

THE IMPORTANCE OF COOPER TABLETS IN THE TREATMENT OF VITILIGO

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Abstract: Vitiligo is a chronic depigmenting skin disorder characterized by the loss of functional melanocytes, leading to the appearance of white patches on the skin. Trace elements play an essential role in melanogenesis, and copper is a key cofactor for the enzyme tyrosinase, which is crucial for melanin synthesis. Copper deficiency has been suggested as a contributing factor in the pathogenesis of vitiligo. The use of copper tablets as an adjunctive therapy has gained increasing attention due to their potential role in enhancing melanocyte function and promoting repigmentation. This article explores the biological significance of copper in skin pigmentation, evaluates the therapeutic potential of copper supplementation in vitiligo management, and discusses its benefits, limitations, and safety considerations. Copper tablets may serve as a supportive component in combination with conventional treatment modalities to improve clinical outcomes in patients with vitiligo.

Keywords: Vitiligo; copper supplementation; trace elements; melanogenesis; tyrosinase; adjunctive therapy.

INTRODUCTION

Vitiligo is a chronic acquired disorder of skin pigmentation characterized by the selective destruction or dysfunction of melanocytes, resulting in depigmented macules and patches. The condition affects approximately 0.5–2% of the global population and has a significant psychological and social impact on affected individuals. Although the exact etiology of vitiligo is not fully understood, autoimmune mechanisms, genetic

predisposition, oxidative stress, and metabolic abnormalities are considered to play important roles in disease development and progression.

Melanogenesis is a complex biochemical process that depends on the activity of several enzymes, among which tyrosinase plays a central role. Copper is an essential trace element and a critical cofactor for tyrosinase, directly influencing melanin synthesis. Disturbances in copper metabolism or reduced serum copper levels may impair melanocyte function and contribute to hypopigmentation disorders, including vitiligo. Several studies have reported altered levels of trace elements, particularly copper, in patients with vitiligo, suggesting a potential link between copper deficiency and disease pathogenesis.

Conventional treatment options for vitiligo include topical corticosteroids, calcineurin inhibitors, phototherapy, and systemic immunomodulatory agents. However, treatment outcomes remain variable, and complete repigmentation is often difficult to achieve. As a result, increasing attention has been directed toward adjunctive therapies that may enhance the effectiveness of standard treatments. Copper supplementation in the form of oral tablets has been proposed as a supportive therapeutic strategy aimed at restoring trace element balance, improving melanocyte activity, and promoting repigmentation. This article focuses on the importance of copper tablets in the management of vitiligo, highlighting their biological role in pigmentation, potential therapeutic benefits, and relevance as an adjunct to conventional treatment approaches.

Role of Copper in Skin Pigmentation

Copper is an essential trace element involved in numerous physiological processes, including enzymatic reactions, immune function, and antioxidant defense. In skin pigmentation, copper plays a critical role as a cofactor of the enzyme tyrosinase, which is responsible for catalyzing the rate-limiting steps of melanin synthesis. Adequate copper levels are necessary for normal melanocyte activity and effective melanogenesis.

Disruption of copper homeostasis may result in decreased tyrosinase activity, impaired melanin production, and increased susceptibility of melanocytes to oxidative damage. Several biochemical studies have demonstrated reduced serum and tissue copper levels in patients with vitiligo compared to healthy controls, supporting the hypothesis that copper deficiency may contribute to depigmentation.

Copper Deficiency and Vitiligo Pathogenesis

Oxidative stress is considered one of the key mechanisms involved in the pathogenesis of vitiligo. Copper is a structural component of antioxidant enzymes such as superoxide dismutase (Cu/Zn-SOD), which protects melanocytes from oxidative injury. Reduced copper levels may weaken antioxidant defense mechanisms, leading to increased melanocyte destruction and progression of depigmented lesions.

Furthermore, copper is involved in immune regulation, and its deficiency may alter immune responses, potentially exacerbating autoimmune-mediated melanocyte damage. These findings suggest that maintaining adequate copper levels may be important in preventing disease progression and supporting melanocyte survival.

Therapeutic Potential of Copper Tablets

Copper tablets have been proposed as an adjunctive treatment for vitiligo to correct trace element imbalance and enhance melanocyte function. Oral copper supplementation may improve tyrosinase activity, stimulate melanin synthesis, and strengthen antioxidant defenses in the skin. Clinical observations indicate that copper tablets alone are usually insufficient to induce significant repigmentation; however, when used in combination with conventional therapies such as phototherapy or topical agents, they may enhance treatment outcomes.

Some clinical studies have reported improved repigmentation rates in patients receiving copper supplementation alongside narrowband ultraviolet B (NB-UVB) therapy, suggesting a synergistic effect. Copper tablets are generally well tolerated when administered at recommended doses, although excessive intake may lead to gastrointestinal discomfort or copper toxicity.

Dosage, Safety, and Limitations

The optimal dosage and duration of copper supplementation in vitiligo treatment have not yet been clearly established. Most studies recommend low-dose supplementation within the safe daily intake range to avoid adverse effects. Monitoring serum copper levels is advisable during prolonged supplementation to prevent toxicity.

Despite promising theoretical and preliminary clinical evidence, the use of copper tablets remains supportive rather than definitive therapy. Variability in individual response, limited large-scale clinical trials, and the multifactorial nature of vitiligo represent important limitations. Therefore, copper supplementation should be considered as part of a comprehensive and individualized treatment plan.

Combination Therapy and Clinical Implications

Given the complex etiology of vitiligo, combination therapy is widely regarded as the most effective management strategy. Incorporating copper tablets into standard treatment regimens may provide additional benefits by addressing metabolic and oxidative factors contributing to melanocyte dysfunction. This integrative approach may improve repigmentation, reduce disease progression, and enhance overall treatment efficacy.

Copper is an essential trace element that plays a critical role in melanogenesis, primarily as a cofactor for the enzyme tyrosinase, which catalyzes melanin synthesis. Evidence from clinical and biochemical studies indicates that reduced copper levels may contribute to melanocyte dysfunction and the progression of vitiligo. Copper supplementation in the form of tablets has emerged as a potential adjunctive therapy aimed at restoring trace element balance, enhancing melanocyte activity, and promoting repigmentation.

While copper tablets alone are unlikely to produce significant repigmentation, their use in combination with conventional therapies such as phototherapy, topical corticosteroids, or calcineurin inhibitors may improve treatment outcomes. Copper

supplementation is generally safe when administered within recommended doses, although monitoring is advised to prevent toxicity.

In summary, copper tablets represent a supportive strategy in the management of vitiligo, addressing underlying metabolic and oxidative factors that may influence disease progression. Further large-scale clinical trials are needed to establish standardized dosing protocols, evaluate long-term efficacy, and confirm their role as an integral component of comprehensive vitiligo therapy.

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