Scientific Bulletin. Series F. Biotechnologies, Vol. XXX, No. 1, 2026
ISSN 2285-1364, CD-ROM ISSN 2285-5521, ISSN Online 2285-1372, ISSN-L 2285-1364

IMMUNOLOGICAL ASPECTS REGARDING THE EVALUATION OF CELLULAR INDICES IN CATTLE

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Abstract

The paper represents a study conducted on cattle regarding the evaluation of cellular indices, the main ones in triggering cellular immunity depending on different age periods. Aspects of the behavior of the immune cell system against antigens represented by bacteria, parasites, fungi, etc. are presented. The objective of this research is to present an evaluation of some cellular indices in cattle depending on age and to follow the behavior of immune resistance. The results of the study generate possibilities for assessing the importance of immune cellular effectors in determining the resistance of the animal organism and provide valuable information about the reactivity of the animal organism according to the levels of some immune cellular indicators.

Key words*: cell, immunological indices, immune system, lymphocytes.*

INTRODUCTION

The body's immunobiological defense to cell surfaces, where they can be recognized by lymphocytes bearing antigen receptors. Each antigen receptor is highly specific, and each lymphocyte expresses only one form of antigen receptor. Thus, millions of cells have the potential to recognize millions of antigens (Găjăilă, 2003; Golban, 2016).

For these reasons, the main objectives of this research are to study the dynamics of immunobiological indices in cattle depending on age constitute a powerful weapon system whose use must be controlled to minimize external damage. For these reasons, a large part of the immune system is dedicated to the production of regulatory cells, whose function is to ensure that immune responses occur only under appropriate circumstances (Rosen, 2008; Golban, 2024).

At present, the immune system is a term increasingly used in biological sciences to define the defense mechanisms of the animal body against pathogens. This defense role is important for maintaining the health of the body, due to the multiple interaction with the environment, where it is continuously subject to the influence of external factors. For these reasons, living organisms have a phagocytic defense system, and the immune system is all the more complex as the organism considered is located on the scale of biological evolution and development. Acting more differentiated and more effective, in animals this system has matured, becoming an important complexity (Brocaw, 2013)

The immune responses to defend the body cannot always guarantee protection. In some situations, they lack the flexibility to respond optimally to a diverse set of microorganisms, which can cause substantial tissue damage (Siloși, 2013; Golban, 2019).

The most important defense mechanism is the immune system with its key characteristics, which include its ability to act automatically in response to microbial invasion, to generate resistance and to improve the general condition of the newborn and adult body (Andrieș, 2014; Siloși, 2014; Tașbac, 2014; Golban, 2015).

At the same time, normally, the immune system, through its mechanisms, contributes to the removal or elimination of microorganisms, viruses and fungal agents that have entered the body (pathogens), contributing to the destruction of harmful internal structures, providing protection and resistance to various infections of the animal body.

Bibliographic studies confirm that a strong immune system stops the millions of microbes with which the body constantly comes into contact. For these reasons, some infections

occur in the animal body given that the immune system can be weakened by the lack of nutrients, an unbalanced diet, environmental pollution, and aging. Stress hormones secreted in excess unbalance the immune system and predispose the body to infections and other diseases (Carp-Carare, 2014).

It is important to note that immune-based defenses are not the only forms of defense. The stages of manifestation of the establishment of immunity are of interest by involving the mechanisms of synthesis of some classes of immunoglobulins. The initial period constitutes the processing of external factors by transferring them to some internal environments of the organism, these being represented by the elements of the immune system. These reports confirm the importance of foreign elements with certain peculiarities characteristic of the antigen-antibody interaction. However, the elements of the immune system present characteristics of identifying numerous groups of foreign elements with action on the immune system (Golban, 2007).

According to studies in the field of immunology, the immunological profile or immune status results from the process of complex analysis of cellular immunobiological elements, which are part of the immune system. It is made up of the sum of qualitative and quantitative data, which characterize the morphological - structural aspects and the mode of functioning of the immune system in animals in various physiological and pathological states. The values, indices and qualifiers through which the immunological profile is expressed (cellular elements, phagocytic indices) represent an aspect, which includes both the components and the set of immune effectors and mechanisms. Ultimately, through the immune status, a synthesis of the defining elements of immunological competence is achieved, of the immune system's ability to recognize disturbances of exo- or endogenous origin, to integrate or eliminate them, to develop the most appropriate replica and to maintain the state of immunostasis (Cristea, 2011).

