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*Original Research Article*

# The Effect of Cadmium Salt on Osmotic Endurance of Erythrocytes in Rabbit Blood

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**ABSTRACT:**
This article presents literature materials on the study of the effects of heavy metal salts on the animal organism and the environment in which they live. The presented information was obtained in the scientific research conducted in the conditions of foreign countries, and we presented it with the assumption that it can be used by our researchers in the implementation of the work planned to be carried out in the extreme conditions of Uzbekistan, and in the prevention of negative situations that have arisen in the animal organism, as well as in the correction of some metabolic processes. Because salts of heavy metals have a negative effect on the animal body and are manifested in the form of disruption of digestive functions and neurovegetative processes, rapid failure of the heart, increased occurrence of diseases in the heart and blood vessels, deterioration of calcium metabolism, decrease in the quantity of livestock products and deterioration in quality, we have given information from the literature that it is one of the main factors.

**Keywords:** Erythrocytes, Membrane, Osmotic Endurance, Organism, Nutrients, Environment, Diseases, Salts Of Heavy Metals, Mercury, Cadmium, Lead, Poisoning.

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## INTRODUCTION

Heavy metals in water and soil accumulate in plants and serve as the main source of heavy metal poisoning of human and animal bodies. Heavy metals also accumulate in fat, muscle tissue and milk of animals. Eating such foods is becoming a very serious threat to human health (Dzhugkoeva F.S. et al., 2011).

Among chronic poisonings, poisoning with heavy metal salts occupies one of the main places. Heavy metals include elements with a density greater than 5g/cm3, an atomic weight between 63,546 and 200,509, and a specific

gravity greater than 4.0. The most common of them are mercury, copper, cadmium, gold, iron, lead, antimony and others. They occur naturally in the earth's crust. It also includes organic and inorganic compounds of industry, agricultural herbicides and medicines. The effect of heavy metal salts on certain physiological processes in the body of farm animals has been studied by several scientists.

Heavy metals (including lead and cadmium) and their compounds are widely distributed and have the ability to accumulate in all living organisms, forming a series of highly toxic substances. Salts of heavy metals interact with biological components of cells and seriously affect the functions of the body. Inhibition of enzymes and irreversible conformational changes of macromolecules can lead to changes in a number of metabolic processes. Nowadays, it is well known that the environment is being polluted on a large scale by harmful and toxic substances. They are present in the air, in the water we drink, in the food we eat, in the soil, and are usually collected by the roots of plants, and they are among the active participants in the cycle of substances in nature. Therefore, we find them everywhere, even in the food we eat. Therefore, it is important to study the concentration of heavy metals in animals.

The respiratory tract and gastrointestinal tract allow large amounts of heavy metal compounds to enter the circulation, as heavy metal salts are reabsorbed into the circulating blood. Cadmium salts circulate in the circulating blood combined with α-2-macroglobulin and albumin of erythrocytes.

In addition to having a toxic effect on the central nervous system, mercury can cause emotional impatience by causing tachycardia, memory impairment, insomnia, apathy and paranoia. People feel constantly tired, get tired very quickly, can't concentrate and become irritable. They may be bothered by constant headaches (Gizatullin R.R, 2007; Dobranić T et al., 2004; Bersényi A.et al., 2003).

Humanity should henceforth have constant information about the amount of these metals in the environment and food. Contamination of meat and other animal products with heavy metals is a major concern for food safety and human health, as some of these heavy metals are toxic even at relatively low concentrations. (Charles Milam, et al., 2017).

Metals such as iron, copper, zinc, molybdenum in small amounts participate in the biological processes of plants, humans and animals, and serve as necessary components that play an important physiological role. They participate in the processes of photosynthesis and nitrogen assimilation of plants and ensure the balance of synthesis of sugar, proteins, and starches (Ilyazov R.G., et al., 2006).

Heavy metals and their compounds cause various diseases and have harmful and toxic effects on the human body.

Certain metals can accumulate in certain organs and tissues over a long period of time, of which lead, cadmium, arsenic and mercury usually form a group of highly dangerous substances. Lead usually accumulates in the bones, causing them to slowly decay and accumulate in the liver and kidneys. Lead can cause people to lose their ability to work, lose their memory, and even cause chronic brain diseases

As a result of the daily development of industrial enterprises, the amount of polluting waste is increasing, 25-50% of the environmental factors that have a negative effect on human health today correspond to the share of the above polluting waste (A.N. Aralbaeva, 2019).

