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# Study of the Influence of Trace Element Imbalance on the Progression of Myasthenia

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**Abstract** Myasthenia gravis is a chronic autoimmune disease characterized by muscle weakness and rapid fatigue, which significantly reduces the quality of life of patients. Modern research suggests that exogenous and endogenous factors play a significant role in the development and progression of this disease. One of the important aspects that deserves attention is the micronutrient imbalance, which can have a significant impact on the functioning of the nervous and muscular systems.

**Keywords** Myasthenia gravis, Micronutrient imbalance, Magnesium, Calcium, Zinc, Selenium, Progression, Autoimmune diseases, Quality of life

## 1. Introduction

Trace elements such as magnesium, calcium, zinc, and selenium are involved in transmitting nerve impulses, regulating muscle contractions, and maintaining overall body homeostasis. A deficiency or excess of these components can lead to disruption of the normal functioning of the neuromuscular connection and, as a result, worsen the clinical manifestations of myasthenia gravis. Understanding this relationship will help develop new approaches to the prevention and treatment of myasthenia gravis, as well as improve the effectiveness of existing therapies [1]. Myasthenia gravis is a chronic autoimmune disease that affects neuromuscular transmission and manifests itself in the form of muscle weakness and rapid fatigue, which significantly impairs the quality of life of patients.

The relevance of myasthenia gravis research is due to its high prevalence, the complexity of diagnosis and treatment, as well as its profound impact on the social adaptation of patients. In recent decades, the attention of scientists and clinicians has become focused on studying the factors contributing to the progression of this disease [2]. Among the many factors, microelement imbalance deserves special attention. Trace elements such as magnesium, calcium, zinc and selenium play a key role in maintaining healthy nervous and muscular tissues. Their deficiency or excess can lead to serious functional disorders, which, in turn, can worsen the course of myasthenia gravis [3]. Deficiency of essential trace elements can contribute to impaired neuromuscular transmission, increased symptoms and deterioration of the general condition of patients. Studying the effect of microelement imbalance on the progression of myasthenia gravis is an important scientific task. This knowledge can become the basis for creating new approaches to the diagnosis, prevention and treatment of the disease, as well as help improve the effectiveness of existing therapies [4]. Given the importance of this problem, the study of the role of trace elements in the context of myasthenia gravis is not only relevant, but also a necessary step towards improving the quality of life of patients suffering from this disease. Thus, studying the role of micronutrient imbalance in the progression of myasthenia gravis is an urgent task that contributes to the deepening of knowledge about the pathogenesis of the disease and the creation of comprehensive strategies for its treatment [5].

The problem of the adverse effects of environmental factors on health is becoming increasingly relevant every year both worldwide and in the Orenburg region, due to the increase in anthropogenic pollution of industrial cities and rural settlements located in the zone of influence of industrial facilities. It is known that an imbalance of micro- and macronutrients in the environment contributes to the development of diseases, including hereditary etiology [6] Environmental pollution by anthropogenic chemical compounds poses a real threat to the human gene pool, which can manifest itself in gross pathology of the nervous system, in particular, myasthenia gravis. The issues of etiology, pathogenesis and tactics of therapeutic measures remain unclear [7]. There are several theories in the pathogenesis of myasthenia gravis, which indicates the heterogeneous nature of the disease. Hyperfunction of the thymus gland, a decrease in the number of functioning cholinergic receptors, due to changes in the characteristics of ion channels, and neurotransmission disorders in the neuromuscular synapse due to the action of trace elements with neurotoxic properties play a certain role in the development of myasthenia gravis. There is some information in the literature about the role of

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trace elements in the pathogenesis of myasthenia gravis [8].

