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THE ROLE OF BIOCOMPLEXES IN THE METABOLISM OF PRODUCTIVE ANIMALS

РОЛЬ БІОКОМПЛЕКСІВ В ОБМІНІ РЕЧОВИН ПРОДУКТИВНИХ ТВАРИН

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Abstract. *We have established a rather important role of calcium-protein complexes of blood during lactation. Highly productive cows with a milk yield of up to 6,000 kg of milk and with a milk yield of 2,000-3,000 kg per lactation were studied. It turned out that there were significantly more complexes in the blood of high-yielding cows than in medium-yielding cows, while the content of total calcium in the blood of cows during lactation changed slightly in both the first and the second. The amount of calcium bound to albumins significantly decreases during lactation and becomes the lowest during the dry period (6 times less than the norm). In the blood of high-fat dairy cows (Jerseys), the content of cholesterol-albumin complexes is always higher (by 20% or more) than in moderately fat dairy cows (for example, black and spotted). The number of phosphatide-protein complexes in the former was always higher by 30% or more than in the latter, despite the fact that the content of total protein in the serum is less in Jerseys than in black-spotted cows. With a decrease in milk yield, the ability of blood albumins to bind phosphatides in high-fat dairy Jersey cows was always 30-40% higher than in black and spotted cows. Research results indicate that in the blood of beef cows, almost all cholesterol is in the form of complexes with proteins and, above all, with serum albumins. With animal diseases (endometritis, paresis, litter retention, etc.), the number of these biocomplexes decreases sharply, and the content of free cholesterol increases sharply (sometimes 8-10 times against the norm). At the same time, the number of cholesterol-globulin complexes in sick animals increases.*

Key words*: biocomplexes, proteins, nucleic acids, fat, organism, animals, cells*

Introduction.

Biocomplexes or mixed biopolymers are formed during life from proteins and carbohydrates. Fats, nucleic acids, mineral substances and other compounds of the body as a result of their interaction with each other. Biocomplexes are quite numerous, diverse in composition, strength and properties. The formation of biocomplex compounds in the tissues and fluids of the body is a mandatory process of vital activity. Biocomplexes are found in the body of all animals, plants, viruses, and microorganisms[2].

The discovery and study of these substances led to new important insights into the science of cell structure and metabolism. first of all, a new chapter on the supramolecular structures of the cell appeared. Then, in connection with the study of the role and importance of these substances in the life process, completely new ways of studying the metabolism of substances in the body of animals, plants, and microorganisms were revealed. The study of biocomplexes in the dynamics of the life process was of particular importance[6].

The main stages of metabolism are as follows: chemical and physicochemical characteristics of substances that enter the body with food; processes of digestion and absorption of substances; state of substances in blood and tissues; processes of breakdown and synthesis of proteins, fats and carbohydrates in the body; regulation of metabolic processes; metabolic products that are excreted from the body. The leading role in metabolism belongs to protein[1].

Biocomplexes of cell organelles take an active part in the most important metabolic processes: transport of substances, protein synthesis, activation of metabolic substances, temporary binding of metabolic substances, regulation of enzymatic processes, etc. A much more important role of biocomplexes in blood and tissue juice has been proven. Different biocomplexes in the blood are quite well studied [4].

Metabolism begins with the assimilation of substances that come with food. In this phase, at the moment of absorption and immediately after that, the substances interact with blood and tissue proteins. Biocomplexes of different complexity, strength and activity appear.

Biocomplexes formed in this phase of exchange can be called biocomplexes of the first order. They have properties that differ from the properties of the components that form them, and are quite active in further metabolic reactions. As shown by studies [5], among them there are biocomplexes, some of which reveal the functions of catalysts, others - transmitters of nervous excitement or carriers of various substances, and others - regulators of metabolism; there are biocomplexes that take part in mechanical functions, create immunity, regulate permeability, tissue swelling, etc. Examples of such biocomplexes include rhodopsins in the eye, coenzymes in tissues, properdins, antibodies, bound vitamins and hormones in the blood, etc.

