rearing young farm animals in the early stages of postnatal ontogeny is a critical point. There are many aspects of theoretical and practical research on improving the safety and prevention of diseases of calves, but one of the main ones is a comprehensive knowledge of the morphofunctional and adaptive features of calves during the newborn period. To continue to exist in a modified environment is to maintain vital activity and some aspects of homeostasis that are characteristic of organisms of this species, this level of development of its nervous and hormonal mechanisms. When analyzing the incidence and death of calves, it was found that the transfer of calves from individual cells to General ones and the change of milk feeding to hay and mixed feed provokes the growth of diseases at the age of 10 days and older than one month (70%), and also dies at this age (58%). Morpho-physiological features of newborns are the impenetrability of the placenta of hoofed productive animals to the immunoglobulins of the mother's blood. Nature has created a unique mechanism for receiving immunoglobulins in the body of newborn ungulates. After direct maternal immune protection during pregnancy ceases, nature replaces it with colostrum immune protection. To confirm and derive biological laws, the dynamics of immunoglobulins in the blood and colostrum of cows and pigs before and after childbirth were studied.

1 Introduction

The existence of biological objects on the planet is governed by biological laws. However, their role is not as obvious as the manifestation of physical laws. But the analysis of the incidence of young cattle in the southern regions of the Far East shows a high level of morbidity and mortality, if special prevention measures are not taken into account the scientific approach. The problem of growing healthy offspring remains relevant. Determining the status of a healthy calf will help in organizing activities to raise a healthy, highly productive herd.

In this regard, we would like to track their manifestation on the system "mother-fetus". The system "mother – fetus" occurs in the course of pregnancy and involves two subsystems – the body of the mother and the fetus and placenta is the link between them. The interaction between mother and fetus is ensured primarily by neurohumoral

* Corresponding author: Letter_box_n@mail.ru

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mechanisms. In both subsystems there are the following echanisms: a receptor that receives
the information, the regulatory carrying out its processing and enforcement [1, 2].

The process of embryonic development of animals is the result of a long evolution, and
to some extent reflects features of other animals [3].

One of the main features allowing the body to continue existence in the changed
environment is the maintenance of life and some sides of homeostasis, characteristic
organisms of this type, the level of development of nervous and hormonal mechanisms.

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In the organism of animals reacts to endogenous and exogenous changes and plays a
leading role in the processes of adaptation to environmental conditions - endocrine system.
Regulatory influence on the organism of the fetus and newborn is having thyroid, as in
these periods there is the emergence of basic metabolic processes (heat generation, protein
synthesis), adaptation of newborns to extraterine life [4, 5].

After direct maternal immune protection during pregnancy ceases, nature replaces it
with colostrum immune protection. A large role in regulatory mechanisms of homeostasis
belongs to the adrenal glands, which are among the first included in the response of
organism to various factors of external and internal environment. In the system “mother –
fetus” significant life supporting, regulatory effects are tab thyroid and adrenal glands,
which occur in the early embryonic period [6, 7].

The endocrine system begins to function early. For example, in cattle two months of age
fetal thyroid is functioning independently from the thyroid gland of the mother. Dysfunction of the thyroid leads
to an immunodeficient state [4, 5].

In growing calves the most crucial period – the molozivno, as at this time the most great
waste of the young. In case of non-compliance with veterinary and sanitary standards, signs
of diseases in calves may appear on 7-14 days after their transfer from individual to group
maintenance. When animals get into the General group, calves experience stress. Current
research confirms that oral administration of immune serum preparations allows correction
of colostral immunity in weakened calves and piglets born with low weight.

As you know, the cultivation of young growth of agricultural animals in the early stages
of postnatal ontogenesis is the most critical and responsible moment, as the development at
this time preapre shared future growth, health, milk and meat productivity. Diseases of
young animals, forced slaughter reduce the economic efficiency of cattle breeding up to 20-
30% [7].

Theoretical and practical research to improve the safety of and prevention of diseases of
calves many aspects, but one of which is that a comprehensive knowledge of
morphofunctional and adaptive characteristics of calves in the neonatal period. In the study
of the organism in ontogenesis, the influence of internal and external factors are used for
scientific integrated approaches.

The structure of the intestinal wall of newborns allows you to transport the mother's
immunoglobulin molecules by pinocytosis until the body of newborn animals begins to
synthesize them independently. A very low level of immunoglobulins in the blood serum of
those animals that did not receive colostrum after birth was detected. The issues of
improving the intensively-STI growth and productivity, strengthening of protective forces
of an organism of young animals and require a modern scientific possibilities of approach
to their solution [9]. Animals are constantly experiencing the impact of biotic factors and the risk of immunodeficiency States is always present [6, 7, 10].

