ECOLOGICAL AND TOXICOLOGICAL EVALUATION OF THE IMPACT OF SELENIUM CONTAINED IN FEED ON MORPHOLOGICAL AND FUNCTIONAL CHANGES IN THE BONE TISSUE OF ANIMALS

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ABSTRACT — Physiological role and toxic-metric characteristics of selenium compounds for animals and humans are poorly studied. In this regard, this article studies morphological changes in bone tissue against the background of selenium intoxication within a chronic experiment. 2 groups of animals were studied during the experiment — reference and experimental ones. Animals (Wistar rats) received plants (rapeseed, spring wheat) grown on meadow chernozem soil using selenium at a dose of 2 MAC (*Selenium* experimental group). An increase in selenium concentration in the diet leads to reactive changes in osteogenic process.

KEYWORDS — selenium, animals, intoxication, osteogenic process.

Selenium is one of biogenic elements, it is a permanent component of animal and human organs and tissues [1, 2, 3, 4]. Selenium deficiency is considered as a factor contributing to the development of oncological diseases, diseases of cardiovascular system [5, 6, 7]. The deficiency can cause a decrease in functional activity of the thyroid gland, liver and pancreas, chronic diseases, diabetes mellitus and depressive state. It results in the development of dysbacteriosis and allergies, dystrophic changes in muscles, multiple sclerosis, growth and development retardation, increased number of gastroenterological disorders. Therefore, it is likely that one of the leading causes of occurence and rapid growth of the *diseases of civilization* during the 20th century is an increase of selenium deficiency — because the more toxic factors affect a human, the more acute is the body's need for this element [8, 9, 10, 11].

Physiological role of selenium is not completely studied. The content of this element in plants is of particular importance, since this element plays an important role in nutrition of animals, especially domestic ones, since it can simultaneously be both a microcomponent of nutrition and a toxin [10, 11].

Toxic-metric characteristics of selenium compounds for animals and humans are poorly studied. In general, the mechanism of toxic action of selenium is associated with impaired metabolism of sulfur in the body and effect of anomalies caused by it [9, 12]. To date, the toxic effect of selenium on a number of parenchymal organs has been studied. At the same time, its effect on bone tissue is not studied enough. In this regard, this article studies morphological changes in bone tissue against the background of selenium intoxication within a chronic experiment.

MATERIALS AND METHODS

2 groups of animals were studied during the experiment — reference and experimental ones. Animals (Wistar rats) received plants (rapeseed, spring wheat) grown on meadow chernozem soil using selenium at a dose of 2 MAC (*Selenium* experimental group). Selenium content in the feed was 5 mg/kg. Animals of the reference group received the same feed, but grown without the use of the microelement. The experiment lasted 6 months [4]. At the end of the experiment, bone tissue of the animals was examined.

Material of the study comprised areas of alveolar bone of the upper jaw fixed in 10% formalin. Decalcification was performed using Jenkins fluid, after which the material was washed in two changes of absolute alcohol and poured into paraffin according to the standard technique. 4 μm thick sections were made from the blocks obtained, and subsequently stained with hematoxylin and eosin.

RESULTS

When describing morphological picture of changes in the bone tissue against the background of intoxication with selenium in a chronic experiment, there was found that, compared with the reference group, histological examination of spongy bone tissue sections revealed signs of bone alternation, which manifested as both osteosclerosis and resorptive processes.

Signs of reactive osteogenesis consisted in thickening of trabeculae of the preexisting bone and formation of new trabeculae, occlusion of Haversian canals.

The newly formed bone was characterized by richness of the bone substance, increase in straight and even basophilous gluing lines, which obtained concentric features (Fig. 1).

Against the background of events of reactive osteogenesis, there were signs of loss of bone substance in form of various forms of resorption. Presence of lacunar resorption areas was typical. Along the edge of the bone trabeculae, there were formed pits (so-called Howship lacunae) (Fig. 2), which had osteoclasts comprised large giant cells containing up to 8 nuclei (Fig. 3).

In addition, there were areas of axillary resorption in form of formation of spaces filled with *liquid* bone in form of a plasma-like amorphous substance stained in pink (Fig. 4). These areas were quickly replaced by delicate fibrous connective tissue, poor in vessels (Fig. 5).

CONCLUSION

Thus, an increase in selenium concentration in the diet leads to reactive changes in osteogenic process, which have a dual character. On the one hand, there is an increase in production of the main substance of the spongy bone, which is manifested by events of osteosclerotic process. On the other hand, excess of newly formed bone leads to activation of resorptive processes, manifested by both cellular (lacunar) and non-cellular (axillary) forms. As a result, fibrous connective tissue grows in the areas of loss of the bone substance.

