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The influence of metisevit and metifen on the intensity of lipid per oxidation in the blood of bulls on nitrate load

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The level of primary and secondary lipid per oxidation products were investigated: diene conjugates and malondialdehyde in conditions of nitrate loading. It was established that at bulls feeding with sodium nitrite at a dose of 0.2 hNO₃/kg of body weight, the level of diene conjugates and malondialdehyde in their was increased during the entire the experiment. On the 30th day of the experiment the level of diene conjugates in blood of bull, which were conducted with nitrate load was 7.44 ± 0.15 mmol/l, and the level of malondialdehyde – 0.305 ± 0.014 mmol/l.

Under conditions of nitrate load, young cattle was used a new integrated drug «Metisevit», which consists of sodium selenite, vitamin E and metifen. It was found the stimulating effect of metifen and metisevit on antioxidant system of the body of young cattle. Depressing effect of metifen and metisevit on the processes and lipid per oxidation in the blood of bulls under conditions of chronic nitrate–nitrite toxicity. Metifen and metisevit interact with radicals of fatty acids and delay the development of a chain reaction of oxidative stress, reduce the oxidation of phospholipids and form a biologically inactive compound with products of per oxidation of fats. Obtained results of the research indicate antioxidant drugs «Metisevit» and «Metifen» in the application of their young cattle.

The mentioned changes are occurring through the comprehensive action of the drug components «Metisevit», that leads to the normalization of metabolic processes and free radical in the body of bulls. Obtained results of the research indicate the antioxidant action of the drugs «Metisevit» and «Metifen» in the application of their young cattle and the reasonableness of their administration to improve the antioxidant status of the organism according to nitrate loading.

Key words: toxicology, nitrates, lipid per oxidation, bulls blood.

Вплив метісевіту і метіфену на інтенсивність процесів перекисного окиснення ліпідів у крові бичків за нітратного навантаження

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Досліджено рівень первинних та вторинних продуктів перекисного окиснення: дієнових кон'югатів і малонового діальдегіду за умов нітратного навантаження. Встановлено, що при згодовуванні бичкам нітрату натрію у дозі 0,2 гNO₃/кг маси тіла, рівень дієнових кон'югатів та малонового діальдегіду у їх крові зростає протягом усього досліді. На 30 добу досліді рівень дієнових кон'югатів у крові бичків, яким здійснювали нітратне навантаження, становив 7,44 ± 0,15 мкмоль/л, а рівень малонового діальдегіду – 0,305 ± 0,014 мкмоль/л.

За умов нітратного навантаження, молодняку великої рогатої худоби застосовували новий комплексний препарат «Метісевіт», до складу якого входять селеніт натрію, вітамін Е та метіфен. Виявлено стимулювальний вплив метісевіту і метіфену на стан антиоксидантної системи організму молодняку великої рогатої худоби. Встановлено пригнічуючу дію

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метифену і метисевіту на процеси перекисного окиснення ліпідів у крові бичків за умов хронічного нітратно–нітритного токсикозу. Метифен та метисевіт вступають у взаємодію із радикалами жирних кислот і затримують розвиток ланцюгової реакції окиснювального стресу, зменшують окиснення фосфоліпідів та утворюють біологічно неактивні сполуки з продуктами перекисного окиснення жирів.

Вказані зміни відбуваються завдяки комплексній дії складників препарату «Метисевіт», що призводить до нормалізації метаболічних та вільнорадикальних процесів в організмі бичків. Одержані результати досліджень вказують про антиоксидантну дію препаратів «Метисевіт» та «Метифен» при застосуванні їх молодняку великої рогатої худоби та про обгрунтованість їх введення з метою підвищення антиоксидантного статусу організму за нітратного навантаження.

Ключові слова: токсикологія, нітрати, перекисне окиснення ліпідів, бички, кров.

