The influence of drugs containing polyhydroxy acids on metabolic processes and physiological vital signs of rabbits

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Abstract. The work is devoted to the use of polyhydroxy acids with antioxidant properties in rabbit breeding. The authors examined the effect of gluconolactone, used in the diet of animals, on metabolic processes and physiological indicators of the vital functions of rabbits. To raise healthy rabbits with high meat quality, balanced feeding is necessary. When there is an imbalance in feed rations, animals get sick more often and gain body weight more slowly. Rabbits, like other animals, can obtain antioxidants from plant foods, but their concentration may not be sufficient to provide full protection against oxidative stress. To stabilize feed rations, various biologically active additives are used to increase the efficiency of raising animals and improve productivity indicators. Based on the studies conducted (using the example of gluconolactone), the authors showed the therapeutic significance and feasibility of including supplements containing polyhydroxy acids in the diet of rabbits.

1 Introduction

Breeding rabbits in modern agriculture is a fairly promising area of animal husbandry. Rabbit meat has many beneficial properties and is considered a dietary food product, recommended, among other things, for children's menus due to its hypoallergenicity and easy absorption by the body. Thus, rabbit breeding occupies an important place in the structure of agricultural production and has a fairly high demand for products. [13].

As is known, qualitative and quantitative indicators of rabbit productivity depend on complete and balanced feeding. At the same time, an important factor is not only the correct combination of nutritional components, but also the feeding regimen [7].

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The relevance of the study lies in the fact that to raise healthy rabbits with high meat quality indicators, balanced feeding is necessary. When there is an imbalance in feed rations, animals get sick more often and gain body weight more slowly.

Rabbits, like other animals, can obtain antioxidants from plant foods, but their concentration may not be sufficient to provide full protection against oxidative stress. To stabilize feed rations, various biologically active additives are used to increase the efficiency of raising animals and improve productivity indicators. [6].

There are a number of studies [2, 7] confirming the effectiveness of the use of polyhydroxy acids in animal feed rations, including rabbits. However, it must be taken into account that the choice and dosage of antioxidants must be optimal in order to strengthen the animal’s body and improve the quality of the resulting meat products.

In view of this, the use of polyhydroxy acids as dietary supplements is a promising area of research. Polyhydroxy acids, which are antioxidants, when regularly administered with food, help to increase the overall resistance of the body, stimulate the growth and healthy development of animals, which in turn leads to the production of high-quality agricultural products. [8].

2 Materials and Methods

The object of the study is the drug “Gluconolactone E575 Roquette SG”.

The subject of the study is the effect of gluconolactone on metabolic processes and physiological vital signs of rabbits.

The purpose of the study is to evaluate the effectiveness of the use of the drug “Gluconolactone E575 Roquette SG” in rabbit breeding.

The effectiveness of the drug was assessed by monitoring hematological blood parameters and the dynamics of live weight of rabbits.

The studies were conducted in a private rabbit farm (Ryazan region, Ryazan district, Zubenki village).

For experimental studies, we selected analogous animals in the amount of twenty heads. Healthy male rabbits were selected according to the following parameters:
- breed: chinchilla;
- age: 30 days;
- weight: 1 kg (+/- 100 g);
- medical history: not burdened by taking medications.

After a medical examination and control weighing, the rabbits were divided into two groups of ten heads - control and experimental (experimental).

The experimental period was 3 months: from June 2022 to August 2022.

The rabbits of the experimental and control groups were kept in the same conditions, characteristic of the climatic conditions of the Ryazan region in the summer: two-tier sheds were installed in the fresh air under a canopy opposite each other, each rabbit was allocated an individual cage, which was regularly cleaned and put away. The choice of shed housing for rabbits was due to the fact that a fairly warm climate and fresh air in the summer are conducive to the growth and development of animals.

The basis of the diet of animals in both groups was compiled identically based on the standards and recommendations contained in GOST 34088-2017 “Guide to the maintenance and care of laboratory animals. Rules for keeping and caring for farm animals” [1].

The rabbits' diet was formulated according to their age, weight, health status and physiological needs. The diet was based on complete granulated feed, grain and high-protein grasses (alfalfa and clover).