In the study of issues of immunity in ontogenesis and especially in the early suckling period permanent interest is the impact of colostrum on the body, the content of serum protein in the blood of newborns after feeding calves colostrum. Conducted comparative analyses of the biochemical composition of colostrum the first milk yield [11, 12].

From scientific sources it is known that before starting to operate the system, which is develop faster [13]. Current scientific studies it is known that the body's endocrine system participates in the regulation of all vital processes. Hormones have a regulatory effect on the growth and development of the body. From the hormonal state of the organism depends on the organism adaptation to the external environment [1].

The viability and immunological protection of animals in the first days of life correlated with the contents of serum immunoglobulin, and further this relationship is not observed [14, 15, 5].

It is well known that placental mammals depending on the species of histological features may hinder or facilitate the transfer of antibodies in the system "mother-fetus". Placenta of rabbits and Guinea pigs (givendaily type), monkeys and women (hemochorial type) provide in the embryonic period of active transport of molecules of antibodies from the mother's bloodstream into the bloodstream of the fetus [16].

These types of newborns are born with the Existence of biological objects on the planet is governed by biological laws. However, their role is not as obvious as the manifestation of physical laws. In this regard, we would like to track their manifestation on the system "mother-fetus", in particular the dynamics of antibodies in the blood and colostrum of mothers. It is well known that placental mammals depending on the species of histological features may hinder or facilitate the transfer of antibodies in the system "mother-fetus". Placenta of rabbits and Guinea pigs (givendaily type), monkeys and women (hemochorial type) provide in the embryonic period of active transport of molecules of antibodies from the mother's bloodstream into the bloodstream of the fetus. These types of newborns are born with maternal set of antibodies in the blood.

Placenta cows, sheep and goats (syndesmoplasty type), horses, donkey and pigs (epithelially type) block the transfer of circulating maternal antibodies to the fetus. The representatives of these types of transfer of antibodies is the post-Natal colostrum through the wall of the intestine of newborn animals (usually the first 24-72 hours after birth). Antigenic history of the mothers is mainly due to the contact with disease-causing microorganisms in the process of ontogenesis and is reflected by antibodies against antigens characteristic of a given territory and in a given historical period of time. Every mother was at the time, newborn animals and as growth and development have had contact with pathogens typical for the area. Newborn children have a similar history of interaction with antigens during the stay in the womb of mothers. In this development period of their antigenic protect carries the maternal immune system, possessing the necessary spectrum of antibodies [7].

In the period and after giving birth direct maternal immune protection of newborns descendants shall be terminated and replaced with molozivno mediated immune protection. First hours after delivery in the colostrum of mothers contains the maximum amount of immunoglobulins which are mainly antibodies against pathogens of various nature. Revealed a very low level of immunoglobulins in the blood serum of animals after birth have not received colostrum [6].

Molecular structure of immunoglobulins, as they transition to the breast is not changed and the composition of the immune protein fractions of blood serum practically does not differ from serum to colostrum. Immunoglobulins circulating in the blood of the mother into the colostrum, and then into the blood of newborn animals across the enterocytes of the
small intestine. The structure of the intestinal wall of the newborn to transport molecules of immunoglobulins of the mother by pinocytosis as long as the body of the newborn animals begin to synthesize their own [11, 14].

Due to the fact that the dynamics in immune proteins in the sera of mothers before childbirth and after them, and their dynamics in the serum of colostrum is studied not enough, we set ourselves the task to explore the formation of immunoglobulin component of colostrum in the sample of colostrum of cows and sows. To establish the connection and interdependence of the levels of the immune proteins in the blood serum and colostrum, necessary and stable relations between them. To diagnose biological laws describing changes in levels of immune proteins in the blood and colostrum [17, 18].

2 Materials and methods

For research groups of cows (n=40) and sows (n=40) on the principle of analogues. The material for the study was the blood serum of cows and sows are obtained by conventional methods. Before birth the serum of the blood examined every 24 hours for seven days before giving birth for the first time minutes after them, and every 24 hours for seven days after birth. The serum colostrum was investigated in cows and sows first minutes after birth and on 1, -2, -3, -4, -5, -6, -7 day after them.

After birth, examined the serum of colostrum, obtained by the removal of fat and fermentation of casein. To obtain serum skim colostrum was heated to 380°C in a water bath and added to an equal volume of 0.1 N hydrochloric acid solution and 1 drop of a saturated solution of pepsin in 5 ml of the mixture. The contents of the vials stirred, kept at a temperature of 380°C for two hours and subjected to centrifugation at 5000 rpm for 10 minutes. In the serum of colostrum was determined by the content of total protein refractometric method and protein fractions by electrophoresis in agarose gel [12].