The incidence of myasthenia gravis in Bukhara in 2022 was 8.12 per 100,000 population with an uneven distribution by region, which exceeds the Uzbek figure by more than 2 times [9]. All this indicates the need for a deeper study of the effect of trace elements of soil, water and food on the epidemiology and trace element status of the blood of patients with myasthenia gravis, which is an unexplored aspect that may affect the clinical manifestations of the disease. Studying and clarifying the influence of anthropogenic factors in Bukhara on the prevalence of myasthenia gravis, the involvement of trace elements in the development of clinical manifestations of the disease, and dermatoglyphic features will contribute to the discovery of new aspects of the pathogenesis of the disease, the development of early diagnosis methods, and adequate treatment of myasthenia gravis, which dictates the relevance of the problem under study [9]. Throughout the world and Uzbekistan, myasthenia is a relatively rare neurological disease, with a 3:2 ratio of women to men [5]. The prevalence of myasthenia is 17.5–20.3 per 100,000 inhabitants, with this indicator increasing by 5-10% each year. There have been many scientific studies on the causes of myasthenia, of which micronutrient dysbalance and vitamin deficiency are also one of the areas not studied and subject to research. In patients with myasthenia, the levels of manganese, copper, lead, nickel, chromium, strontium, zinc and iron in the blood were studied, and various deities were found to deviate from the norm of their quantity [6]. Microelement dysbalance is caused by anthropogenic effects of chemical xenobiotics. As a result of various pathological processes occurring in the body, a tendency to change in the amount of microelement in the blood is determined. When a decrease in iron levels and an increase in copper are detected in cranial vascular pathologies, as well as in tumors of poor quality, a decrease in iron and copper levels is detected in myasthenia and uterine fibroids. A decrease in the amount of manganese and nickel is detected in myasthenia gravis. The data obtained indicate that it is necessary to study the pathogenetic mechanism of the disease and the relationship between enzymatic reactions in the presence of and blood metallopherments. The fact that the Uzbek population does not pay attention to the dependence of these cases on myasthenia gravis suggests that this problem should be studied in depth [7].

In Uzbekistan, it is observed that this aspect of myasthenia is not given enough importance, attention is not paid to the importance of trace elements in the pathogenesis of the disease, the disease is detected late in patients, as a result of which the quality of life decreases. Therefore, the study of the importance of microelements and vitamin dsbalance in myasthenia, a modern approach to early diagnosis and treatment, the improvement of the correct diagnostic and therapeutic approach is a requirement of the present [10].

**The purpose of this study** is to assess the effect of micronutrient imbalance on the progression of myasthenia gravis, as well as to identify possible correlations between the level of micronutrients and the severity of the disease.

## 2. Materials and Research Methods

The study involved 100 patients suffering from myasthenia gravis who were selected from clinical departments of neurology between January 2022 and December 2023. All participants were divided into two groups: the first group (50 patients) consisted of patients with diagnosed myasthenia gravis, the second group (50 patients) was a control group, including healthy individuals who matched the age and gender of the first group.

To assess the level of trace elements (magnesium, calcium, zinc and selenium), blood serum was analyzed using the atomic absorption spectrometric method. The analysis was carried out in a specialized laboratory in compliance with all standards and protocols.

To assess the severity of myasthenia gravis, the standard Myasthenia Gravis Foundation of America (MGFA) scale was used, which made it possible to classify patients according to the severity of the disease. Data on the level of trace elements and indicators on the MGFA scale were analyzed using statistical methods, including correlation analysis and multivariate regression, in order to identify the relationship between trace element imbalance and the progression of myasthenia gravis.

## 3. Results

**The results of the study** showed a significant decrease in serum magnesium and zinc levels in patients with myasthenia gravis compared with the control group ($p < 0.05$). Calcium and selenium levels did not show statistically significant differences between the groups.

Correlation analysis revealed a strong inverse relationship between the levels of magnesium ($r = -0.68$; $p < 0.01$) and zinc ($r = -0.72$; $p < 0.01$) with the severity of myasthenia gravis, according to the MGFA scale. This indicates that a decrease in these trace elements is associated with a deterioration in the condition of patients.

It was also recorded that 60% of patients with low levels of magnesium and zinc had moderate to severe myasthenia gravis, in contrast to 30% in the control group. Multivariate regression analysis confirmed that magnesium and zinc levels significantly affect the severity of myasthenia gravis ($p < 0.001$).

## 4. Conclusions

The study of the influence of trace element imbalance on the progression of myasthenia revealed an important connection between the reduction of magnesium and zinc levels and the severity of the disease. These results underscore the necessity of monitoring trace element levels in patients with myasthenia, as well as potential therapeutic strategies aimed at correcting the trace element imbalance. This research opens new avenues for further studies, which may include the development of dietary correction recommendations and

additional measures to improve the condition of patients with myasthenia.

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