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Kısa Bildiri ***Short Communication***

Influence of "Chelavite" Mineral Supplement Use on Cadmium and Lead Content in Blood, Wool and Milk of Heavy Cows

Anna Borisovna ANDREEVA[1], Larisa Yurevna KARPENKO[1], Abram Israyelovich ENUKASHVILI[2]*

[1]Department of Biochemistry Veterinary Faculty, Saint Petersburg State Academy of Veterinary Medicine, Russia,
[2]Department of Physiology Veterinary Faculty, Saint Petersburg State Academy of Veterinary Medicine, Russia

Sorumlu Yazar / Corresponding Author:
Larisa Yurevna KARPENKO
e-mail: l.u.karpenko@mail.ru

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Abstract

The purpose of this research was to study the influence of this supplement use on the concentration of cadmium and lead in blood serum, wool and milk of heavy cows. The cows of milking herd of black-and-white breed, of 3-5 years old were the object of research. Their yearly milk production was 6 thousand litters (control and experimental group, each having 15 heads). The cows have been fed according to the balanced ration for heavy cows. The mineral supplement dose was determined according to the instruction for application for cows of experimental group with feed. The curative dose was 0.6 ml for 10 kg of body mass 1 time a day during 30 days. The samples were taken before giving the mineral supplement "Chelavite" and after the course had finished. The device Unicam AAS-939 was used to determine the cadmium and lead content in blood, wool and milk by way of atomic absorption spectrophotometry. It has been found that the cadmium level reduced by 2.35 times, the lead level reduced by 1,5 times in cows blood, the cadmium level reduced by 1.33 times, the lead level reduced by 4.34 times in cows wool, the cadmium level reduced by 2.2 times, the lead level reduced by 3.7 times in cows milk after giving them mineral supplement "Chelavite". Thus, the application of chelate compounds in form of "Chelavite" for cows reduces concentration of heavy metals such as cadmium and lead. Then this is one of the ways to improve the milk quality.

Özet

"Chelavite" Mineral Desteği Kullanımının Kilolu İneklerin Kan, Yapağı ve Sütlerindeki Kadmiyum ve Kurşun İçeriği Üzerindeki Etkisi

Bu çalışmanın amacı destek katkı kullanımının kilolu ineklerin kan serumu, yapağı ve sütlerindeki kadmiyum ve kurşun düzeyleri üzerindeki etkisini araştırmaktır. Siyah alaca ırkı, 3-5 yaşlarında sütçü inekler bu çalışmada kullanıldı. Bunların senelik süt üretimleri 6 bin litredir (kontrol ve deney grupları, her birinde 15 baş olmak üzere). İnekler, kilolu inekler için hazırlanan dengeli rasyonlarla beslendi. Mineral destek dozu, deneysel grup inekler için verilen uygulama talimatı doğrultusunda belirlendi. Tedavi edici doz 10 kg'lık vücut ağırlığı için 30 gün süreyle günde bir kez 0,6 ml'idi. Örnekler mineral desteği "Chelavite" verilmeden önce ve tedavi sona erdikten sonra alındı. Kan, yapağı ve sütte kadmiyum ve kurşun miktarlarını atomik absorpsiyon spektrofotometresi yoluyla belirlemek için Unicam AAS-939 cihazı kullanıldı. Mineral desteği "Chelavite" verildikten sonra ineklerin kanındaki kadmiyum düzeyinin 2,35 misli, kurşun düzeyinin 1,5 misli; ineklerin yapağılarındaki kadmiyum düzeyinin 1,33 misli, kurşun düzeyinin 4,34 misli, ineklerin sütlerindeki kadmiyum düzeyinin 2,2 misli, kurşun düzeyinin 3,7 misli azaldığı saptandı. Sonuç olarak, "Chelavite" formundaki şelat bileşiklerinin uygulanması ineklerde kadmiyum ve kurşun gibi ağır metallerin düzeylerini azaltmaktadır. Bu da süt kalitesini iyileştirme yollarından biri olmaktadır.

