

Vitamin D and Autism Spectrum Disorder: An Intriguing Association

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INTRODUCTION

Autism spectrum disorder (ASD) encompasses a range of neurodevelopmental disorders characterised by challenges in social interaction and communication, restricted interests, repetitive and stereotypical behaviours, and sensory processing issues that typically appear in early childhood. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders, published by the American Psychiatric Association, classifies childhood autism, pervasive developmental disorder not otherwise specified, and Asperger's syndrome under the umbrella of ASD. Genetic factors are believed to contribute to 10% to 20% of ASD cases. Potential environmental factors include advanced parental age, birth by caesarean section, exposure to lead, maternal obesity, hypertension, air pollution, and diabetes.

Vitamin D is widely recognised for its immunomodulatory properties. The active form of vitamin D, calcitriol, can bind to vitamin D receptors (VDRs) and modify gene transcription. These VDRs are expressed by all immune cells in the human body, enabling vitamin D to carry out a range of functions. It is estimated that 30% of the global population is deficient in vitamin D, while 60% have suboptimal levels. Recent discoveries have highlighted the importance of vitamin D in the development of the foetal and early postnatal brain, beyond its established role in regulating calcium and phosphorus levels. An increasing amount of evidence indicates that vitamin D is implicated in the pathogenesis of ASD, and that vitamin D deficiency may be a contributing factor to ASD. Concurrently, some studies have demonstrated that vitamin D can ameliorate the core symptoms in children with ASD.

MATERIAL AND METHODS

We examined studies on vitamin D and autism spectrum disorder (ASD) from PubMed, Google Scholar, Scopus, and Web of Science up to January 2024. We included research that explored vitamin D levels in relation to ASD, focusing on observational studies and randomized controlled trials. Key aspects reviewed included vitamin D status during pregnancy, infancy, and early childhood, as well as the impact of supplementation. We extracted data on study design, sample size, and outcomes, and assessed the overall quality of the evidence to summarize current knowledge and identify research gaps.

EPIDEMIOLOGY AND PATHOGENESIS OF ASD

The global prevalence of ASD is on the rise, posing a pressing societal challenge. Genetic and environmental factors play pivotal roles, with Vitamin D deficiency emerging as a potential contributing factor. Urban living and reduced UVB exposure further amplify the prevalence of ASD, reinforcing the need for a nuanced understanding of its etiology.