In the blood serum and colostrum were determined by total protein and protein fractions of 6 indicators, including the major classes of globulins: albumin, α1, α2, β1, γ1, γ2 – globulins. A content analysis of immune proteins was carried out according to the amount of antibodies in a percentage of the total protein content in blood serum and colostrum. The obtained data were processed by variation statistics.

3 The results of the research

The experimental data show that a significant decrease of levels of immune proteins in the blood of cows and sows began a week before the birth, particularly marked decrease in the levels of immunoglobulins is observed for two days, and on before delivery (Table 1).

The number of immune proteins was decreased to childbirth. A whole week in cows, the level of immune proteins in the blood decreased by 35.4% (p<0.001) from the average of data on farm (34.2 ± 1.3%), pigs – by 32.5% (p<0.001) from the average of data on farm (30.2 ± 1.2%). The established fact allows to predict the quantitative and qualitative composition of the colostrum of ungulate animals by major classes of immunoglobulins, which allows the prediction and correction of immunodeficiency in newborn calves and piglets.

The level of immunoglobulins in the blood serum of animals after calving and farrowing subject to fluctuations. During labor, the number of antibodies in the blood of animals is minimal. During the first two days after birth, the level of antibodies in the blood of cows and sows increased sharply and stabilized to the third day.
On the third day after birth, the amount of antibodies in the blood of cows increased by 56.1% (p<0.001), blood pigs – 21.4% (p<0.001). Over the next five days there was a slight fluctuation of the indices within the average for the farm.

A measure of the amount of immunoglobulins in the serum of colostrum is also subject to fluctuations. During childbirth, the level of antibodies in the colostrum was at maximum height. During the first two days after birth, this ratio sharply decreased and on the third day stabilized.

**Table 1.** The Dynamics of immunoglobulins in the blood and colostrum of cattle and pigs as a percentage of the total protein content before and after childbirth, n=40.

| Day before and after childbirth | 7    | 6    | 5    | 4    | 3    | 2    | 1    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    |
|---------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Cattle                          |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Blood                           | 32.1±0.4 | 31.7±0.3 | 30.6±0.7 | 29.4±0.7 | 28.2±0.6 | 25.5±0.2 | 24.7±0.7 | 22.1±0.6 | 28.9±0.7 | 32.5±0.5 | 34.5±0.8 | 35.5±0.3 | 35.3±0.2 | 35.2±0.8 | 34.9±0.7 |
| Colostrum                       | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Pigs                            |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Blood                           | 28.2±1.9 | 27.8±1.2 | 27.6±1.0 | 27.4±0.9 | 26.8±0.7 | 26.1±0.9 | 25.1±1.9 | 22.4±1.1 | 25.5±1.4 | 27.5±1.8 | 32.5±0.9 | 34.5±0.8 | 35.5±0.3 | 35.3±0.2 | 35.2±0.8 | 34.9±0.7 |
| Colostrum                       | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |

The level of immunoglobulins in the serum of colostrum in cows on the third day after calving decreased by 33.2% (p<0.001) in pigs, the number of antibodies in the colostrum decreased by 34.0% (p<0.001). Over the next five days there were slight fluctuations in the level of antibodies in the serum of colostrum, their number practically did not changed.

According to table 2, calves and piglets that had 50 g/l of total protein in their blood serum had a high incidence and low safety. Calves and piglets with a total serum protein level of more than 50 g/l had high safety and the best indicators of natural resistance.

**Table 2.** The ratio of natural resistance of newborn calves and piglets to the level of total protein in the blood serum.

| Total protein, g/l | Immunoglobulins, g/l | FAN, % | BASQUE, % | Number of animals | Fall ill | Palo | Safety, % |
|-------------------|----------------------|--------|-----------|-------------------|---------|------|-----------|
| **Calves**        |                      |        |           |                   |         |      |           |
| Before 50         | 11.8±1.3             | 39.5±0.4 | 24.1±1.2 | 40                | 40      | 9    | 60        |
| Higher 50         | 16.6±1.3             | 51.4±0.5 | 28.8±1.2 | 40                | 40      | -    | 100       |
| **Pigs**          |                      |        |           |                   |         |      |           |
| Before 50         | 13.4±0.7             | 50.7±0.7 | 21±0.6   | 100               | 100     | 40   | 60        |
| Higher 50         | 18.7±0.9             | 56.7±0.2 | 28.1±0.8 | 100               | 60      | 20   | 80        |
4 Discussion of research results

The period from the birth of calves and piglets to three months is critical for physiological and morphological adaptations to the new environment and especially nutrition. This period is conventionally called milk. The preservation of young animals and the search for ways to increase the overall resistance of the body should be brought to the fore in animal husbandry. The main tasks in solving practical issues are to ensure the normal development of the fetus and develop the most rational technology for growing young animals.