An excess of cadmium in the body can cause anemia, liver damage, lung dysfunction, osteoporosis, skeletal deformities, and hypertensive conditions. Cadmium usually accumulates in the kidneys and can cause the formation of stones in its nephrons (Sizentsov A.N., et al., 2018).

Based on the above, the main task of this presented article is to determine the level of pollution of the surrounding nutrient plants, water and atmospheric air with heavy metal salts, the effects of the salts consumed in the food consumed by animals on the animal body, the gastrointestinal system, their activity and in

order to prevent negative effects on productivity and in order to prevent salt poisoning of the animal body, it is planned to convey to the students what kind of tests (in blood and lymph) can be used to control the health of animals during the preventive measures carried out in medicine and veterinary medicine. In addition, it was necessary to explain the need to study the composition of foods obtained from pastures and cultivated areas in the field, and how many toxic substances are contained in the food products obtained from them. We found it appropriate to bring to the attention of master's and doctoral students which organs and tissues are sampled for these laboratory analyses.

Currently, the attention of researchers is focused on the study of the effects of heavy metal salts on human and animal organisms, which can be explained by the fact that the biological membranes of the body are highly dependent on the effects of heavy metal salts.

Heavy metals such as lead and cadmium are among the most toxic trace elements. The main source of environmental pollution with cadmium and lead compounds is metal and rubber waste and gases released from industry and automobiles. Heavy metals can enter the human body during production of galvanic cells, metal dilution, accumulators and batteries, mineral fertilizers, tobacco and paint products, and they can enter the animal body while feeding on pastures around large industrial centers and major highways (Bernhoft R.A., 2013).

The mechanism of the toxic effect of cadmium is explained by the fact that it binds to itself all the sulfur-containing amino acids and enzymes in the blood, injuring the cytoplasm and nuclei of cells (Boytler E, 1981).

According to G.A. Teplaya [2013], kidneys (50%), liver (15%), muscles (20%) are the main organs of cadmium accumulation, and they are damaged by an increase in the percentage of metal compounds. In addition, it causes damage to the central nervous system, a violation of phosphorus-calcium exchange in the body, which leads to bone fractures, and the development of anemia. Cadmium salt poisoning is usually acute and can be chronic. The clinic of acute poisoning is characterized by headache, dizziness, nausea (nausea, vomiting), pallor of the skin, and the sensation of a certain level of sweet taste in the mouth. Chronic poisoning, in turn, is characterized by a decrease or loss of smell, cadmium parkinsonism, hypothalamic syndromes of vegetative disorders, etc (Teplaya, G.A., 2013).

M.O. Trusevich, after studying the effects of various heavy metal salts with a final concentration of 0.008 to 1 mM on red blood cells, concluded that any concentration of heavy metals above 0.008 mM has a toxic effect on the durability of the erythrocyte membrane (Nabivach V.M., Sukhoi M.P., 2010).

The integrity of the erythrocyte membrane in the blood can be affected by various factors of the external environment and change its morpho-functional characteristics. The so-called natural endurace of erythrocytes, that is, their endurance to the effects of the external environment, depends primarily on the age of the blood-forming elements, and may decrease as their age approaches the transition period. This reduction of erythrocyte endurance to a minimum level leads to their hemolysis. An indicator of this condition is the release of hemoglobin from the erythrocyte. The duration of the onset of hemolysis is the main parameter for assessing the durability of cell membranes (Shafran L.M., Pykhteeva E.G., 2011).

Based on the above, we can conclude that ions of heavy metal salts have a negative effect as a factor that ensures high permeability of cell membranes of erythrocytes. It is important to check the endurance of animal blood erythrocytes to hypotonic solutions of table salt in different concentrations in pasture breeding and in the conditions of complex breeding of animals on an industrial basis.

**THE PURPOSE OF STUDY**

The purpose of this study was to study the effect of various cadmium salts (chlorine, acetate and sulfate) added to the diet of industrial rabbits on the osmotic endurance of the erythrocyte membrane in the blood.

