

Article

Measures for Treatment and Prevention of Mixed Infection of Colibacteriosis and Salmonellosis in Lambs

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Abstract: In the article, as a result of vaccination of lambs with the vaccine "GOA-associated formol vaccine against colibacillosis and salmonellosis of calves, lambs and piglets", the duration of immunity was established in experiments at 9-12 months. In the treatment of colibacillosis and salmonellosis in lambs, it was noted that due to the stabilization of the immune system due to gamma globulins in hyperimmune blood serum, the effectiveness exceeds 90 percent. The article also provides information about pathomorphological, hematological and biochemical changes in the body in the mixed form of these diseases.

Keywords: Antibody, titer, agglutination, treatment, prevention, hyper immune blood serum, microbiology, antibiotic, vaccine, gastritis, splenetic, atrophy, dystrophy, thrombosis.

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1. Introduction

Nobody needs to be told that colibacteriosis and salmonellosis, which primarily affect young animals like lambs, are among the illnesses that seriously harm the livestock industry. Occasionally, these infections manifest in combination, making losses among individual animals owned by farmers, communal farms, and homeowners even more severe.

Conducting a comparative analysis between the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" and other vaccines, with an emphasis on their impact on the immune system of the animal body, is a pressing issue. The vaccine is made using local strains.

The use of antibiotics to treat bacterial infections in animals has resulted in a cumulative state that is troublesome because it changes the biochemical structure of the medications and causes pathological conditions in the liver, spleen, central nervous system, and other organs.

Determining the efficacy of treating illnesses like salmonellosis and colibacteriosis, which are particularly common in young animals, with hyperimmune blood serum made from local strains is one of our primary goals as researchers. Based on experimental data, it's critical to ascertain if the immune system's stability is caused by complicated proteins or other active organic substances (like gamma-globulin) that the body produces in response to these antigens.

The purpose of the research is to study on the length of time that the GOA formalin vaccination protects calves, lambs, and piglets from colibacteriosis and salmonellosis; the advantage of hyperimmune blood serum over antibiotics in the treatment of these infections; and the pathomorphological alterations that initially reveal the illness. Determination of hematological and biochemical alterations in the blood of lambs given this vaccination is another aspect.

2. Literature Review

Among livestock, enterotoxigenicity and prevalence of colibacteriosis in lambs and calves are 11-29% in Canada, 13-50.8% in the US, 6% in the Netherlands, 58% in France, 4% in England, 6% in Australia, and 6-47 percent in Israel [1]. The disease is characterized by symptoms of gastrointestinal tract dysfunction.

Colibacteriosis is an acute infectious disease that primarily affects newborn calves between the ages of 2 and 7 days, piglets, lambs, and chicks from the first day to 3-5 months, and fur animals from 1 to 5 days. It is caused by *E. coli* and manifests as colienteritis, severe diarrhea, septicemia, and weakness symptoms. It is normal for an animal's immune system to deteriorate and for invasive (respiratory tract, gastrointestinal) illnesses to become more common. This condition exacerbates financial losses, such as those resulting from colibacteriosis infections in lambs. The immune system, morphopathological, and morpho-functional states of the body are all negatively impacted by the use of antibiotics in the treatment of these conditions [7].

Salmonellosis is a septic acute infectious illness that causes fever, gastrointestinal distress, and diarrhea in young animals. Calves between the ages of 3–4 weeks and 4 months, piglets starting at 4 months, sheep of any age, poultry in their early days of life, and pregnant mares are the principal hosts of salmonellosis.

Colostrum deposits are seen in the abomasum of young animals infected with *Salmonella* and *E. Coli* infections. Animals with the condition have enlarged, mucus-covered mucous membranes and blood-filled blood vessels [2].

