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## Research Article

# The Specifics of the Metabolism of Thyroid Hormones of Horses under Conditions of iodine and Selenium Deficiency -

**Alesya Aleksandrovna Bakhta\* and Larisa Y Karpenko**

*Department of Biochemistry, Veterinary Faculty. Saint Petersburg state academy of veterinary medicine, Russia*

**\*Address for Correspondence:** Alesya Aleksandrovna Bakhta, Department of Biochemistry, Veterinary Faculty .Saint Petersburg state academy of veterinary medicine, Russia. E- mail: L.U.Karpenko@mail.ru

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## Abstract

The purpose of this research was to study the characteristics of iodine, selenium and thyroid hormones metabolism of horses and the influence of mineral supplement "Chelavite" use on these values of horses. The experimental part of work was realized in equestrian club "Lada" (Leningrad region, North-Western region of the Russian Federation). Apparently healthy horses of 5-12 years old were the object of research. During the research two groups were formed – experimental group and control one. Each group 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 horses of experimental group with feed. The curative dose was 0,6 ml for 10kg of body mass 1 time a day during 30 days. The animals of control group have not been given the mineral supplement "Chelavite". The results of the researches have shown that the horses' state before the beginning of the experiment can be considered to be euthyroid. After using the mineral supplement "Chelavite" the content of protein-bound iodine in blood has been repaired as well as the balance of T3 and T4 in blood, the selenium level has increased. This allows to conclude that the use of selenium and iodine together leads to optimization of their homeostasis and thyroid metabolism improvement. Thus, this preparation may be recommended as a preventive and treatment agent of iodine and selenium deficiency of horses.

**Key Words:** Horse; Iodine; Selenium; Triiodothyronine; Thyroxine; Thyrotropin Releasing Hormone; Insufficient Iodine; Selenium Deficiency; Chelates

## INTRODUCTION

It is known that dis balance of microelements in the environment has direct influence on functioning of almost all horses' organism organs and systems. In case of the microelements excess or deficiency in the organism adaptation mechanism begin to have an effect [1]. Among a variety of microelements the iodine is the most studied. Its deficiency influence in a negative way on health because of the thyroid function abnormality [2]. It is deniable that the main cause of iodine deficiency states development is the deficiency of iodine in ground, water. As a result its content in feed is low. This influence in a negative way on horses' state [3]. The influence of many microelements on iodine deficiency development was studied in experiments. These experiments concerned the thyroid structure and function (iodine, zinc, selenium). Selenium is of the most interest among these microelements. At the present time it is determined that selenium takes part in thyroid hormones metabolism, because it is a component of deiodinases which are involved in conversion of thyroxin (T4) into triiodothyronine (T3) realizing deiodination of T4 outer ring. Deiodinases belong to Selenium-containing enzymes including selenocysteine. At the present time the market provides a wide range of treatment agents and biologics for microelements correction. Among a variety of these preparations chelated metallic salts which are characterized by superior bioavailability and low toxicity because of chemical structure [4]. That is why the purpose of our research was to study the influence of mineral supplement "Chelavite" use on the characteristics of iodine, selenium and thyroid hormones metabolism of horses.

## MATERIALS AND METHODS

The experimental part of work was realized in equestrian club "Lada" (Leningrad region, North-Western region of the Russian Federation). 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». Apparently healthy horses ( $n = 15$ ) of 5-12 years old were the object of research. All animals were well nourished and apparently healthy. The horses have been fed according to the main nutritive balanced rations. They have not been received any additional mineral supplements. During the research two groups were formed – experimental group and control one. Each group included 15 heads. The animals were taken into the groups according to the pair-analogues method. The mineral

supplement "Chelavite" dose was determined according to the instruction for application for horses of experimental group with feed. The curative dose was 0, 6 ml for 10kg of body mass 1 time a day during 30 days. The animals of control group have not been given the mineral supplement "Chelavite". The samples were taken before giving the mineral supplement "Chelavite" and after the course had finished. Before taking blood the animals took clinical examination and thermometry. The blood was taken from jugular vein subject to aseptic and antiseptic regulations. Protein-bound iodine was determined by method of extraction with toluene, the content of iodothyronines was determined by radioimmunoassay technique with use of chemical agents for radioimmunometric method of IMMUNOTECH A BECHMAN COULTER COMPANY, selenium in blood serum was determined by stripping voltammetry using ABA-3 device (Voltammetric analyzer, "Burevestnik" Research and production enterprise). The obtained data underwent statistical treatment by means of software package Statistical 6.0. The following indexes were determined: M - arithmetical mean; m- error of arithmetical mean; t - Student's test.