Introduction

The territories of megalopolises including Leningrad region are characterized by entry of different industrial toxicants into the environment such as toxic metals (Bespamyatnov and Krotov, 1985). Toxic metals can cause different types of animals' intoxications which result in loss of productive ones. That is why the assessment of toxic substances concentration in animals organism as well as development of ways to reduce the concentration of these elements in their organism and

consequently in animal products (Filov, 1988) present some features of interest. Cadmium belongs to toxic (immunotoxic) elements. In case of Itai-Itai disease the urinary and reproductive systems are principally damaged. Cadmium blocks conversion of 25-hydroxycalciferol to 1,25-dihydroxycholecalciferol and inhibits the activity of lysyl oxidase in bones. Cadmium binds to mercapto groups, phospholipids, nucleic acids and influence on the phosphorylation processes (Pourjafar, 2008; Shevchenko, 2006). As for mechanism of lead influence, the enzymopathic effect plays a key role. Lead binds to sulfhydryl, carboxy and aminogen groups of active centres. The influence of lead intoxication on synthesis of porphyrins, hem, key enzymes in liver, kidneys and erythrocytes (Bolotnikov and Dobronin, 1989; Kello and Kostial, 1978; Krupa and Wozniak, 2000) is great. The use of chelate compounds is one of the ways to eliminate heavy metals from organism. Besides, protein-rich food, vitamin and mineral complexes containing Zn, Cu, Fe, Se, Ca, phosphates, D, C, B6 vitamins, methionine can also reduce the toxic effect of cadmium and lead (Meyer and Harvey, 2007). It is possible to meet all these requirements by using mineral supplement “Chelavite”. This supplement consists of iron, cuprum, manganese, selenium, iodine, zinc and cobalt in form of chelate complexes with organic compound, succinic acid derivative. The mechanism of lead and cadmium elimination from organism consists of the ability of formation of chelate with heavy metals which are very persistent. They are usually highly soluble and are eliminated through the kidneys from organism (Shamberger, 2002).

The purpose of this research was to study the influence of this supplement use on the concentration of cadmium and lead in blood serum, wool and milk of heavy cows.

Materials and Methods

The experimental part of work was performed by JSC “Udarnik” of Volosovsky district of Leningrad region. Biochemical researches have been conducted at the department of biochemistry of the Federal State Educational Institution of Higher Professional Education «Saint Petersburg state academy of veterinary medicine».

Experimental Design and Animals

The cows of black-and-white breed, of 3-5 years old were the object of researches. Their yearly milk production was 6 thousand litters. All animals were well nourished and apparently healthy. The cows have been fed according to the main nutritive balanced rations. They have not received any additional mineral supplements. Cows housing system - farm housing during the whole year. During the research two cows groups were formed – experiment group and control one. Each included 15 heads. The animals were taken into the groups according to the *pair-analogues method.* The mineral supplement dose was determined according to the instruction for application for cows of experimental group with feed. The curative dose of chelavite was 0,6 ml for 10 kg of live weight 1 time a day during 30 days. The animals of control group have not been given the mineral supplement “Chelavite”.

Sampling of Blood, Wool and Milk

The samples were taken before giving the mineral supplement “Chelavite” and after the course had finished. Before taking samples the animals took clinical examination and thermometry. The blood was taken from jugular vein subject to aseptic and antiseptic regulations. The samples were taken in withers area by way of trimming. Milk samples were taken during morning milking. The device Unicam AAS-939 was used to determine cadmium and lead content in blood, wool and milk by way of atomic absorption spectrophotometry.

Statistical Analyses

The results of the researches are shown in the schedule. The obtained data underwent statistical treatment by means of software package Statistica 6.0. The following indexes were determined: M - arithmetical mean; m- error of arithmetical mean; t – Student’s test.

Results

According to the data of the schedule this concentration was not beyond the maximum concentration level. It has been found that the cadmium level reduced by 2.35 times, the lead level reduced by 1.50 times in cows blood, the cadmium level reduced by 1.33 times, the lead level reduced by 4.34 times in cows wool, the cadmium level reduced by 2.20 times, the lead level reduced by 3.70 times in cow’s milk after giving mineral supplement “Chelavite”. The lead and cadmium concentration in blood serum and milk of control group cows have not evidently changed (Table 1).