The only difference in nutrition was that the rabbits of the experimental group were given the biologically active additive “Gluconolactone E575 Roquette SG” as a supplement. The
drug is a white powder that easily dissolves in water. Thus, the rabbits of the experimental group received gluconolactone twice a day during morning and evening feeding at a dosage of 250 mg/kg. The rabbits of the control group did not receive any supplements.

Weight dynamics were monitored by control weighing on key dates: June 1 (beginning of experimental work), July 1, August 1 and September 1 (end of experimental work) 2022.

The dynamics of hematological parameters were monitored by weekly sampling into an IMPROMINI EDTA K3 tube with a volume of 0.2-0.5 ml and the study of general blood test parameters using the Mindray BC-2800vet device in the conditions of the 9 Lives veterinary laboratory (LLC “Veterinary Medicine”). The throughput of the “Mindray BC-2800vet” analyzer is 30 studies per hour. Manufacturer: “Mindray”, official importer: LLC “Zoomed”.

The device is suitable for testing the blood of various animals, including rabbits. The analyzer has three free positions for performing a general clinical blood test. For each animal species, its own standards for each studied parameter are determined. The analyzer's general standards are common to all ages and breeds, and therefore, when deciphering indicators, it is recommended to rely on the standards given in the program's analysis forms.

Digital data obtained during the research were statistically processed using Student methods.

3 Results

The composition of the drug “Gluconolactone E575 Roquette SG” includes gluconolactone, which is an antioxidant. Gluconolactone is one of the most common polyhydroxy acids (PHA) in modern medicine. The mechanism of action of polyhydroxy acids is similar to the chemical activity of alpha hydroxy acids (AHA). For example, gluconolactone is as soluble in water as lactic acid, but has a larger molecule size, which allows it to provide a much milder and hypoallergenic effect on the body. Thus, polyhydroxy acids, in particular gluconolactone, are well suited for sensitive animals that require the most careful rearing [9].

The results obtained during the use of the drug “Gluconolactone E575 Roquette SG” as a food additive led to the conclusion that in rabbits of the experimental group, blood parameters at the end of the experimental period underwent minimal changes associated with normal age-related changes in animals, while in rabbits in the control group there was an increase in the level of leukocytes with a shift in the leukocyte formula to the left.

The results of experimental studies of a general blood test, obtained by us during the experiment, are presented in the Figures 1-7.
Figure 1 shows a comparative graph of changes in leukocytes in the general blood test for the entire experimental period, which clearly shows the difference between the level of leukocytes in the control and experimental groups.

Analysis of the figure allows us to conclude that in the control group the level of leukocytes increased by the end of the experimental period, which indicates the likelihood of inflammatory processes in the animals’ bodies.

Presumably, the negative trends in the dynamics of blood parameters in the control group occurred due to a sharp decrease in ambient temperature during the period of the experiments. As a result of hypothermia, the animals had a decrease in the level of immune defense, which could lead to the emergence and development of an infectious disease with subsequent inflammatory processes in the body of rabbits in the control group.
As can be seen from Figure 2, in the rabbits of the experimental group the level of lymphocytes was within normal limits throughout the entire experimental period, and in the rabbits of the control group, after August 10, the number of lymphocytes in the blood began to sharply decrease, which may indicate a drop in immune defense as a result of the fight with a bacterial infection (the possibility of a viral infection must be excluded, since with a viral infection the number of lymphocytes increases). To clarify the clinical picture, consider other blood parameters obtained as a result of the experiment.

Fig. 3. Dynamics of changes in hematological blood parameters (Monocytes (MON), abs. *10^9/L)
As can be seen from Figure 3, in rabbits of the control group there is an increase in the number of monocytes, which, along with an increase in the number of granulocytes (Figure 4), indicates an infectious process.

**Fig. 4.** Dynamics of changes in hematological blood parameters (Granulocytes (GRAN), abs. *10⁹/L)

Under experimental conditions, other indicators of the general blood test were also analyzed, presented in Figures 5-7.

**Fig. 5.** Dynamics of changes in hematological blood parameters (Erythrocytes (RBC), abs. *10¹²/L)
As can be seen from Figure 5, the content of erythrocytes in the blood of rabbits in the control group decreased by the end of the period. The dynamics of hemoglobin indicators also reflects a downward trend (Figure 6).