Therefore, in order to prevent and identify the negative effects of heavy metal salt ions, it is advisable to carry out tests to study the changes in the permeability of blood cell membranes when they are transferred to new conditions from time to time, when the composition of the rations is changed. Because the composition of food consumed by industrial rabbits is constantly increased according to their live mass, physiological condition, amount of daily growth and sex. Therefore, naturally, after each change in the composition of the ration, it is necessary to carry out experimental analytical experiments in the above order. While the changes in the composition of the diet are determined based on the study of the chemical composition of food, the amount of chlorinated, acetate and sulfate salts of cadmium in the food is not determined. One of the methods of evaluating the physico-chemical properties of blood cell membranes is to study the osmotic endurance of erythrocyte cells. Based on the above, it was studied which of the listed salts have a negative effect on the osmotic endurance of erythrocyte cells.

## MATERIALS AND METHODS

Determination of osmotic endurance of blood of rabbits was carried out according to the unified method modified by (L.I. IdelsonIdelson L.I., Kassirsky M.A., 1970). The main content of this method is to quantitatively determine the degree of hemolysis of erythrocytes in post-buffer hypotonic solutions of table salt. As a hemolyzing solution, we used a NaCl solution with an osmotic concentration equal to 10% of table salt. Tests were performed on freshly obtained and incubated blood samples. The main reason for using an incubated blood sample in testing is that, according to the literature, a decrease in the osmotic endurance of erythrocytes can be determined only in incubated blood samples (Warm G.A., 2013).

Working concentration by dilution from the main solution: 0.85%, 0.75%, 0.70%, 0.65%, 0.60%, 0.55%, 0.50%, 0.45%, 0.40 %, 0.35%, 0.30%, 0.20%, 0.1% table salt solutions were prepared. We obtained cadmium salt with a concentration equal to 0.001 mM/ml. To determine the optical density of solutions, we used a photoelectrocolorimeter with a wavelength of 500-550 nm (with a green light filter) and a layer thickness of 10 mm. After calculating the obtained data, we tried to explain them in the form of graphs. We present indicators of changes in the level of hemolysis of erythrocytes in the blood of rabbits depending on the concentration of a hypotonic solution of NaCl.