## RESULTS OF THE RESEARCHES

The results of the researches are shown in the schedule.

The data received shows that before the beginning of the experiment the state may be considered as euthyroid, but the disruption of iodothyronines balance in blood is observed. The content of triiodothyronines is increased. This fact features iodine deficiency in logical combination with protein-bound iodine concentration decrease and explains low thyroxin content. After using this preparation the content of protein-bound iodine in blood has repaired as well as balance of T3 and T4 in blood. Thus, protein-bound iodine has significantly increased ( $P < 0,05$ ) in 1,9 times, thyroxin in 1,5 times, selenium in 10 times while triiodothyronine has significantly decreased in 7 times and TSH in 2,3 times. During the experiment period these values of control group animals have not significantly changed.

## DISCUSSION

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. Today there is a huge number of preparations at the market. The difference of this preparation from others is a form good for organism. It consists of complex with bioligands (chelate compounds) similar to transport proteins of organism providing high availability of micro- and macro elements. It has been also established that due to their active participation in metabolic processes the synthetic chelate complex compounds influence in a positive way on productivity and reproductive function of animals. At the present time the influence of microelements chelate complexes to animals is widely researched. It is considered that metal chelators have a range of advantages compared to popular nonorganic preparations (salts, metal oxides). Thus, many scientists note that the toxicity of the metals in nonorganic form is significantly higher than the toxicity of chelate banded metals in case of giving them to animals in over dosage [5,6]. Many researches show that animals absorb chelate banded microelements much more intensively than nonorganic preparations [7-13]. point out following reasons for metal chelator's absorbtion: 1) chelate complexes are absorbed more

intensively in gastrointestinal tract; 2) chelate banded metals do not bind with feed phytates; 3) chelate banded metals do not demonstrate antagonism while absorbing in gastrointestinal tract.

The influence of mineral supplement "Chelavit" on iodine status of horses was assessed according to changes in thyroid hormones metabolism, in content of which iodine generally realizes its biological effect. It has been established that the concentration of triiodothyronine of horses which had received the preparation has decreased compared to horses of control group, while the concentration of free thyroxin has increased. Further it has been established that the concentration of thyrotropic hormone has significantly decreased compared to the control group under influence of mineral supplement "Chelavit" using. This effect, apparently, is explained by effect of homeostatic mechanism of thyrotropic hormone production regulation according to feedback. Based on the data received, it can be concluded that the mineral feed supplement "Chelavit" can be recommended as a preventive agent of thyroid function abnormality and treatment agent of iodine and selenium deficiency of horses.

**Table 1:** The impact of Helavit preparation on the content of iodothyronines, protein-bound iodine and selenium in the blood serum of horses (M ± m).

Substance	Unit of measurement	Group of animals			
		Trial group		Control group	
		Beforeapplying "Chelavite (n =15)	30 days after first use "Chelavite (n = 15)	Before the start of the study (n = 15)	30 days after the start of the study (n = 15)
Protein-boundiodine	ug/g%	2,0 ± 0,68	3,8 ± 0,95*	2,11 ± 0,45	2,24 ± 0,5
T3	Nmol/l	8,0 ± 2,1	1,1 ± 0,22*	8,15 ± 1,66	8,5 ± 2,0
T4	Nmol/l	16,0 ± 0,68	23,57 ± 1,3*	15,9 ± 1,2	16,01 ± 2,11
TTG	MME/l	0,15 ± 0,56	0,065 ± 0,01*	0,14 ± 0,43	0,15 ± 0,32
Selenium	ug/l	27,13 ± 7,55	261,8 ± 10,4*	29,66 ± 9,11	30,41 ± 8,61

Note: \*- reliable compared to the initial data (P < 0,05).

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