![Fig. 6. Dynamics of changes in hematological blood parameters (Hemoglobin (HGB), g/L)](image)

The dynamics of platelets in the rabbits of the experimental group was generally within normal limits. In the rabbits of the control group, platelet dynamics have some negative deviations and complement the overall picture of the animals’ blood analysis, also indicating the likelihood of an infectious disease (Figure 7).

![Fig. 7. Dynamics of changes in hematological blood parameters (Platelets (PLT), abs. *10^9/L)](image)
Analysis of the obtained experimental data forced us to pay attention to the fact that the negative trends in the dynamics of blood parameters in the control group occurred due to a sharp decrease in ambient temperature during the period of the experiments. As a result of hypothermia, negative changes affected indicators such as leukocytes, erythrocytes and platelets, which was directly related to the ongoing inflammatory processes in the body of the control group rabbits.

Based on the test results, a preliminary diagnosis was made - a bacterial infection. An autopsy of the dead animals showed that death was due to acute renal failure.

Thus, as a result of hypothermia, some animals in the control group developed a bacterial infection, which complicated the urinary system, which led to death from renal failure.

The hematological parameters of the rabbits in the experimental group remained within normal limits throughout the entire duration of the experiment under similar housing conditions and the composition of the basic diet for rabbits in both groups.

Thus, enriching the food ration of experimental group rabbits with gluconolactone, which belongs to the group of polyhydroxy acids and has antioxidant properties, helped strengthen the animals’ immune system.

Also, the introduction of gluconolactone into the diet had a positive effect on the increase in live weight of rabbits in the experimental group (Figure 8).

![Fig. 8. Dynamics of body weight growth in rabbits](image-url)

At the beginning of the experimental period, control weighing of the experimental animals was carried out. The live weight of one-month-old rabbits at the time of experimentation varied from 0,9 kg to 1,2 kg. The body weight of the rabbits in the experimental group averaged 0,9-1,0 kg, while in the control group the weight varied between 0,9-1,2 kg. The mass difference was no more than 1%, which corresponds to the experimental conditions with analogous animals.

During the experimental period, the rabbits of the experimental group gained live weight more actively than the rabbits of the control group. At the final weighing at the end of the experiment (09.01.2022), the average weight of the rabbits in the experimental group was higher and amounted to 3,8-4,1 kg, while in the control group the same figure varied between 3,6-3,8 kg.

Thus, enriching the rabbits’ diet with gluconolactone contributed to a more active gain of body weight in the rabbits of the experimental group relative to the control group.
4 Discussion

Issues related to the effectiveness of the use of antioxidants were considered in the works of such Russian authors as: D.D. Adzhiev, G.Yu. Maltsev, S.A. Rumyantsev, E.N. Malyarenko, N.F. Zatorskaya [2]. The use of gluconolactone as a dietary supplement with a pronounced antioxidant effect is reflected in the works of such authors as: V. V. Kulakov, E. O. Saikhanov, A. V. Koyudenko [7].

The positive effects of antioxidants on blood counts and the body of rabbits as a whole are discussed in the works of such authors as: N.F. Hassan [1], M. Shiomori, H. Takeda, Y. Irino [12], A.S. Ansari, A. Badar, N.K. Lohiya [3], M. Saadia, M. Sher, S. Bashir [11] and all.

5 Conclusion

The results obtained from a study of the dynamics of hematological blood parameters in the control and experimental groups allowed us to conclude that the drug “Gluconolactone E575 Roquette SG” has a positive effect on the immune system and the general resistance of the rabbits’ body, even under the influence of unfavorable environmental factors in the form of a decrease in ambient temperature.

This is due to the fact that gluconolactone is a natural antioxidant and has the ability to bind and neutralize oxidation products directly in the blood of animals, which increased the resistance of the rabbits’ body and had a positive general strengthening effect on the immune system.

Also, enrichment of the feed ration with gluconolactone contributed to a more active gain of body weight in rabbits of the experimental group relative to the control group. Animals in the experimental group were more willing to eat enriched feed due to improved taste. Thus, the inclusion of the dietary supplement “Gluconolactone E575 Roquette SG” in the diet of rabbits helps to strengthen the immune system, increase the growth rate and increase the live weight of rabbits, which is most likely due to an improvement in metabolic processes due to an increase in the activity of the antioxidant system of the animal body.

References

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