Through immunological laboratory tests, which allow a true exploratory dissection, therefore knowledge of the immune system's response capacity, it becomes possible to assign a "grade" that appreciates these important immunological mechanisms, or a qualification to all or most of the mechanisms involved in this system. Going beyond the initial stage of analyzing isolated properties of each effector, the methodology by which the immunological profile is defined ensures the characterization of the essential pathways through which the path from the aggression of any foreign factor to its recognition and then to the response is achieved.

These processes are important through mechanisms of capture, processing and presentation of foreign antigens, cellular cooperation, achieving the balance between stimulation and suppression, cooperation at the molecular level between antigen, receptor and histocompatibility antigen and modeling the activity of the system through molecular messages. Therefore, the constitutive data of the immunological profile provide, not perfectly, a concrete image of the network of cells – with their molecular membrane structures – messages, humoral effectors and mechanisms that articulate in the immune system (Golban, 2015).

For these reasons, the main objectives of this research are to study the dynamics of immunobiological indices in cattle depending on age.

MATERIALS AND METHODS

Immunological scientific investigations were carried out in a didactic farm of cattle of different ages in different seasons. Blood samples from the investigated cattle were used for the investigations.

Blood samples were collected from the jugular vein with heparin based on the calculation of 0.3 ml of heparin per 10 ml of blood for the purpose of anticoagulation. The samples were investigated with the aim of identifying the dynamics of the number of leukocytes, erythrocytes, lymphocytes, opsonophagocytic indices.

To perform the opsonophagocytic test, 1.0 ml of blood stabilized with heparin and 0.1 ml of E. coli microbial culture suspension were used from the calculation of 1.0 ml of physiological solution per 500 ml microbial cells.

The tubes were shaken, then incubated in a thermostat for 30 minutes at T-37ºC and centrifuged at 1500 rpm.

The supernatant was removed using a Pasteur pipette. Stained smears were made by special microbiological staining methods, which were exposed with chemicals regarding the rule of performing bacterioscopic preparations. Smears made from the samples investigated concurrently were microscopically examined using a microscope.

As a result of performing immunological laboratory evaluations, the amount of bacteria involved in the mechanism of incorporation was assessed.

Simultaneously, the indicators regarding the degree of incorporation characteristic of the phagocytic process were also assessed at the same time and it was assessed after evaluating the amount of microbial germs digested by lymphocyte cells. The final determination was made taking into account the calculation of the total number of incorporated bacteria and the amount of lymphocytes present in the opsonphagocytic reaction.

RESULTS AND DISCUSSIONS

The results obtained regarding the immunelogical investigations on the immune system regarding the study of immunological aspects on the activity of some immunobiological indices in cattle of physiological groups in different periods denote important immunelogical indices.

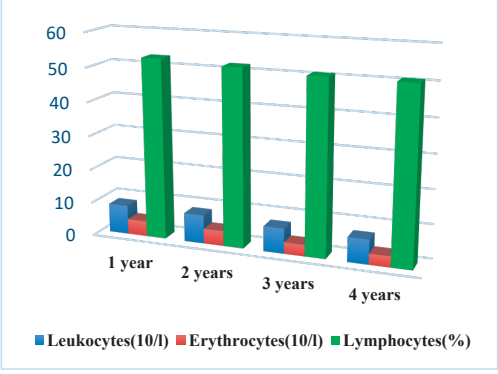

Figure 1. Evaluation of immunological indices in cattle during the winter period depending on age

The data obtained shown in Figure 1 denote variations in the level of leukocytes, erythrocytes, lymphocytes at different ages in cattle investigated in the winter period. Significant values were recorded in cattle aged 1; 2 years where the values constituted the number of leukocytes, erythrocytes and lymphocytes higher than 8.56±1.53; 4.50±0.14; 53.81±4.3 and 8.45±0.03; 4.45±0.12; 52.24±4.1 compared to the age of 3; 4 years with the values of 7.43±1.42; 3.45±0.12; 51.21±4.2 and 7.22±1.51; 3.22±0.11; 51.14±4.2.