In addition to having a disagreeable odor, gas bubbles in the intestines can occasionally include blood clots. The mucous membrane has hemorrhages that are punctate and spotted, and it is bloated and coated with mucus. The lymph nodes in the stomach are swollen. Bleeding is a sign of the septicotoxic character of the infectious process when discussing pathological alterations [4]. Changes in these organs are certainly worthy of consideration in pathological diagnosis. Organ changes are particularly exudative in character [3]. In this instance, the spleen grows and occasionally remains inside its bounds. If growths are present along the organ's margin, they are gluey-looking and rather spherical. There is bleeding beneath the smooth capsule. The sliced area is reddish-brown, dry, and has white lines all over it. Histological examination does not reveal an increase in lymphoid and reticular tissue components. When diagnosing salmonellosis and colibacteriosis in lambs, differences in pathological alterations in these organs should be considered since they are of varying relevance [5]. Dysbiosis and other digestive problems can produce toxic compounds that enter the circulation and cause overall body intoxication as well as organ and system malfunction, especially in the liver and kidneys [6].

3. Materials and Methods

The laboratory portion of our research is conducted in the "M.Ibragimov" Karakolchilik M.ch.j., Dehqonabad District, Kashkadarya Region, under production conditions, and at the Veterinary ITI (microbiology, pathomorphology, and research laboratories of diseases of young animals) in order to prevent and treat colibacteriosis and salmonellosis in lambs as well as to identify pathomorphological changes. completed at.

Using the social origin circumstances of the farm, 28 lambs naturally infected with salmonellosis and colibacteriosis were evaluated for treatment with hyperimmune blood serum and pathomorphological alterations.

The animals used in the trials underwent hematological, biochemical, serological (agglutination reaction), pathomorphological, and microbiological testing. The VITI Microbiology Laboratory developed antigens of Salmonella and E. Coli based on strains found locally for the serological (agglutination response) test. Hematological tests were conducted in the laboratory of young cattle illnesses, and pathomorphological alterations in lambs infected with E. Coli and salmonella pathogens under natural settings were carried out at the pathomorphology laboratory of VITI. The biochemical laboratory of the 1st Republic Scientific and Practical Hospital in Samarkand city assessed the findings of the hematological and biochemical examination of blood.

4. Results and Discussion

The accompanying tables (tables 1, 2, 3, 4, and 5) mostly provide the laboratory results of the conducted research. "GOA formalin vaccine against colibacteriosis and salmonellosis associated diseases of calves, lambs, and piglets" is administered to sheep and lambs raised at the LLC's Dehkhanob District "M.Ibragimov" specialist cattle breeding facility. Hematological analysis looks at hemoglobin levels, leukocyte and erythrocyte counts in the blood (Goryaev counting grid). A Sali hemometer was used to measure quantitative indicators, the refractometric method was used to measure biochemical indicators of total proteins in blood serum, the color reaction with ortho toluidine was used to determine the amount of glucose in the blood, and generally accepted methods were used for pathomorphological examination (on a 10x0.25 object of a Carl Zeiss microscope) [8].

For the experiment, the farm's lambs were split into two groups. Ten lambs in the first experimental group received a subcutaneous injection of the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" (1 ml) the first time, and then another 14 days later (2 ml) in accordance with aseptic and antiseptic guidelines. The "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" in an amount of 2 ml was administered subcutaneously to 10 lambs in experimental group II just once.

In experimental animals, epizootic occurrences were seen for nine months. Based on the agglutination response up to 30, 60, 90, 180, and 270 days, the experiment calculated the titer of antibodies in the blood serum of vaccinated lambs (Tables 1-2).

Table 1. Antibody titer dynamics against E.coli in the blood serum of vaccinated lambs (AP 1:25)

Groups	Numb er of heads	Until the experience	Days (after vaccination)				
			30 days	60 days	90 days	180 days	270 days
Experimental group I (vaccinated 2 times)	<i>n</i> =10	1:40	1:1240	1:1200	1:972	1:800	1:400
Experimental group II (vaccinated once)	<i>n</i> =10	1:60	1:600	1:720	1:800	1:600	1:270

In line with the current manual, 10 lambs in experimental group I received two doses of the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" based on the results of the agglutination reaction. Additionally, the dynamics of the E. coli antibody titer from the start of the experiment to nine months Based on statistical analysis, it was shown that the results after one and nine months declined by 2.22 ± 0.18 times, whereas the reduction was 0.2 times.