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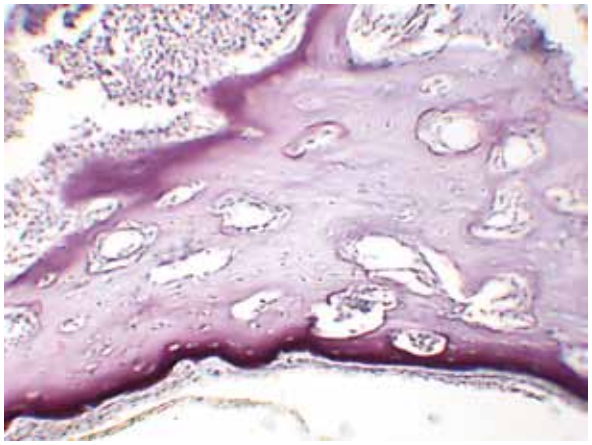

Fig.1. *Manifestation of osteosclerosis of spongy vone tissue dring chronic administration of the feed grown using selenium in a dose of 2 MAC. Staining with hematoxylin and eosin. x270*

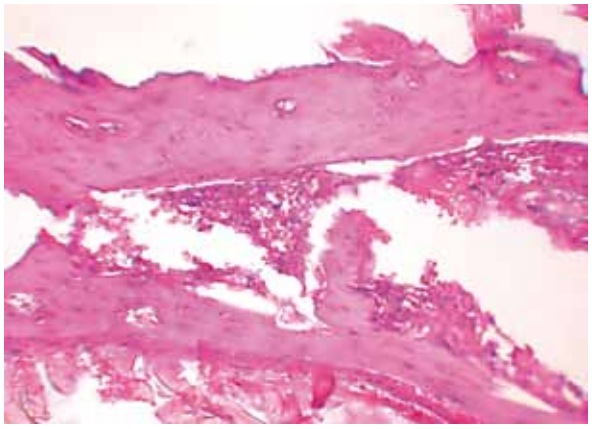

Fig.2. *Areas of lacunar resorption of sclerotic bone changes in animals of "Selenium" experimental group. Stained with hematoxylin and eosin. x270*

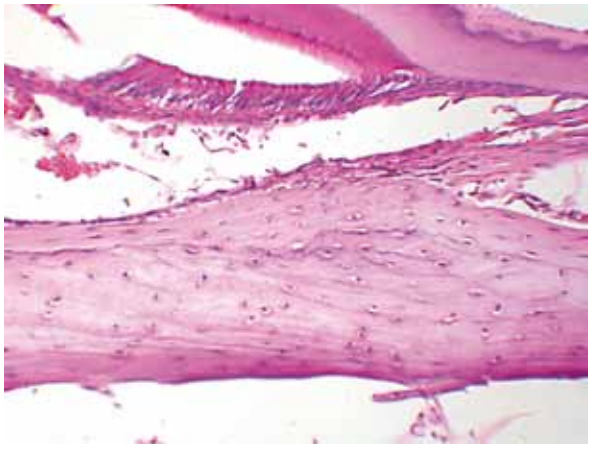

Fig.3. *Areas of lacunar resorption of sclerotic bone changes in animals of "Selenium" experimental group. Stained with hematoxylin and eosin. x900*

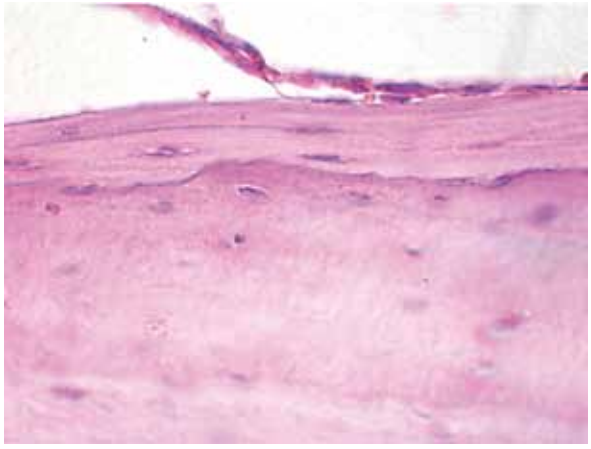

Fig.4. *Area of axillary bone resorption, replaced by fibrous connective tissue in animals of "Selenium" experimental group. Stained with hematoxylin and eosin. x900*

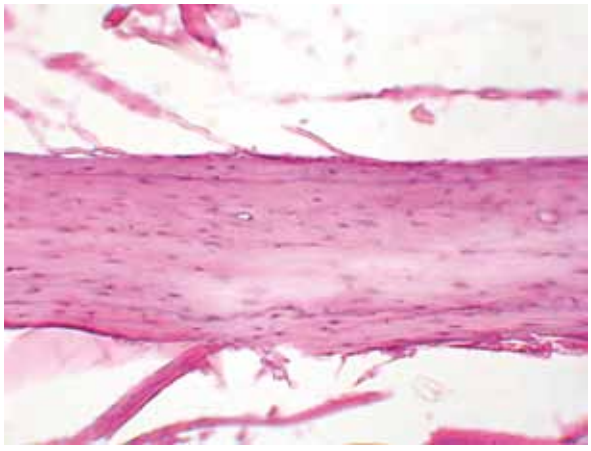

Fig.5. *Formation of delicate fibrous connective tissue in place of foci of axillary bone resorption in animals of "Selenium" experimental group. Staining with hematoxylin and eosin*

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