All these complexes are quite dynamic. Under the influence of the central nervous system, various physical and chemical environmental factors, etc., they disintegrate into their components. As a result, free metabolites are simultaneously determined in the blood and tissues: glucose, fatty acids, choline, adrenaline, cholesterol, histamine, Ca, K, Mg and other substances. However, the same metabolites can again form a complex when physiological conditions change, and then the amount of free substances decreases. Therefore, in the assimilation phase of exchange, the most mobile compounds are first-order biocomplexes [3,7].

Goal. Comprehensively characterize both permanent and temporary biochemical reactions and processes in body tissues and fluids that occur continuously, and based on these studies understand all forms of the state of substances in the body and develop methods of influencing and controlling metabolism. This is the main way to increase the productivity of farm animals. Studying the dynamics of these complex substances will reveal the most hidden states in the animal organism and the life process.

Research results.

Other processes take place in the dissimilation phase of exchange. Biochemical complexes of the first order are in a state of certain chemical excitation and disintegrate. But intermediate products of metabolism (polypeptides, urea, amino acids, uric acid, sugar, fatty acids, etc.) in a certain amount again interact with

proteins and other tissue substances, and new biochemical complexes are formed, which are called second-order complexes. They, like first-order complexes, have physiological activity, but are less complex. As examples of biocomplexes of the second order, we can cite glycoprotein complexes of blood, aminoprotein complexes, acylprotein complexes of tissues, lipoprotein complexes of milk, etc. The above ideas about the participation of biocomplexes in the metabolism of farm animals were confirmed in our research.

Our research revealed proteid, lipoprotein, glycoprotein, nucleoprotein, metalloprotein and other biochemical complexes in the blood and tissues of animals and revealed their dynamics in different periods of productive activity, in particular during the synthesis of milk and fat in cows, wool in sheep, eggs in poultry, and also with barrenness of cows, with mastitis, rickets and other diseases. Many important facts were established in numerous experimental studies. First of all, it was indicated that in the blood of animals during the periods of the highest productivity, the most dynamic and active participants of the exchange are the biochemical complex compounds of proteins with phosphatides, proteins with sterols, proteins with carbohydrates, minerals and other substances. On the contrary, free substances - phosphatides, cholesterol, calcium, potassium, etc. - are less active. The number of free compounds and their complexes with proteins changes due to changes in physiological conditions and reflects the most intimate aspects of metabolism.

It should be noted that in highly productive laying hens, a significant part of blood calcium is bound in complexes with both albumins and globulins. However, if the amount of total calcium in the blood of hens during the period of preparation for egg laying and at its beginning changes little, the content of calcium bound to globulins increases many times compared to the period of rest.

During the period of intense egg laying, the number of complexes of globulins and phospholipids increases rapidly (by 8 times or more against the norm). At the same time, the number of albumin and phospholipid complexes decreases. Thus, the great role of lipoprotein complexes is revealed. When the egg-laying process is completed, the position is restored. It can be concluded that the indicated blood complexes take part in the synthesis of egg protein as the main building material and activate this process.

We have established a rather important role of calcium-protein complexes of blood during lactation. Highly productive cows with a milk yield of up to 6,000 kg of milk and with a milk yield of 2,000-3,000 kg per lactation were studied. It turned out that there were significantly more complexes in the blood of high-yielding cows than in medium-yielding cows, while the content of total calcium in the blood of cows during lactation changed slightly in both the first and the second. The amount of calcium bound to albumins significantly decreases during lactation and becomes the lowest during the dry period (6 times less than the norm). It is this calcium bound to albumins that most easily enters the metabolic processes and is most quickly used in the process of milk synthesis, and the complexes in general stimulate milk production.

The amount of calcium-protein complexes in the blood of cows that stopped giving milk was always very low. This indicator is specific for low-yielding cows.