Table 2. Anti-Salmonella antibody titer dynamics in serum of vaccinated lambs (AP 1:25)

Groups	Numb er of heads	Until the experience	Days (after vaccination)				
			30 days	60 days	90 days	180 days	270 days
Experimental group I (vaccinated 2 times)	<i>n</i> =10	1:42,5	1:920	1:840	1:880	1:680	1:540
Experimental group II (vaccinated once)	<i>n</i> =10	1:50	1:470	1:620	1:667	1:533	1:333

As per the current manual, 10 lambs in experimental group I received two doses of the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" based on the results of the agglutination reaction. The dynamics of Salmonella antibody titer decreased by 1.703 ± 0.09 times between the start of the experiment and nine months. Since the lambs in experimental group II received this vaccine only once, it was statistically determined that the study's results at one and nine months decreased by 1.411 ± 0.1 times.

To ascertain the outcomes of hematological analyses after nine months, blood samples of lambs immunized with the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" were analyzed. In our research, hematological indicators of vaccinated lambs were checked. As a result of the tests, an

increase in the number of leukocytes and erythrocytes in the blood of vaccinated lambs, a relative change in leukoformula was noted (Table 3).

Table 3. Hematological parameters of the blood of lambs vaccinated against colibacteriosis and salmonellosis (n=10)

Checkout time	Erythrocyte, million/ μ l	Leukocyte, thousand/ μ l	Leukoformula					
			E	B	M	L	Neutrophils	
							rod nucleated	articular core
The norm	9,16 \pm 0,88	8,74 \pm 0,74	7,0	0,6	3,4	44,8	4,8 \pm 0,41	41,6 \pm 4,12
Experimental group I (vaccinated 2 times)								
30 кун	9,21 \pm 0,77	11,91 \pm 0,72	8,1	0,4	3,1	44,0	4,9 \pm 0,28	36,4 \pm 2,14
60 кун	8,85 \pm 0,54	10,82 \pm 0,71	6,9	0,3	3,0	47,0	4,7 \pm 0,39	33,2 \pm 3,16
90 кун	9,24 \pm 0,84	9,20 \pm 1,05	6,7	0,5	3,7	44,4	4,3 \pm 0,18	41,4 \pm 2,24
180 кун	9,21 \pm 0,78	8,28 \pm 1,04	6,2	0,5	3,4	46,2	4,7 \pm 0,44	42,0 \pm 2,41
270 кун	9,55 \pm 0,45	8,71 \pm 0,41	7,4	0,7	3,2	41,4	4,1 \pm 0,27	44,2 \pm 1,81
II experimental group (vaccinated 1 time)								
30 кун	9,18 \pm 0,28	11,62 \pm 0,41	7,4	0,4	2,2	44,2	4,8 \pm 0,31	35,4 \pm 1,87
60 кун	9,21 \pm 0,84	10,64 \pm 0,81	8,2	0,5	3,0	48,4	4,2 \pm 0,21	37,5 \pm 2,21
90 кун	9,20 \pm 0,85	8,74 \pm 0,89	8,0	0,4	3,2	41,1	4,6 \pm 0,38	36,4 \pm 3,21
180 кун	9,18 \pm 0,45	8,45 \pm 0,78	7,8	0,4	2,5	41,2	4,8 \pm 0,22	36,9 \pm 2,22
270 кун	9,24 \pm 0,85	8,41 \pm 0,56	7,9	0,5	3,2	40,9	3,8 \pm 0,18	38,5 \pm 2,52

All of the experiment's hematological changes were contrasted with the norm. To compare the leukoformula change at 30 days in eosinophils, lymphocytes, basophils, myelocytes, bacillus, and joints, and to find a partial decrease in nucleated neutrophils, experimental group I animals that received two doses of the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" were vaccinated twice. While leukocytes grew by 1.363 \pm 0.06 times relative to the average, erythrocytes remained almost unaltered. This suggests the immune system's humanitarian reaction and the entry of certain antibody types into the body. Animals of experimental group II that received a single vaccination with the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" showed alterations in their myelocytes and joint nuclear lymphocytes.

The effectiveness of the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" was tested in blood samples to ascertain the biochemical alterations that occurred. According to Table 4, the tests revealed variations in total protein and partial creatine in the blood of lambs vaccinated twice and once, respectively, in comparison to the default.