Discussion

Recently the problem of reducing of heavy metals intoxication of live-stock animals, particularly lead and cadmium is becoming very important considering the difficult environmental situation. Cadmium and lead are the most widespread in the environment (Bespamyatnov and Krotov, 1985). There are a lot of ways to eliminate heavy metals from animals organism providing use of different means: elementary sulfur,

white mud, biologically-active preparation (erakond, licorice root infusion) (Filov, 1988). Nevertheless any of them have deficiencies: the intensity and level of metals elimination directly depends on absorption of sulfur in the gastro-intestinal tract. Since the absorption of sulfur is affected by several factors, the effect of heavy metals elimination is limited. That is why the value of this method is reduced. A lot of preparations are absorbed with heavy metals and the substances needed for normal activity are eliminated from organism. In order to reduce heavy metals intoxication health professionals use complexing pharmaceuticals which eliminate toxic metals and reduce degree of intoxication development and effect. Complexones form complex compounds with metals that is why they loose their biological toxicity (Meyer and Harvey, 2007). General feature of all complexing compounds is that their protective effect is stipulated by ability to interact with toxic metals. Thus, heavy metals are eliminated. Mineral supplement "Chelavite" contains complex of the following components, mass %: 2Na- or 2K-salt ethylene diamine - N, N1 - disuccinic acid 15.0-35.0; Na- or K – amino-acid salt 2.0-10.0; iron (III) 0.6-3.0; manganese (II) 0.5-2.5; cuprum (II) 0.05-0.25; zinc (II) 0.3-2.5; cobalt (II) 0.005-0.05; selenium (IV) 0.01-0.03; iodine (I) 0,03-0,08; water and others. In animals organism minerals compete for banding with shuttle molecules transporting them from intestinal lumen to cytoplasm of intestinal epithelial cells. Original formula of "Chelavite" microelements complex and their competition for carrier proteins is probably one of the causes of reducing of cadmium and lead absorption into blood and then into milk of cows which have been taken "Chelavite". Therewith there is no side effect, which is observed when applying other complexons and which is connected to the parallel elimination of important microelements from organism. This is related to the fact that "Chelavite" contains the whole complex of microelements with polyaminoacids and fully completed coordination capacity of complexon (Shamberger, 2002).

Thus, the application of chelate compounds in form of "Chelavite" for heavy cows reduces concentration of heavy metals such as cadmium and lead in blood and wool. Then this is one of the ways to improve the milk quality.

Table 1. The influence of mineral supplement "Chelavite" on the content of cadmium and lead in blood serum, wool and milk of cows (M±m, n = 15).

Tablo 1. Mineral desteği "Chelavite"in ineklerin kan serumu, yapağı ve sütlerindeki kadmiyum ve kurşun miktarı üzerine etkisi (M±m, n = 15).

Substance	Unit of Measurement	Control Group		Trial Group	
		Before the Application of the Preparation	After the Application of the Preparation	Before the Application of the Preparation	After the Application of the Preparation
		in the Blood Serum			
Cadmium	nmol/l	3.81±0.20	3.9±0.10	3.6±0.35	1.25±0.20*
Lead	nmol/l	1.2±0.20	1.3±0.20	1.1±0.25	0.6±0.05*
		in Wool			
Cadmium	ug / g	0.13±0.02	0.12±0.01	0.12±0.03	0.09±0.01*
Lead	ug / g	1.8±0.15	1.75±0.05	1.91±0.12	0.44±0.001*
		in Milk			
Cadmium	ug / ml	27.5±3.10	28.5±2.60	27.3±1.6	11.5±1.10*
Lead	ug / ml	3.3±0.50	3.1±0.40	3.2±0.30	0.8±0.02*

*Reliable compared to the initial values before "chelavite" application (P<0.05).

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