Figure 2 reflects the dynamics of immunelogical indices in cattle during the winter period depending on age.

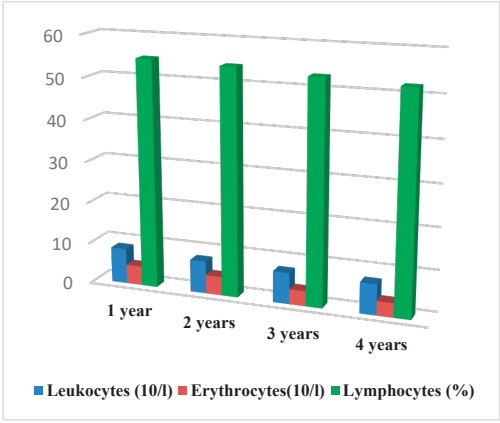

Figure 2. Evaluation of immunological indices in cattle during the spring period depending on age

It can be seen from the data of Figure 2 that leukocyte, erythrocyte and lymphocyte indices in cattle aged 1; 3 years are higher compared to cattle aged 2; 4 years, where the indices constituted values of 8.54±1.53; 4.60±0.14; 54.81±4.2/cattle aged 1 year and 7.51±0.13; 3.61±0.11 and 53.11±4.3/cattle aged 3 years compared to the immunological indices of cattle aged 2; 4 years where the indices constituted values of 7.81±0.02; 4.52±0.12; 54.21±4.1/2-year-old cattle and 7.42±0.03; 3.45±0.13 and 52.21±4.4/4-year-old cattle.

Investigations of the evaluation of immunological indices in cattle in the summer period depending on age according to Figure 3 regarding the dynamics of immunological indices in cattle in the spring period depending on age recorded higher indices of 7.92±0.05; 4.63±0.16; 54.84±4.6 and 7.81±0.02; 4.53±0.13; 55.24±4.3 at cattle aged 1 and 2, compared to cattle aged 3 and 4 where the

recorded indices confirmed values of 7.52±0.04; 3.63±0.16; 54.84±4.6 and 7.33±0.03; 3.53±0.13 and 52.24±4.3.

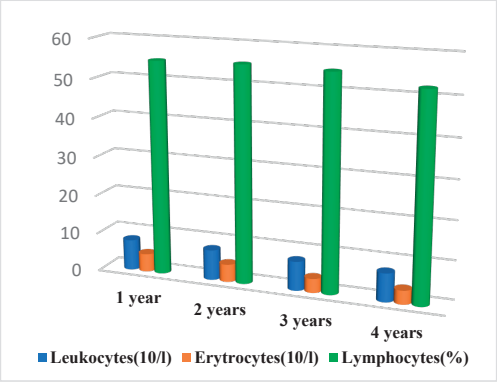

Figure 3. Evaluation of immunological indices in cattle during the summer period depending on age

The results of the investigations shown in Figure 4 regarding the evaluation of immunelogical indices in cattle in the autumn period depending on age reveal higher indices of the number of lymphocytes and leukocytes with values of 8.28±0.02; 5.12±0.15; 56.24±4.0 in 1-year-old cattle, compared to the indices in 2; 3; 4-year-old cattle, which constituted lower values.

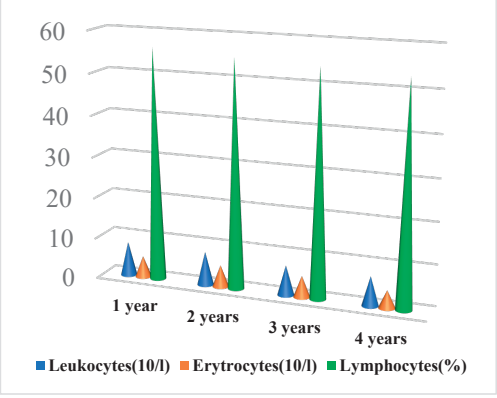

Figure 4. Evaluation of immunological indices in cattle during the autumn period depending on age

The results indicate indices of 8.12±0.01; 5.25±0.12; 55.14±3.2 in 2-year-old cattle compared to 3-year-old cattle, where the values constituted leukocyte, erythrocyte and lymphocyte indices of 7.21±0.02; 5.11±0.13 and 54.22±3.0 and a level of 7.11±0.01; 4.25±0.12; 53.24±3.1 of these indices in 4-year-old cattle. These recorded indices reveal some increases in their level in the cattle studied in different age periods, especially the concentration of leukocytes and lymphocytes, which justifies the importance of cellular and humoral resistance specific to the animal immune status.