Under modern conditions in animal husbandry, it is quite possible to create conditions for excluding immunodeficiency in newborns. Finding ways to increase the overall resistance of the body should be brought to the fore in animal husbandry. Veterinary doctors' knowledge of biological, morphofunctional and adaptive features of newborn calves and piglets will create conditions for improving the safety and prevention of diseases.

One of the main reasons for economic losses in cattle breeding is the death of young animals, low growth in live weight, reduced productivity and breeding qualities of adult animals, as well as high costs for medical measures. The death of calves in some farms of the region reaches 40-50%. In sick and ill animals, weight gain decreases by 2-3 times.

As a result of studies in animals with molozivno type of transfer of antibodies from mother to descendants the tendency to decrease in the level of immunoglobulins in the blood before birth. If the optimal regime for keeping and feeding pregnant cows is not observed, especially in the second half of pregnancy, it leads to the birth of weak calves.

It can not be considered random, as is characteristic of many animals of two species. The decrease in the level of immune proteins in the blood before birth is a biological law, characteristic of many species of animals. And can be formulated as the biological "Law of diminishing levels of immunoglobulins in the blood before birth in animals with molozivno type transfer of antibodies".

Normal levels of immunoglobulins in the blood of cows and pigs on the third day after birth reflects the "law of the restoration of the level of immune proteins in serum after birth in animals with molozivno type transfer of antibodies".

The analysis of the obtained experimental data characterizing the dynamics of the levels of immunoglobulins in the blood and colostrum of cows and sows, an inverse dependence of the levels of the immune proteins of whey of colostrum from the level of immunoglobulins in the blood serum. This dependence has a very high correlation coefficient. The strength of the link between indicators is very high \( r = -0.92 \), so it can also be regarded as a biological "Law of inverse proportion to the level of colostrum immunoglobulins from the immune serum proteins after birth in animals with molozivno type transfer of antibodies".

The decrease in the level of immunoglobulins in the blood serum of cows and pigs, examined immediately after birth, in comparison with the average data by farm, confirms the origin of serum immune proteins from colostrum. Before birth the immune blood proteins flock to the mammary gland and become immunoglobulins of colostrum.

The relative stabilization of the levels of immunoglobulins in sera of colostrum and blood of cows and sows to the third day after childbirth, undoubtedly, due to biological factors, reflecting the loss of the ability of the small intestine of newborn calves and piglets to absorb the immunoglobulins and transport them in the blood without breakdown into peptides and amino acids, by pinocytosis. This confirms the hypothesis about the absorption of immune proteins by the intestine in newborn animals, only the first few days of life.

In the farms of the southern zone of the Far East, respiratory diseases of calves are widespread and occur heavily during the period of transfer to group maintenance. For many
years, the situation with respiratory diseases has not been positive, so we need to develop new approaches to preserving young animals, taking into account the scientific approaches of biological laws. The results of the analysis of the incidence of respiratory diseases in calves in the regions of the Far East show that there is a tendency to increase the number of calves with respiratory diseases.

Oral administration of immune whey preparations allows to conduct correction of colostral immunity in animals that are born with low weight; piglets born last and calves for some reason did not receive colostrum in the first hours of life.

5 Conclusion

The conducted research allowed to diagnose the manifestation of biological laws of transfer of immune proteins from serum in the serum of colostrum before childbirth, the maximum presence in the first portions of colostrum and the restoration of physiological levels of immunoglobulins in the blood serum on the third day after birth.

The studies diagnosed the inverse dependence of the level of immunoglobulins of colostrum from the content of immune proteins in the blood serum. The concentration of antibodies in the serum of colostrum is higher, the lower their levels in the serum of animals before birth.

Indicators of the total protein level in the blood serum of newborn calves and piglets can be used to characterize the state of the humoral link of the immune system. Newborn calves and piglets that have less than 50 g/l of total protein in their blood serum have low natural resistance. The revealed morpho-physiological regularities are a biological law inherent in many animal species.

As a result of the research, the relationship and interdependence of the levels of immune proteins in blood serum and colostrum, as well as the necessary and stable relationships between them, have been established. Biological laws that characterize changes in the levels of immune proteins in the blood and colostrum have been diagnosed.

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