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CHEMICAL STRUCTURE OF NON-APATITIC ENVIRONMENT OF THE NANOCRYSTALS TRABECULAR BONE

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Non-stoichiometric apatite crystals are the mineral fraction of bones. The apatite surface plays a crucial role in biological bone behavior. The bioapatite crystals have a multilayer hydrate shell, which contains impurity ions such as magnesium, sodium, potassium. Nowadays the qualitative and quantitative characteristic of non-apatitic environment of the nanocrystals is not clear yet. Water is the major component of non-apatitic environment in bones. That is why, we studied the surface of nanocrystals from trabecular bone in healthy rats under the water deficiency.

During the experiment, we have used an adult laboratory rats (8-month age), removed the calcaneal bone, cleaned it from muscles and tendons and dried it to the constant weight. The specimen was burned under the temperature from 560 to 760 °C and treated with ultrasound in deionized water. This solution was checked on the amount of calcium, magnesium, potassium and sodium by atomic absorption method.

Pyrolytic degradation of crystals surrounding at 680 °C causes a rise of soluble Ca^{2+} concentration that was significant higher in case of dehydration. This effect shows a high Ca^{2+} concentration in the non-apatitic component and a defect structure of apatite crystals.

Mg^{2+} ions moves from the bound to a labile state on the nanocrystals surface at 700-750 °C. It may indicate an increase of the crystallites size, disappearance of lattice microdeformations and decomposition of carbonate biomineral complexes. The concentration of the “labile” Ca^{2+} decreases significantly at the same temperatures. That may indicate their transition from the surface layer to the apatite grate. Counter migration of Mg^{2+} and Ca^{2+} begins at a lower temperature in the cases of the experimental pathology (“dehydration”) then in control samples. Active mobility of K and Na confirms the fact of defective crystal structure in the cases of dehydration.

Thus, our research has shown the ability of replacement the vacant places of water by the trace elements. That may affect structural integrity of bone apatite.