The dynamics of phagocytic indices in cattle during the winter period depending on age regarding phagocytic activity and intensity denotes the values shown in Figure 5, where the aspects of these indicators regarding phagocytic activity constitute in animals of different ages values of 53.45±1.21 in cattle aged 1 year, being the highest, compared to the ages of 2; 3 and 4 years, where the values constituted 51.40±1.71; 50.32±1.19 and 48.40. Regarding the values of phagocytic intensity, the highest index also constituted in younger cattle aged 1 year, being 5.04±0.13; compared to cattle of other ages, the values being 4.00±0.11; 4.46±0.12; 3.20±0.11. These results demonstrate that the body's resistance gradually decreases with increasing age.

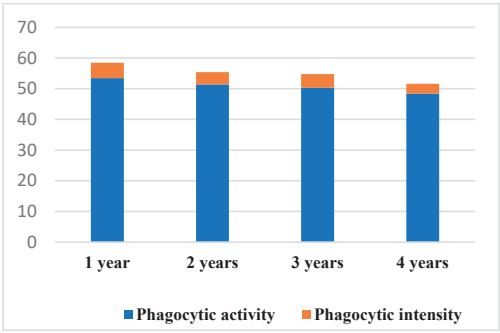

Figure 5. Dynamics of phagocytic indices in cattle during the winter period depending on age

In the spring period, the dynamics of phagocytic indices in cattle depending on age according to Figure 6, indicates that in young animals aged 1-2 years, phagocytic activity and intensity revealed indices of 54.25±1.11; 52.12±1.62 and 5.25±0.12; 5.62±0.11 compared to 3-year-old animals where the indices obtained demonstrated values of 55.25±1.11; 48.11±1.62 regarding phagocytic activity and 4.35±0.12 and 3.62±0.11 regarding phagocytic intensity values.

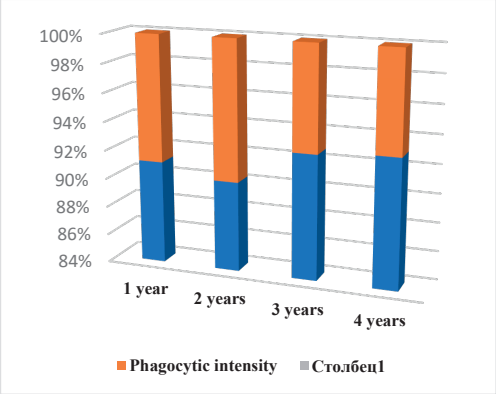

Figure 6. Dynamics of phagocytic indices in cattle during the spring period in dependence on age

The characteristic of the dynamics of phagocytic indices in cattle during the summer period depending on age is demonstrated in Figure 7, values in animals of different ages where the index of phagocytic activity and intensity confirms important characteristics of the phagocytic mechanisms that we determined by obtaining the following indices: 51.25±1.12; 49.12±1.72; 47.22±1.12; 45.32±1.72 which confirms phagocytic activity and 5.01±0.13; 4.64±0.12; 3.01±0.13; 3.64±0.12, which confirm the phagocytic intensity in animals investigated at different ages of research on the phagocytic index.

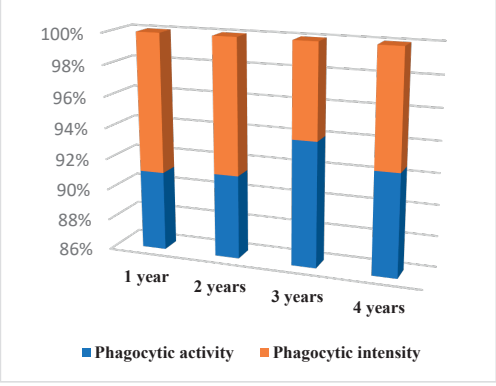

Figure 7. Dynamics of phagocytic indices in cattle during the summer period depending on age

The results of the investigations shown in Figure 8 indicate the dynamics of phagocytic indices in cattle in the autumn period depending on age, which denotes a mixing of the body's resistance in all animals studied in different age periods. The values in the animals studied regarding phagocytic activity and intensity constituted phagocytic activity indices of 48.13±1.11; 46.12±1.61; 44.11±1.11; 42.12±1.61 and phagocytic intensity indices of 3.42±0.04; 4.22±0.03; 3.40±0.04; 4.22±0.03.