VITAMIN D: PRODUCTION AND METABOLISM

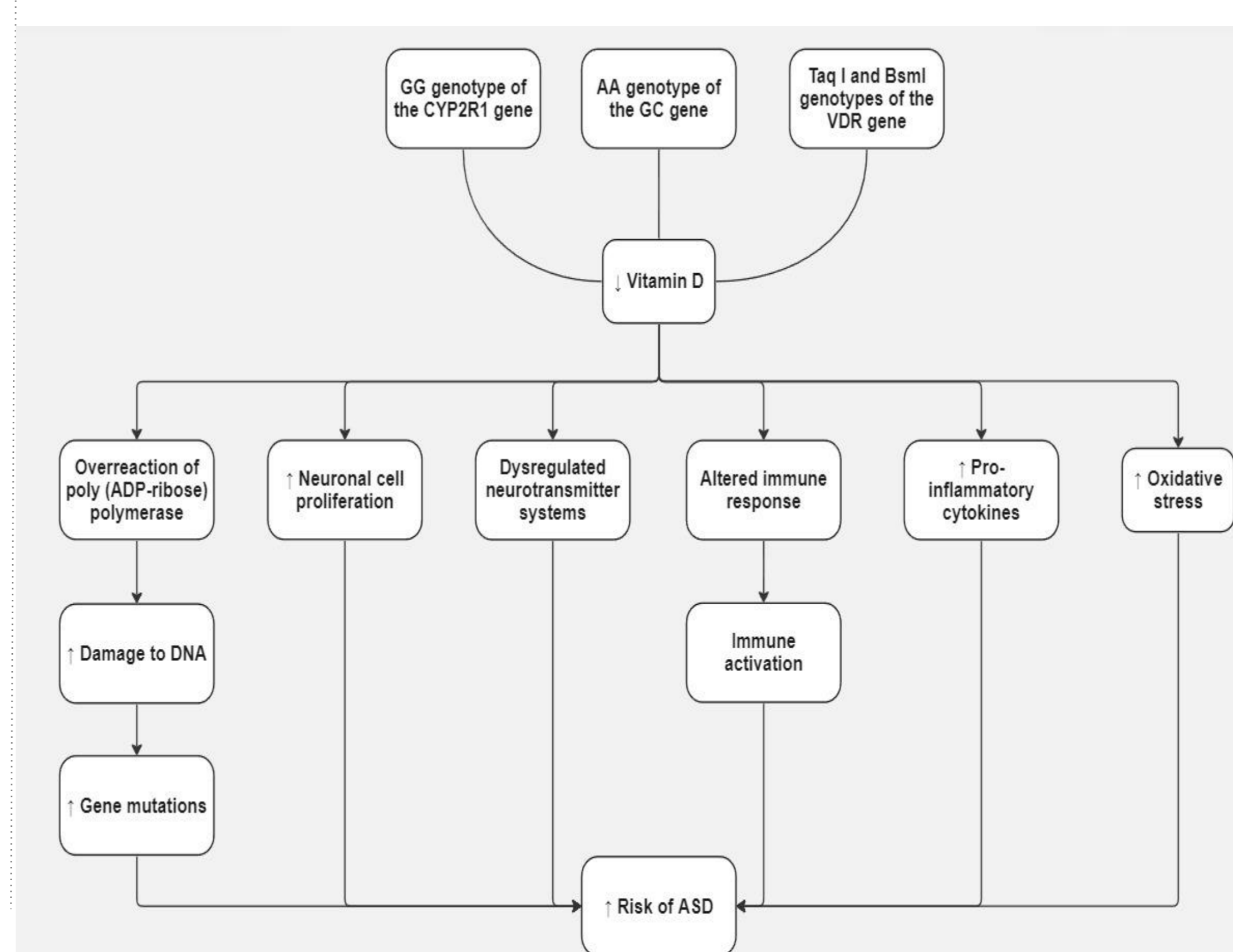
Vitamin D's role extends beyond its classical function in regulating calcium metabolism. It is integral to brain development, influencing synaptic plasticity, immune function, and gene expression. Recent research underscores the significance of Vitamin D during fetal and early postnatal brain development, adding a layer of complexity to its role in ASD pathogenesis.

ASSOCIATION OF VITAMIN D LEVEL WITH AUTISM SPECTRUM DISORDER:

Children and adolescents diagnosed with ASD consistently exhibit lower Vitamin D levels. Maternal deficiency during pregnancy is linked to ASD-related symptoms in offspring. Genetic factors, such as variations in the CYP2R1 and VDR genes, emphasize the intricate interplay between genetics and Vitamin D in influencing ASD risk.

MECHANISM OF VITAMIN D'S INVOLVEMENT IN AUTISM SPECTRUM DISORDER

Vitamin D's influence on DNA repair, neurotransmitter systems, and immune function provides a compelling mechanistic link to ASD. From promoting DNA stability to regulating neurotransmitters associated with ASD, Vitamin D deficiency may contribute to the neuroanatomical defects observed in ASD.



EFFECT OF VITAMIN D

SUPPLEMENTATION ON AUTISM SPECTRUM DISORDER

Studies suggest potential benefits of Vitamin D supplementation in ameliorating core ASD symptoms. Ongoing research endeavors to elucidate the nuanced relationship between Vitamin D supplementation and ASD, exploring its preventive and therapeutic implications.

CONCLUSIONS

The high incidence of ASD has turned it into a pressing social issue, yet the etiology of the disorder remains elusive. While ASD is believed to be influenced by a combination of genetic and environmental factors, existing research has not satisfactorily accounted for the disorder's epidemiological traits, and pharmacological interventions have yet to prove effective. Consequently, exploring the origins and development of ASD from a novel angle is crucial for devising ground-breaking treatment strategies. There is evidence to suggest that insufficient vitamin D levels during pregnancy, after birth, and in early childhood may be associated with neurodevelopmental disorders, including ASD. Certain studies indicate that vitamin D supplementation in vitamin D-deficient children with ASD can ameliorate their fundamental symptoms. To fully comprehend the connection between vitamin D and ASD, extensive research is required. Delving deeper into this relationship could pave the way for a straightforward, cost-effective, and safe new approach to treating and preventing ASD.

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