

## 16. Streszczenie w języku angielskim

Glaucoma is a chronic optic neuropathy characterized by the progressive loss of retinal ganglion cells and their axons, leading to irreversible structural damage to the optic nerve head and the retinal nerve fiber layer. It remains one of the leading causes of permanent vision loss worldwide. The pathogenesis of glaucoma is complex and multifactorial, with elevated intraocular pressure (IOP) being the only well-established modifiable risk factor.

Recent scientific reports suggest that oxidative stress (OS), resulting from an imbalance between the production of reactive oxygen species (ROS) and the ability of antioxidant systems to neutralize them, plays a significant role in the pathogenesis of glaucoma. Appropriate plasma concentrations of key elements such as selenium (Se), zinc (Zn), and copper (Cu), which are essential for the biosynthesis of antioxidant enzymes, may contribute to reducing ROS levels and, consequently, mitigating OS.

This doctoral dissertation is based on two significant publications. The first is a review paper that provides a detailed discussion on the application of modern imaging technology, optical coherence tomography (OCT), in glaucoma diagnostics. This technology has revolutionized the diagnosis and management of glaucoma by enabling precise assessment of structural changes in the retina and optic nerve. Early detection of the disease and timely initiation of treatment significantly improve patient outcomes. OCT technology continues to advance, with new algorithms and imaging techniques regularly introduced into clinical practice, further enhancing its diagnostic efficiency.

Glaucoma treatment remains a significant clinical challenge. Despite the use of advanced therapeutic methods to lower IOP, some patients experience progressive optic neuropathy. As a result, increasing attention is being directed toward identifying additional strategies to support glaucoma management.

The aim of this study was to investigate the potential impact of dietary factors and identify micronutrients that may play a significant role in the pathogenesis of glaucoma. The findings of this research could contribute to the development of new, more effective therapeutic strategies to complement traditional treatment methods.

This was a single-center, prospective study conducted at the Department of Ophthalmology, University Clinical Hospital in Białystok. A total of 104 patients (70 women and 34 men) diagnosed with glaucoma and scheduled for planned glaucoma surgery were included. All patients underwent a detailed ophthalmologic examination, including assessments of visual acuity, refraction, IOP measurement, and evaluation of the anterior and posterior segments of the eye. According to the guidelines of the European Glaucoma Society, the stage of glaucoma was determined based on gonioscopy, OCT, and visual field results. The control group consisted of 65 healthy individuals with a comparable distribution of age and sex.

The study revealed that serum concentrations of Se and Zn were significantly lower in patients with glaucoma compared to the control group, while the molar ratio of copper to zinc (Cu/Zn) was elevated. Additionally, it was found that serum Se levels were significantly lower in smoking patients with glaucoma compared to non-smoking patients, suggesting a potential influence of lifestyle on the levels of key micronutrients. No significant differences were observed in serum Cu concentrations or total antioxidant status (TAS) between glaucoma patients and the control group. Moreover, no differences in serum element concentrations or TAS were identified between patients with different types of glaucoma.

Survey-based research has demonstrated that the consumption of specific food groups by patients with glaucoma affects the serum concentrations of Se, Zn, Cu and TAS. Consequently, implementing dietary modifications that address deficiencies in selected micronutrients with antioxidant properties may play a significant role not only in the prevention of glaucoma among high-risk individuals but also in the treatment of patients in the early stages of the disease.

In summary, the results of the study suggest a relationship between dietary habits and the concentration of selected elements in blood serum and the occurrence of glaucoma, which opens the prospect of further research on the influence of diet and microelements on the development of the disease. Integrating dietary interventions with conventional treatment may offer valuable therapeutic support for glaucoma patients.

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