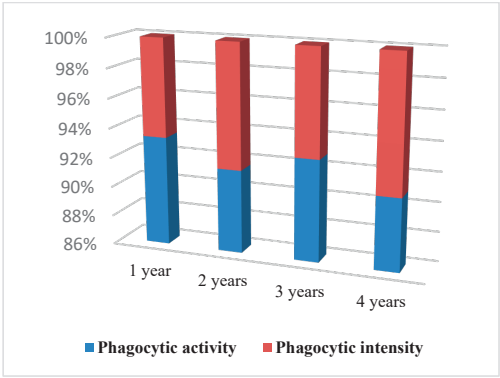

Figure 8. Dynamics of phagocytic indices in cattle during the autumn period depending on age

Therefore, as a result of the investigations carried out, immune mechanisms are essential biological mechanisms that protect living organisms from foreign invaders, distinguishing between self and non-self tissues. In this process, two categories of mechanisms with protective functions are involved: nonspecific and specific. According to some bibliographic reports, nonspecific defense is present even in primitive animals, includes multiple physical barriers (such as skin), chemical responses (such as mucus and gastric acid) and presents mechanisms of action of phagocytic cells that engulf foreign germs. Specific defense, characteristic of vertebrates, is based on the ability of the immune system to generate characteristic immune responses regarding antigenic mechanisms due to the particularities of the mechanisms of lymphocytes in the T and B categories.

T cells are involved in cell-mediated immunity, while B cells produce antibodies for humoral immunity. The adaptive nature of these immune responses allows for rapid responses upon re-encounter with pathogens, demonstrating the importance of memory cells. The immune system also plays an important role in preventing autoimmune diseases, in which the body mistakenly attacks its own cells. Research on animal immune systems has

provided insights that inform human health and therapies, particularly autoimmune infections. Understanding these mechanisms highlights the complexity and adaptability of immune responses across animal species.

Previous reports confirm that the immunological aspects of the animal body's resistance against various pathogenic germs are due to cellular immune elements. These, being involved in autoimmune reactions, present defense functions and, respectively, mechanisms for strengthening the animal body from foreign aggressors.

The immune system is important through its forms of defense determined by the elements of the immune system. The immune protection of the body constitutes the development of tolerance by imposing regulatory mechanisms.

These bibliographic assessments in recent years have become an extremely dynamic field in which research and discoveries follow each other very quickly. The qualitative and quantitative accumulations increasingly require the study of the defense mechanisms of organisms against the aggression of various agents from the external environment, recognized as antigens and/or allergens, as well as against their own modified or altered structures, and the understanding of immunological mechanisms starting with the recognition, processing and analysis of antigens, the transmission of antigenic information, the humoral and cellular immune response, as well as the implications in the production of diseases or lesions with an autoimmune mechanism are increasingly becoming elements that must be known by all those who are trained in the field of biology, especially in the biomedical field, both in human and veterinary medicine.

For these reasons, the immune response to antigen aggression can favor unfavorable consequences for the survival of animals in different age periods. In this context, the investigations carried out are important through some aspects of the activity of cellular immunity in cattle in different age periods.

CONCLUSIONS

Phagocytic cells, lymphocytes, other cellular elements constitute the essential elements of immunity in animals, which determine regulatory effects in different physiological periods.

Immunobiological indices constitute important values in different age periods in the investigated cattle, which justifies the importance of cellular resistance by establishing the body's immunity.

The study of phagocytic activity and intensity indices in different periods determined significant values, demonstrating the increase in the animal's resistance.

ACKNOWLEDGEMENTS

The scientific investigations were carried out at the Technical University of Moldova, Faculty of Veterinary Medicine.

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