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Nutrigenomics and Vitamin Metabolism: Implications for Deficiency and Health

Nutrigenomics and Vitamin Metabolism: Implications for Deficiency and Health
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Abstract:
Vitamins are more than essential nutrients, they act as molecular signals that interact with our genes to shape health outcomes. Nutrigenomics, the study of nutrient–gene interactions, has revealed that genetic variation plays a crucial role in determining how individuals absorb, metabolize, and utilize vitamins. A recent systematic review of studies over the past two decades highlights strong evidence linking polymorphisms in genes such as GC, CYP2R1, and DHCR7 with circulating vitamin D levels, while variations in folate and vitamin B12 pathways significantly influence homocysteine metabolism, with consequences for cardiovascular and neurological health. Similar associations have also been identified for vitamin E and carotenoids. These findings demonstrate why some individuals remain vitamin deficient despite adequate intake, while others respond more efficiently to supplementation. The implications are shifting nutrition science from generalized recommendations towards precision nutrition, where dietary strategies are guided by genetic profiles. However, challenges remain in integrating such approaches into healthcare, including cost, accessibility, and ethical considerations around genetic data. By bridging genomics and nutrition, nutrigenomics transforms vitamin deficiencies from simple dietary shortcomings into opportunities for personalized healthcare, which will pave the way for improved global health outcomes.By discussing this, I aim to highlight why nutrition should move beyond generalized dietary recommendations, and how understanding these genetic influences can guide personalized nutrition strategies. This shift from standard advice to more precise, genetics-based interventions has the potential to reduce deficiencies, improve metabolic health, and ultimately contribute to better public health outcomes.
Keywords: Nutrigenomics, Vitamin deficiency, Healthcare , Nutrition, Public Health.

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