MEDICAL AND BIOLOGICAL EVALUATION OF EFFECTIVENESS OF SELENIUM-CONTAINING PREPARATIONS

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Introduction

Epidemiological studies show that more than 80% of the Russian population is provided with the level of selenium lower than the optimum (Golubkina and Alfthan, 1999). The task of correction of selenium deficiency is being solved in two directions: (1) modification during life cycle (production of raw materials of pre-determined component composition); (2) enrichment of food products.

To enrich animal feeds with selenium a domestic high-efficiency preparation DAFS-25 (diacetofenonylselenid), an organic selenium compound, is used.

Selenaktive (selexen) - organic selenium compound, is widely used as biologically active food supplement (BAFS).

Chick pea (Cicer arietinum L.) is an efficient selenium store, containing up to 700 μg/kg of selenium in the most physiologically acceptable form (as selenmethionine) and is used both for feeding animals and in foods.

Objectives: The purpose of this study was to **c**ompare the influence of selenium-containing preparations and their combination with iodine preparation on general physiological state of laboratory animals, pathomorphology, general blood test results and the level of thyroid hormones.

Materials and methods

As the objects of investigations were chosen: synthetic preparations of organic selenium: DAFS-25, Selenaktive; a plant source of selenium – chick pea; a preparation of organic iodine – iodaktive.

Medical and biological evaluation was performed by traditional experimental methods on growing white little male rats during 45 days in vivarium of VNIIMP.

All the animals were divided into 6 groups, 10 animals to each. Group 1 (control) – the animals were on common diets of the vivarium. In Group 2 - the animals obtained 2 g of ground chick pea per 100 g of live weight per day. In group 3 – 2 g of ground chick pea and iodaktive at 96 mg per 100 g of live weight per day. The animals of group 4 obtained the preparation DAFS-25 at 36μg; of group 5 - DAFS-25 at the same dose and in addition - iodaktive at 96 mg per 100 g of live weight a day. Selenaktive at 45 mg per 100 g was added to the feed of the rats of group 6.

Each animal received 50 g of feed and water *ad libitum.* All tested preparations were added to kasha (cooked grain). All the diets were balanced over selenium, the main nutrients and energy value.

Behavior of rats, their appearance and the body weight and daily weight gain were analyzed in the experiments. Slaughter of rats for blood drawing, weighing of internal organs (heart, kidneys, liver and spleen) was carried out by decapitation under conditions of ether raush narcosis.

The integral index of chronic intoxication (IICI) (Snitsar et al.,2000) was calculated as a ratio of the organ weight to total body weight in %.

Results and discussion

No clinical signs of health deviations were found in animals of control and experimental groups during the whole experiment. The preservation of all experimental animals from all the groups was full (100%) during the whole experimental period.

The live weight gain of laboratory animals of control and animal groups during chronic biological experiment was reduced in the row **chick pea> selenaktive>chick pea + iodaktive>DAFS -25>control>DAFS-25+iodaktive.**

After slaughter of the animals pathological and anatomical investigations have revealed a single case of multiple liver abscesses in GROUP 4. In other cases autopsy did not reveal any external signs of pathological or inflammation processes in internal organs.

To determine a possible negative effect of the added selenium in the feed of laboratory animals the integral index of chronic intoxication (IICI) was estimated (Table 1).

The calculated integral index did not reveal any significant differences in the experimental and control animals. suggesting about the absence of cumulative toxic effect of all the tested samples.

Table 1.

IICI	Groups pf animals					
	1	2	3	4	5	6
Spleen	0.27	0.25	0.26	0.26	0.24	0.25
Kidneys	0.33	0.29	0.29	0.30	0.32	0.35
Liver	3.30	3.70	3.68	3.57	3.44	3.46

Heart	0.37	0.34	0.33	0.38	0.42	0.38

To determine the influence of the preparations on the animals' organism the blood test on general clinical indices and biochemical analysis of blood for the content of thyroxine (T 4) and thyreotropic hormone (TTH) in it were carried out. The results are presented in Tables 2 and 3.

Table 2.

Parameters	Groups of animals					
	1	2	3	4	5	6
Erythrocytes, x 10^2 µl	7.1 ±1.1	6.7 ± 1.1	5.4±0.8	7.5±0.7	8.0± 0.3	7.6± 0.5
Mean corpuscular volume (MCV) μm^3	76.5±7.2	69.3 ±2.4	86.1±22.5	72.9±17.4	64.4±9.3	72.4±6.18
Hematocrit,%	54.9±9.6	46.0±6.0	45.7±10.0	53.5±5.7	51.3±8.1	54.7±4.2
Hemoglobin, g/dl	13.0±1.9	14.3±4.3	11.3±1.8	14.3±1.7	13.9±3.1	15.1±0.7
Color index	0.57±0.05	0.67±0.15	0.63±0.05	0.6 ±0.1	0.5±0.1	0.6±0
Leukocytes, x 10^5µl	7.5±2.1	6.5±2.0	10.2±3.2	8.7±3.9	6.9±1.5	8.3±5.1
Neutrophils, %						
- juvenile, %	0	0	0	0	0	0
- stab, %	0.7±1.1	0	0.7±1.1	1.3 ±1.2	1.3±1.2	0
-segmented	30.7 ±9.3	43.3±25.2	38.0±18.3	40.7±8.1	47.3±16.3	47.7±24.5
Eosinophils	1.3±2.3	4.0±2.0	2.0 ±2.0	1.3± 2.3	0.7±1.1	1.7 ±0.57
Monocytes	0	1.3±1.2	0.7±1.1	0	0	0
Basophils	0	0	0	0	0	0
Lymphocytes	67.3±7.6	51.3±27.3	59.3±20.8	56.7±8.1	50.7±17.9	61.3±11.0

Clinical blood test (Table 2) indicated a positive influence of all the preparations on hemopoietic function of rats.

In the analysis of leukocytic formula an increase in the amount of mature forms of neutrophils (segmented) in groups 2, 5 and 6 was found, that suggested about "ageing" of blood. An increase in the amount of eosinophils in Group C-2 can suggest about insignificant allergenic reaction of some animals for chick pea protein.

The content of monocytes in blood of rats, consuming chick pea and chick pea + iodaktive is to some extent higher, than in other samples, but doesn't exceed the norm (0-4%) which indicates the absence of the immune conflict in animal's organism. Full absence of basophil leucocytes in peripheral blood indicates a low level of food sensibilization in all the samples.

Table 3.

Hormone	Unit of measurement	Groups of animals					
		1	2	3	4	5	6
Thyroxine	nmol/l	126±30.1	127±25.0	101.6±16.4	135 ±19.0	135.6± 26	108.9±2.5
TTH	µME/ml	0.51±0.3	0.22±0.03	0.09±0,05	0.07±0.01	0.16±0.05	0.09±0.22

The data obtained suggest that as compared to the control, the level of TTH had reduced in all the groups of experimental animals with the preservation of the level of thyroxin, complying physiologically with this species, i.e. all the supplements contribute to the increase in activity of thyroid gland, but in different degree.

Conclusions

The results of the chronic biological test on laboratory animals have shown:

- reduction of the gain in the order as follows: chick pea > selenaktive> chick pea + iodaktive> DAFS -25 > control > DAFS-25+iodaktive
- absence of cumulative toxic effect and low level of food sensibilization for all the selenium-containing supplements;
- increase in the activity of thyroid gland had reduced in the order as follows: DAFS>chick pea+iodaktive >selenaktive>DAFS+iodaktive>chick pea> control

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