Table 4. Dynamics of biochemical parameters of blood of lambs vaccinated with GOA formalin vaccine against colibacteriosis and salmonellosis diseases

Indicators	Experimental group I (vaccinated twice)	II experimental group (vaccinated once)	Control group III
n=10 before experiment			
Albumin, g/l	29,16±1,13	32,36±0,82	28,84±0,607**
Total protein, g/l	66,28±5,10*	65,84±3,51	65,34±3,72
Urea, mmol/l	4,26±0,12	4,56±0,29	4,86±0,25
AlAt, E/l	58,14±3,26	61,93±1,82	76,58±3,49
Amylase, E/l	1659,31±18,51	1658,45±15,18	1648,62±21,19
Creatinine, µmol/l	78,24±4,24	65,72±4,25	89,39±4,58
n=10 on the 21st day of the experiment			
Albumin, g/l	29,78±3,16	31,49±2,34	29,51±2,55
Total protein, g/l	66,31±3,58	72,46±3,45	56,41±2,31
Urea, mmol/l	4,25±0,23	4,39±0,29	4,28±0,19
AlAt, E/l	58,14±3,41	61,46±2,16	56,34±3,44
Amylase, E/l	1645,84±18,71	1659,31±19,45	1645,56±13,84
Creatinine, µmol/l	71,8±2,74	69,78±5,74	81,19±2,28
n=10 after 14 days of the experiment			
Albumin, g/l	31,58±3,08	29,97±2,16	28,29±1,46
Total protein, g/l	69,06±4,19	72,48±2,54	58,86±2,58
Urea, mmol/l	5,78±0,36	4,49±0,608**	4,89±0,51
AlAt, E/l	61,54±3,24	65,12±2,58	69,49±4,11
Amylase, E/l	1616,24±16,02	1645,73±22,52	1641,45±28,75
Creatinine, µmol/l	66,72±3,79	72,93±3,419**	61,85±2,84
Note: *-p<0,05; **-p<0,001			

Table 4 shows the albumin and total proteins on the fourteenth day of the trial were 2.42±0.081 and 2.42±0.081, respectively, based on a biochemical study of the blood of group I lambs vaccinated twice with the GOA formalin vaccine against the illnesses salmonellosis and colibacteriosis. A 2.78±0.04 difference was discovered. This suggests that the recently discovered E. Coli and Salmonella antigens in lamb bodies are complex protein compounds.

The development of liver dystrophy would result from a reduction in total proteins in blood biochemical analyses. The liver hepatocytes' ability to synthesize proteins was diminished when the amount of albumins decreased.

The first group of lambs, who received two doses of the GOA formalin vaccine to protect them from salmonellosis and colibacteriosis, had lower blood serum urea levels, but the control group's levels stayed same.

The results of our investigation showed that there was a significant rise in creatinine of 72.93±3.419 µmol/l and an increase in urea of 5.78±0.36 mmol/l (P<0.05).

Lambs of the first group, vaccinated twice with the GOA formal vaccine against colibacteriosis and salmonellosis diseases, had an increase in the biochemical composition

of their blood by -13.47 U/l in amylase enzyme and -3.28 U/l in alanine aminotransferase (ALAT) enzyme compared to lambs of the second group, vaccinated once with the GOA formal vaccine against colibacteriosis and salmonellosis diseases. In this case, the function of the enzymes is unaltered despite hepatocyte destruction. It suggests that the lambs in the control group did not exhibit any changes in the activity of the enzyme amylase, which is involved in the metabolism of carbohydrates.

Hence, lambs that receive two doses of the GOA formalin vaccine to prevent colibacteriosis and salmonellosis are guaranteed to have all biochemical indicators of their blood within the physiological range, enhancing their immune system. In the event that the mobodo contracts colibacteriosis or salmonellosis, the illness will be mild and all physiological indicators will return to normal quickly.

The "M.Ibragimov" cattle breeding firm farm's lambs infected with *E. coli* and salmonella infections under natural settings had their pathomorphological modifications analyzed using pathologoanatomical and histological procedures in accordance with the personnel of the VITI pathomorphological laboratory. Pathogistological examination of the internal organs of lambs often reveals the most notable alterations in the parenchymatous organs, which are characterized by the robust development of hemodynamic and dystrophic processes.