Introduction

The analysis of available domestic and foreign literature gives reason to assert that due to the ever-increasing ejection nitrogen compounds in the air and water basins, toxicity issues of nitrates and nitrites in our time are of special attention (Guberuk et al., 2010, 2012, 2015). The question nitrate–nitrite toxicosis are comprehensively studied. To date, a large number of messages are accumulated about the important role of lipid per oxidation (LPO) in the development of many toxicosis (Baglaj et al, 2011; Guttyj, 2013; Guberuk et al., 2015). However not enough was investigated the role of lipid per oxidation in conditions of nitrate loading.

Having established that during the nitrate–nitrite toxicity are coming disorders of lipid per oxidation, we concluded that under the influence of nitrates and nitrites for suppression of excessive free radical reactions in animals body, preparations should be used with a strong antioxidant effect, which can inhibit lipid per oxidation. From the large number of antioxidants at nitrate–nitrite toxics of bulls, we have studied the prophylactic action of metisevit and metifen. These antioxidants are blocking free radicals – products of met hemoglobin creation and prevent the development of oxidative stress in animals (Guberuk et al., 2015; Martyshuk et al., 2016).

Promising detoxification therapy with these preparations is at stress, which are able to not only normalize the antioxidant defense system, but also to participate in maintaining of metabolic homeostasis of animals infected with nitrates and nitrites.

The purpose of our research was to establish prophylactic action of metisevit and metifen on the bulls body, under the conditions of the nitrate load.

Material and methods

Experiments were carried out on 15 bulls of six months of age who were formed into 3 groups of 5 animals in each:

Group 1 – control (K), bulls fed with sodium nitrate forage at a dose of 0,2 hNO₃⁻/kg of body weight;

Group 2 – research (D1), bulls fed with sodium nitrate at a dose of 0,2 hNO₃⁻ / kg of body weight along with metifen at a dose of 0.28 g/kg of feed.

Group 3 – research (D2), bulls fed with sodium nitrate at a dose of 0.2 hNO₃⁻/kg of body weight along with metisevit at a dose of 0.36 g/kg of feed.

The experiment lasted for 30 days. Blood for analysis was taken from the jugular vein on 1–, 5–, 10–, 20–, and 30th day of the experiment.

The level of malondialdehyde was determined by YE.N. Korobeinikova (1989), the level of diene conjugates – by the method of I. Staljna (1977).

Results and discussion

In previous experiments we have found that nitrites initiate the process of lipid per oxidation, resulting in a large number of radical metabolites. With the intensive free radical reactions, biological structures of cell membranes are damaged (Gunchak et al., 2010; Khariv et al., 2016). The intensity of lipid per oxidation can be judged by intermediate and end products of lipid per oxidation, in particular diene conjugates and malondialdehyde.

From the data presented in Table 1 is established that the level of diene conjugates in serum of bulls, which were fed with sodium nitrate throughout the experiment, was growing. On the 10th day of the experiment it increased by 5% compared to the first day.

Table 1

DC level in bulls serum after administration of metifen and metisevit by nitrate load; (M ± m, n = 5)

Time of blood tests (day)	Diene conjugates (mmol/L)		
	Groups of animals		
	control	experimental 1	experimental 2
The first day	6.60 ± 0.20	6.56 ± 0.19	6.53 ± 0.18
The fifth day	6.62 ± 0.22	6.50 ± 0.18	6.35 ± 0.15
The ninth day	6.96 ± 0.22	6.29 ± 0.17*	6.10 ± 0.18*
The Twentieth day	7.30 ± 0.20	6.15 ± 0.17**	6.01 ± 0.17**
The Thirtieth day	7.44 ± 0.15	5.92 ± 0.14***	5.80 ± 0.16***

Subsequently, the level of diene conjugates continued to grow and on the twentieth day was amounted to 7.30 ± 0.20 mmol/l, which is 25% higher compared with healthy animals.

The introduction of metifen and metisevit to calves under the conditions of nitrates and nitrites action, pro-

moted the gradual reduction of diene conjugates in bulls serum from the research groups since the first day of the experiment. On the fifth day of the experiment, the level of diene conjugates in the experimental group D1 was decreased by 1.8%, in group D2 – by 4% relative values of the control group animals. On the 10th day of the ex-

periment, the level of the indices in bulls from the experimental group D1 was 6.29 ± 0.17 mmol/L, experimental group D2 – 6.10 ± 0.18 mmol/l. On the 20th day was decreased by 16 and 18% compared to the value of the control group.