Thus, it is necessary to study the dynamics of calcium in the blood, first of all, by the forms of bound calcium, that is, by calcium-protein complexes.

Lipoprotein complexes were also found to be very mobile in the blood of lactating cows. In all periods of lactation, phosphatide-globulin complexes prevailed in the blood, while phosphatide-albumin complexes appeared in smaller quantities and only slightly increased until the dry period.

The blood of low-yielding cows always contained less phosphatide-globulin complexes and more phosphatide-albumin complexes than the blood of high-yielding cows.

Complexes of cholesterol with proteins are extremely mobile in the blood. Research results indicate that in the blood of beef cows, almost all cholesterol is in the form of complexes with proteins and, above all, with serum albumins. With animal diseases (endometritis, paresis, litter retention, etc.), the number of these biocomplexes decreases sharply, and the content of free cholesterol increases sharply (sometimes 8-10 times against the norm). At the same time, the number of cholesterol-globulin complexes in sick animals increases. In the blood of high-fat dairy cows (Jerseys), the content of cholesterol-albumin complexes is always higher (by 20% or more) than in moderately fat dairy cows (for example, black and spotted). The number of phosphatide-protein complexes in the former was always higher by 30% or more than in the latter, despite the fact that the content of total protein in the serum is less in Jerseys than in black-spotted cows.

With a decrease in milk yield, the ability of blood albumins to bind phosphatides in high-fat dairy Jersey cows was always 30-40% higher than in black and spotted cows. It is interesting to note that the content of cholesterol-protein complexes in the milk of these cows differed more sharply. Jerseys had almost 2 times more cholesterol-casein complexes than black and spotted ones.

A number of studies have established the active role of blood biocomplexes in the growth and development of animals, pregnancy, intense muscle work, wool synthesis, in states of extreme excitement, etc.

Conclusions.

The obtained results show that biocomplexes play an important role in the metabolism of highly productive animals. They are especially active during intense productive activity of the body. Therefore, it is necessary to study the role and significance of biocomplexes of blood and tissues in highly productive farm animals, which will allow to understand the main metabolic processes of animal productivity.

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Анотація. *Нами встановлена досить важлива роль кальцій-протеїдних комплексів крові при лактації. Досліджували високопродуктивних корів з надоєм до 6000 кг молока і з надоєм 2000-3000 кг за лактацію. Виявилось, що у високопродуктивних корів в крові комплексів було значно більше, ніж у середньопродуктивних, тоді як вміст загального кальцію в крові корів в процесі лактації змінювався як у перших, так і других незначно. Кількість кальцію, зв'язаного з альбумінами, при лактації помітно знижується і в сухостійний період стає найнижчим (в 6 разів менше проти норми). В крові високожирномолочних корів (джерсеїв) вміст холестерол-альбумінових комплексів завжди вищий (на 20% та більше), ніж у помірно жирномолочних (наприклад, чорно-рябих). Кількість фосфатид-протеїдних комплексів у перших завжди була вища на 30% та більше, ніж в інших, не дивлячись на те, що вміст загального білку у сироватці менше у джерсеїв, ніж у чорно-рябих корів. При зниженні надоїв здатність альбумінів крові зв'язувати фосфатиди у високожирномолочних джерсейських корів завжди була вищою на 30-40%, ніж у чорно-рябих. Результати досліджень вказують на те що в крові тільних корів майже увесь холестерол знаходиться у вигляді комплексів з білками і перш за все з альбумінами сироватки. При хворобах тварин (ендометрит, парез, затримка посліду тощо) кількість цих біокомплексів різко зменшується, а вміст вільного холестеролу різко зростає (іноді у 8-10 разів проти норми). Одночасно кількість холестерол-глобулінових комплексів у хворих тварин наростає.*

Ключові слова*: біокомплекси, білки, нуклеїнові кислоти, жир, організм, тварини, клітини*