

## VIII. SUMMARY

Osteoarthritis of the spine is a prevalent disease primarily affecting the elderly, but it more and more often affects people aged over 25 years. The disease is chronically progressive and the changes are irreversible. The essence of the disease is the degeneration and premature wear of tissues of a cartilaginous nature. Ailments most often relate to the lumbar spine. The cause is considered to be the resultant of factors such as tissue aging, abrasion of articular surfaces and a slowly progressing inflammatory process of unknown etiology. The most important factors initiating the degenerative process are age, excess body weight, improper diet, hard physical work, congenital and acquired skeletal defects, and excessive physical activity. In addition, the aspect of exposure to chronic heavy metal poisoning, which has a negative impact on the bone and joint system, is more and more often discussed. In the course of the degenerative process, collagen, proteoglycans and dehydration of vertebral structures are damaged, which leads to damage to the intervertebral disc, cartilage degeneration of the inter-process joints, ligament system and joint capsules. The repair process takes place through the formation of local inflammation and bone outgrowths, which is manifested by severe pain. Diet plays an important role in the prevention and treatment of degenerative disease by influencing inflammation and weight control. Excess body weight occurs in about 80% of patients with osteoarthritis of the spine and is the cause of increased inflammation in the body and mechanical overload of joints and intervertebral disc. In the processes of cartilage and bone remodeling, the homeostasis of elements such as calcium and magnesium plays a particularly important role. Calcium salts in the form of hydroxyapatite are the basic building component of bone. However, calcium pyrophosphate, formed in abnormal metabolism, leads to degenerative changes in the articular cartilage. Magnesium, by influencing the calcium metabolism and hormonal regulation, has a significant influence on bone quality. Magnesium salts cover the hydroxyapatite surface, stabilizing the entire structure. The proper concentration of magnesium determines the formation of a more durable form of hydroxyapatite. This macroelement also participates in the process of building and degradation of collagen and elastin, thus affecting the quality of cartilage. B vitamins, as well as phosphorus, sodium and potassium are also involved in modulating the inflammatory process and the level of pain in the nervous and skeletal systems. Maintaining appropriate proportions of minerals and vitamins in the diet may result in better treatment effects, faster recovery and longer periods of remission. Toxic elements are considered to be the cause of many civilization diseases. The most dangerous are cadmium, lead and mercury, which in

small amounts pose a serious threat to human health and life. Chronic cadmium poisoning manifests as Itai-Itai disease, consisting in bone fractures and severe spine pain in the lumbar region, due to calcium displacement from the bones by cadmium. Lead negatively affects bone rotation, causes calcification of cartilage in women, and negatively affects cartilage metabolism in men. Mercury can influence the development of osteoarthritis by inducing connective tissue disorders, autoimmune, inflammatory, genetic and epigenetic processes that have been described in a number of arthropathies and bone and connective tissue diseases.

The main aim of the study was to assess the relationship between the concentration of selected macronutrients (Ca, Mg), toxic elements (Hg, Cd, Pb) in the blood, and nutritional and environmental factors, the image of magnetic resonance spectroscopy and the degree of pain intensity in people with degenerative spine disease.

The material for the research was collected at the Neurological Clinic of the Non-public Healthcare Institution "KENDRON" in Białystok in 2017-2019. The study included a group of 130 adults aged 21 to 73 years. 90 people were patients diagnosed with osteoarthritis in the lumbosacral section, and 40 people were a control group that was appropriately selected in terms of gender, age and percentage of smokers and non-smokers in relation to the group of people with degenerative spine disease. Patients taking dietary supplements were excluded from the study.

Venous blood as well as information on age, sex, smoking was collected, and a survey of the frequency of consumption of particular food group products was carried out, according to the questionnaire of the Committee for the Science of Human Nutrition of the Polish Academy of Sciences. Also, 24-hour nutritional interviews were conducted using the Product and Food Photo Album, which made the assessment of portion sizes more precise. The nutritional interviews were digitized via Diet 6.0, recommended by the Food and Nutrition Institute in Warsaw.

Using the Diet 6.0 computer program, the content of B vitamins (B1, B2, B3, B6, B12, folates) and macronutrients (sodium, potassium, calcium, phosphorus and magnesium) in daily food rations was assessed.

Patients underwent proton magnetic resonance spectroscopy. The test was performed on the SIEMENS Magnetom Spectra 3T device at the Kendron Non-public Clinic. The stems L1 and L5 were analyzed, and subsequently the lipid content and the level of hydration of the intervertebral disc at the L4 and L5 levels were assessed. The fat / water ratio was determined in sections L1, L5 and L4 / 5. A higher value of the fat / water ratio indicates a greater degree of degeneration. Patients also assessed the severity of back pain using the

Visual Analog Scale (VAS).

The concentration of elements in the serum (Ca, Mg) and whole blood (Cd, Pb) was determined by the atomic absorption spectrometry method with acetylene-air flame atomization (Ca and Mg) and by the flameless technique with electrothermal atomization in a graphite cuvette (Cd and Pb), with Zeeman background correction on the Hitachi Z-2000 (Japan). Hg concentration in whole blood was determined by atomic absorption spectrometry using the amalgamation technique on the AMA-254 apparatus from Leco (Czech Republic).

The research shows that the diet of people with degenerative spine disease is incorrect and requires modification. Insufficient intake of: calcium, magnesium and potassium as well as B vitamins (B1, B2, B3, B6, B12 and folates) was shown in 24% to 97% of respondents, as well as excessive consumption of sodium and phosphorus. Studies have shown that the frequency of consumption of selected groups of food products may affect the concentration of the tested elements in the blood from 12% to 66%. In people with degenerative spine disease, serum magnesium levels are lower than in healthy people, and the correct serum magnesium concentration correlates with a lower severity of pain. The concentration of cadmium in the blood of people with degenerative spine disease is higher than in healthy people, and smoking has an additional effect on increasing its concentration. It has been shown that in people with degenerative spine disease there are abnormal ratios between serum calcium and magnesium levels and blood cadmium and lead levels. The level of steatosis of selected structures of the spine in the magnetic resonance spectroscopy image correlated with age in people over 60. Smoking cigarettes had a negative impact on the level of steatosis of selected spine structures observed in the magnetic resonance spectroscopy image. The increase in the concentration of calcium in the blood serum is associated with a decrease in the value of steatosis of selected structures of the spine observed in the magnetic resonance spectroscopy image.

The increase in the concentration of lead in the blood is associated with an increase in the value of steatosis of selected spine structures observed in the magnetic resonance spectroscopy image.

The obtained research results may be helpful in creating dietary recommendations for people with degenerative spine disease, which may contribute to the improvement of their clinical condition and everyday functioning.