On the thirtieth day the level of intermediate products of lipid per oxidation in serum was decreased by 20% in bulls from the experimental group D1 and by 22% of the experimental group D2.

From conducted research it implies that antioxidants inhibit the rate of secondary lipid per oxidation products in the blood of bulls under conditions of nitrate load.

At research of malondialdehyde in serum after bulls feeding with sodium nitrate, it was found that it gradually grows: on the first day by 8%, the tenth day – 14% compared with healthy animals. On the twentieth day, the level of the end products of lipid per oxidation in calves

from the control group of animals was 0.291 ± 0.012 mmol/l (Table. 2).

Bulls, fed with sodium nitrate along with antioxidants, had the gradual reduction of malondialdehyde level in serum. On the tenth day its level was in calves from the research group D1 0.259 ± 0.010 mmol/l, and in the experimental group D2 – 0.255 ± 0.011 mmol/l.

On the twentieth day of the experiment the level of malondialdehyde of research groups D1 and D2 was decreased by 12 – 13%, and on the thirtieth day it was returned to normal.

Thus, the use of antioxidants: metifen and metisevit, under conditions of nitrate load, it normalizes the intensity of lipid per oxidation, as indicated by the decrease in intermediate and final products of lipid per oxidation in the blood of experimental animals.

Table 2

The level of MDA in blood serum of calves after metifen and metisevit introduction on nitrate load; (M ± m, n = 5)

Time of blood tests (day)	Malondialdehyde (mmol/L)		
	Groups of animals		
	control	experimental 1	experimental 2
The first day	0.268 ± 0.011	0.266 ± 0.010	0.267 ± 0.011
The fifth day	0.278 ± 0.011	0.264 ± 0.011	0.259 ± 0.010
The ninth day	0.289 ± 0.012	0.259 ± 0.010	0.255 ± 0.011
The Twentieth day	0.293 ± 0.012	$0.256 \pm 0.010^*$	$0.252 \pm 0.010^*$
The Thirtieth day	$0,305 \pm 0.014$	$0.254 \pm 0.011^{***}$	$0.250 \pm 0.010^{***}$

Based on the experimental results you could argue that metifen and metisevit for chronic nitrate–nitrite toxicosis, enhance detoxification function of the liver, suppress lipid per oxidation and activate antioxidant system of animals body from the experimental group.

It was found that in experiments (Gunchak et al., 2010; Nazaruk et al., 2016) that metifen and medisvit interact with fatty acid radicals of fat acids and delay the development of a chain reaction of oxidative stress, reduce the oxidation of phospholipids and form a biologically inactive compound with products of fats per oxidation.

Thus, the mechanism of metifen and metisevit action is associated with the direct influence of its components on the inhibition of absorption processes of metabolites, which show toxic effects on the cell membranes of animals. As a result, the absorbent action of zeolite in the digestive canal, it occurs a decrease in the concentration of substances which can be substrates for LPO, this is confirmed by data (Nazaruk et al., 2015, 2016; Martyschuk et al., 2016;), and also the removal of toxic metabolites in the blood that are pro–oxidant. Given process is occurred by osmosis and the diffusion of these substances through the capillary of microvillus of small intestine and their subsequent fixation on the pellet of sorbent. To prevent the entry of toxic substances from the digestive tract into the blood, enter sorption indirectly promotes functional liver unloading, ensuring effective functioning of antioxidant system.

Conclusions

1. When feeding bulls with sodium nitrate at a dose of 0.2 h NO₃⁻/kg the level of intermediate and end products of lipid per oxidation began to grow. The highest level of malondialdehyde and diene conjugates was detected on the 30th day of the experiment.

2. Metifen and metisevit by the nitrate load, inhibit lipid per oxidation processes as indicated the reduction in the blood of experimental animals intermediate and final products of lipid per oxidation;

3. At the nitrate–nitrite toxicosis of bulls, metisevit compared to metifen reveal better prophylactic action.

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