Effect of micronutrients and vitamin D_3 on hyperglycemia and other clinical parameters in patients with type 1 diabetes

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BACKGROUND. Type 1 diabetes mellitus (T1DM) is a chronic autoimmune disease, the course of which is largely determined by the quality of glycemic control and the development of metabolic and microvascular complications. In recent years, there has been growing interest in the role of trace elements and vitamin D_3 as potential modifiers of the course of the disease.

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OBJECTIVE. Generalization and critical analysis of current scientific data on the effect of trace elements (zinc, chromium) and vitamin D_3 on hyperglycemia and other clinical indicators in patients with T1DM in order to evaluate their potential role as adjuvant factors of metabolic control.

MATERIALS AND METHODS. The object of the study is scientific sources published in recent years (original studies, systematic reviews, meta-analyses and experimental works) dedicated to the study of the role of zinc, chromium and vitamin D_3 in the regulation of carbohydrate metabolism, immune and metabolic processes in patients with T1DM.

RESULTS AND DISCUSSION. Zinc is a key trace element in the regulation of synthesis, stabilization and secretion of insulin, as well as in the maintenance of antioxidant protection and immune balance. Zinc deficiency in patients with T1DM is associated with poorer glycemic control, increased oxidative stress, and a higher risk of chronic complications, but convincing evidence for the clinical efficacy of routine use of this trace element is lacking.

Chromium may potentially potentiate insulin action and influence glycemic fluctuations, but most of the available evidence is in patients with type 2 diabetes. For the T1DM population, data are limited and conflicting, preventing chromium from being recommended as a standard component of therapy.

Vitamin D_3 plays an important role in metabolic control in T1DM: 25(OH)D deficiency is associated with hyperglycemia and worse disease compensation. At the same time, the results of intervention studies regarding the effect of vitamin D_3 on HbA1c level are ambiguous, although some studies have noted a decrease in fasting glucose and insulin requirements.

Overall, the evidence base for the use of micronutrients and vitamin D_3 in patients with T1DM remains limited due to small samples, short follow-up, and significant methodological heterogeneity of studies, which makes it difficult to formulate clear clinical recommendations.

CONCLUSIONS. The analysis of current scientific data shows that zinc, chromium and vitamin D_3 have the potential to influence glycemic control and other clinical indicators in patients with T1DM. Decreased zinc and vitamin D_3 levels in these patients are associated with poorer glycemic control and metabolic dysregulation, whereas the evidence base for the role of chromium remains limited and controversial. Correction of deficiencies of these nutrients can be considered individually under clinical supervision, and further large-scale randomized trials are necessary to form clear clinical recommendations.

KEY WORDS: type 1 diabetes, zinc, chromium, vitamin D_3, hyperglycemia, trace elements.