In comparison to the first group, there are more histiocyte, lymphoid, and leukocyte cell clusters around certain cardiovascular arteries, dilated cardiovascular vessels, swelling vascular wall cells, and displaced endothelium. It was discovered that the muscles were made up of fibers, and that some of these fibers had granular dystrophy.

Strong development of hemorrhagic necrotizing pneumonia was also observed in the lungs. The majority of alveolar gaps contain erythrocytes. The blood-filled, enlarged interalveolar capillary networks cause the barriers to thicken and the connective tissue fibers to swell. These alterations caused atelectasis in 1/8 of the lung parenchyma. Under a clear microscope, interstitial tissue swelling was seen in every area of the lung. The core of the necrotic foci that occur in the liver is made up of chromatin granules and cell debris. These foci are frequently seen next to major blood arteries. Histiocyte, neutrophilic, and lymphoid leukocytes around necrotic foci. Hemodynamic and dystrophic alterations were also seen.

The spleen underwent pharmacological alterations manifested as vascular fullness, reduced trabeculae enlargement, and a lack of clarity about the appearance of fibers. There is an increase in the red pulp's boundary. Certain areas showed lymphoid aggregates and little hemorrhages. The overall pathological process occurring in the organism is responsible for these alterations.

Different lymph nodes have different histological alterations. In the trials, serous edema, serous-hemorrhagic lymphodenitis, and extravasates of various sizes formed in the nodes between the portal, intestinal mesentery, and lung wall. These nodes showed noticeable alterations. Apart from hemorrhages in the lymph nodes around the areas of the lungs with significant disease processes, it was discovered that lymphocyte and leukocyte collections filled the sinuses, the follicles became larger, and the lymphocyte count rose.

The majority of the pathological alterations that affect the kidneys are caused by general diseased processes. Hemodynamic, granular, and occasionally fatty deformation of the renal tubule epithelium are the common characteristics of these processes. Under a microscope, only clusters of erythrocytes can be seen due to the kidney balls' capillary nets expanding. The expanded capsules enclosing the balls are packed with fibrinous exudate. Rhexis and lysis have occurred in the cores of epithelial cells.

In the stomach and intestines, *E. coli* toxins primarily impact these organs due to significant and complicated histological alterations. This includes dystrophic and wound-necrotic processes in the mucous membranes of the stomach and intestines, as well as serous-catarrhal and catarrhal-hemorrhagic inflammations.

Massive desquamative patches that have moved make up the cuticle layers of the pregastric regions. There were signs of lysis, rhexis, nuclear pyknosis, and poorly stained cytoplasm in epithelial cells. The evolution of generic necrobiotic processes is indicated by these modifications. In addition to many hemorrhages, a lot of mucus production, and dystrophic digestive glands, it was seen that the stomach's mucous membrane was desquamated.

Solitary follicles in mesenteric lymph nodes and more profound alterations in peer tissue are the primary ways that pathohistological alterations in the intestines are displayed. There are several foci of point hemorrhages, the nodes are enlarged, and some of them have necrobiotic and necrotic core sections.

The co-occurrence of salmonellosis and colibacteriosis results in distinct alterations to the organism in tiny animals with horns. Specifically, from 3 days to 120 days, there are significant and intricate alterations in the hemodynamic and dystrophic processes in different organs of lambs.

The effectiveness of treatment with "Hyperimmune blood serum against colibacteriosis and salmonellosis of young animals" was compared with several types of antibiotic drugs, and scientific and practical research was conducted on 28 lambs on the farm that were naturally affected by colibacteriosis and salmonellosis.

The 14 heads of infected lambs were split into two groups for the experiment. The "Hyperimmune blood serum against colibacteriosis and salmonellosis of young animals" that was made at the VITI microbiology lab using local strains was administered to Group I. In experimental group II, 14 head lambs received the following antibiotic treatments: gentamicin sulfate, penstrip-400, farmostar, doxylox, nitox, tiful, enroflox, and amoxicillin (Table 5).

Each type of antibiotic treatment was distributed to 2 lambs naturally infected with colibacteriosis and salmonellosis.