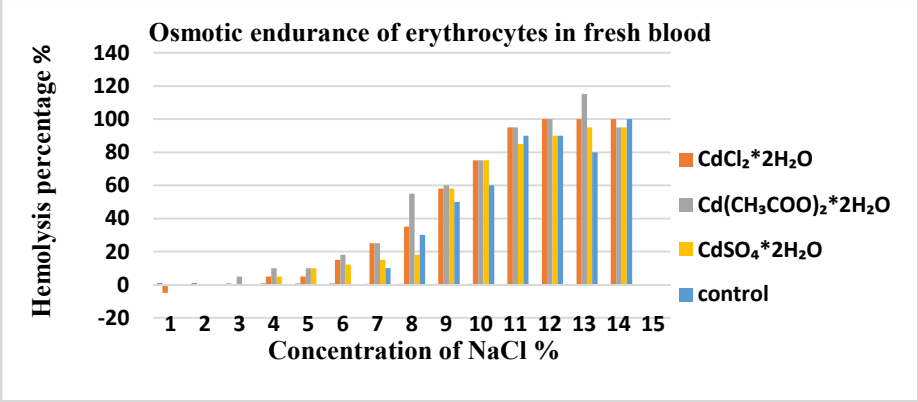


**Figure 1:** Osmotic endurance of erythrocytes in fresh blood under the influence of cadmium salts

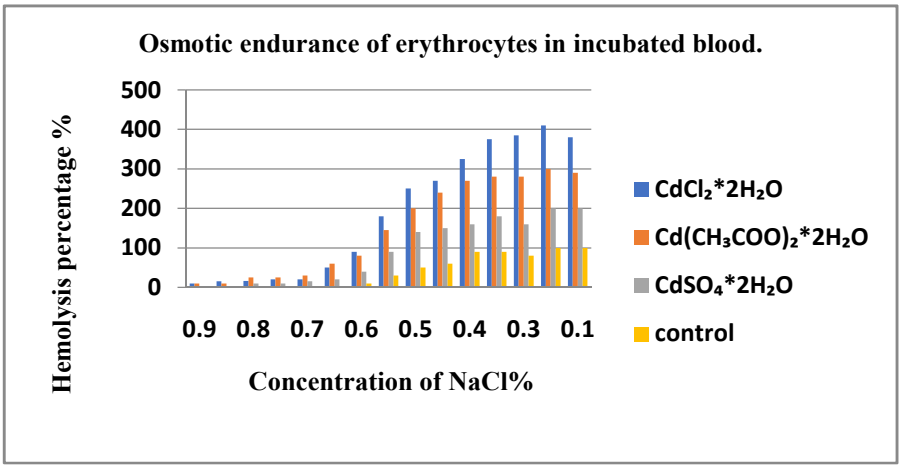


**Figure 2:** Osmotic endurance of erythrocytes in blood incubated under the influence of cadmium salts

## RESULTS AND DISCUSSION

We took the degree of hemolysis of the blood sample stored in a test tube in a 0.1% table salt solution of sodium chloride as 100%, and this period is 8 minutes. The effect of cadmium acetate salt on the osmotic endurance of freshly collected blood samples. According to the data presented in Figure 1, blood in a test tube with a 0.3% concentration of sodium chloride solution was observed to undergo complete hemolysis under the influence of cadmium acetate salt. This indicates that this salt has a weak effect on the osmotic endurance of erythrocytes in freshly collected blood. Other cadmium salts showed no effect on the osmotic endurance of erythrocytes compared to the control group. During our investigations on the effect of various salts of the cadmium element (acetate, chloride and cadmium oxide) on the osmotic endurance of the outer membrane of erythrocytes, 1.5 ml of physiological solution and 0.002 N solution of NaCl acid were added to one cuvette and 0.7 ml 1% of erythrocyte suspension to both cuvettes. In addition, cadmium salts with a concentration equal to 1mM were added to both experimental samples. Then, every 10-30 seconds until the end of hemolysis, we measured the optical density of the size of erythrocytes in a cuvette with a wavelength of 680 nm of a photoelectrocolorimeter. The processes taking place in the experimental samples are the first - we carried out all calculations on the method of studying the erythrogam of acidic substances compared to the control sample.

When erythrocytes were exposed to cadmium acetate, hemolytic processes were completed in 1.5 minutes, which was 6.5 minutes faster than normal. The fastest hemolysis time of erythrocytes is observed in 30 and 60 seconds after the start of hemolysis and consists of 11 and 10%, respectively. In the sample with added cadmium sulfate, 100% hemolysis of erythrocytes was observed after 5 minutes, and this indicator was accelerated by 3 minutes compared to the control sample. In this sample, the highest indicator of hemolysis of erythrocytes corresponded to 20 seconds, 33.5% of erythrocytes, and the lowest, 1.3% hemolysis corresponded to 180 and 210 seconds.

When erythrocytes were exposed to cadmium oxide, the maximum level of hemolysis was reached after 8.5 minutes, which was found to be 0.5 minutes longer than that in the control sample. The time of the highest acceleration of hemolysis indicators corresponded to the interval from 20 to 60 seconds, and during this period 40% of erythrocytes underwent hemolysis. The lowest level of hemolysis occurred between 360 and 480 seconds.

In the cadmium chloride sample, 100% hemolysis was complete 9.5 minutes after exposure, 1.5 minutes later than in the control sample. The highest hemolysis (1.3 times) was

observed in the 30th second after the start of observations.

As a result of the analysis of the data presented in Figure 2, it was concluded that cadmium acetate has the highest toxicity, since 100% hemolysis of erythrocytes was completed 6.5 minutes earlier than in the control sample. It was found that chloride and oxide salts of cadmium are the salts that have a low toxicity effect on the endurance of the erythrocyte membrane to the effects of acidic effects, that is, when exposed to the above salts, hemolysis of erythrocytes in the experimental sample took place much later than in the control sample.

Incubated blood erythrocytes were shown to cause complete hemolysis under the influence of chloride, acetate and sulfate salts of cadmium at high NaCl concentrations of 0.55-0.60%. This tells us that the lower the concentration of the solution, the higher the degree of hemolysis of erythrocytes.

So, we came to the following conclusion based on the study of the effect of various salts of cadmium on the permeability properties of the erythrocyte membrane in the blood of rabbits.

## CONCLUSION

The presented cadmium containing salts [Cl and $(CH_3COO)_2$] as anionic components have a toxic effect on the bilipid membrane layer of rabbit blood. Therefore, we consider that it would be appropriate to start feeding with newly formed rations after chemical analysis of each type of food included in the ration of rabbits, the concentration of heavy metal salts stored in it is determined, and the negative effects on the morpho-biochemical and enzymatic processes in the animal's body are neutralized.

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