Table 5. Effectiveness of treatment of lambs naturally infected with colibacteriosis and salmonellosis with hyperimmune blood serum and antibiotic drugs

Groups	healing agent	observation days										place of dispatch	Result	efficiency %
		1	2	3	4	5	6	7	8	9	10			
Experimental group I, 14 heads	Hyperimmune blood serum against colibacteriosis and salmonellosis	K	K	T	T	T	T	T	T	T	T	under the skin	1 head did not recover	92
	Amoxicillin	K	K	T	T	T	T	T	T	T	K	between the muscles	3 heads did not recover	
II experimental group, 14 heads	penstrip-400	K	K	K	K	T	T	T	T	K	K			
	pharmacist	K	K	T	T	T	T	T	T	K	K			
	doxilox	K	K	T	T	T	T	T	T	T	K			
	nitox	K	K	K	K	K	K	K	K	K	K			
	enroflox	K	K	T	T	T	T	T	T	K	K			
	gentamicin	K	K	K	K	K	K	K	K	K				
	typhoid	K	K	T	T	T	T	T	T	K	K			

Note: K-sick, T-recovered

Table 5 shows that "Hyperimmune blood serum against colibacteriosis and salmonellosis of young animals" was administered to the animals in experimental group I. As directed, 1 ml of blood serum every 3-5 kg of live weight was administered subcutaneously twice a day to treat 14 lambs who were naturally afflicted with various illnesses. Results of therapy with hyperimmune blood serum showed that 92% of lambs with combined salmonellosis and colibacteriosis were healed.

On the eighth and tenth days of the experiment, blood samples from lambs recovered from combined infections of colibacteriosis and salmonellosis were examined for AR titer, with an average of n=14. This signifies the emergence of basic immunity inside the organism. Although they were ill during the first several days of therapy with seven different types of antibiotics per special instructions, the animals in experimental group II received treatment with amoxicillin, farmostar, doxylox, and enrofloks. In spite of this, the lambs began to exhibit clinical symptoms of salmonellosis and colibacteriosis on days nine and ten of the observation period. Follow-up days revealed that recovery was postponed in those treated with penstrip-400, nitox, and gentamicin sulfate, among other antibiotic kinds. These patients did not show signs of recovery. The experimental animals had diarrhea, medication withdrawal, elevated body temperature (+40.5-+410C), heart rate, and respiration on the third and fourth days of observation. There were hemorrhages (partly dotted and mainly spotted) on the mucous membranes of the eyes, their beaks were dry, and the ill lambs were feeble and merely laid down.

5. Conclusion

- 1) At nine months of age, the body's anti-salmonella titer in lambs immunized as directed with the GOA formalin vaccine against colibacteriosis and salmonellosis in calves, lambs, and piglets is 1:540; in lambs immunized with this vaccine only once, the anti-titer was found to be as high as 1:333.
- 2) Colibacteriosis in lambs aged 5 to 30 days was discovered to cause swollen lungs, blood vessel stagnation, point hemorrhage in the spleen and under the kidney capsule, necrotic foci in the liver and its margins, a significant build-up of pus in the spleen pulp, and hyperemia.
- 3) Under natural settings, a combined infection of salmonellosis and colibacteriosis resulted in a damage rate of $y=65.5\pm 0.42\%$ and a death rate of $y=46.18\pm 0.56\%$.
- 4) 1.157 ± 0.04 eosinophils over the course of the experiment because lambs given the "GOA formalin vaccine against colibacteriosis and salmonellosis diseases of calves, lambs, and piglets" twice had the same type of antibodies introduced into their bodies. Additionally, based on the immune system's humanitarian response, leukocytes increased by 1.363 ± 0.06 times.
- 5) In the event of a combined colibacteriosis and salmonellosis infection, 92% of the sick lambs were successfully treated with hyperimmune blood serum; the blood serum of the recovered lambs had an AR titer of $n=14$ (average) 1:564.
- 6) The antibiotic sensitivity of Salmonella and E. Coli pathogens was determined. It was discovered that these pathogens are less susceptible to gentamicin sulfates, nitox, sefur, and penstrip-400, and more sensitive to amoxicillin, farmostar, doxylox, and enrofloks.
- 7) In the event of a combination colibacteriosis and salmonellosis infection, based on biochemical alterations in the blood of the afflicted lambs

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