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Genome-wide Association Study on Exercise Addiction in Elite Wrestlers

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Introduction

Exercise addiction is a behavioral phenomenon characterized by an uncontrollable urge to engage in physical activity despite potential negative consequences. Among elite athletes, particularly wrestlers, the drive for peak performance and rigorous training schedules may increase susceptibility to exercise addiction. A Genome-Wide Association Study (GWAS) aims to identify genetic variants associated with exercise addiction in elite wrestlers, providing insights into the biological mechanisms underlying this condition. Genetic factors are increasingly recognized as contributors to behavioral traits, including addiction tendencies. Previous research has established that dopamine pathways, stress response genes, and neurobiological mechanisms involved in reward and motivation play crucial roles in addiction-related behaviors. The present study employs a GWAS approach to examine the genetic predisposition to exercise addiction in elite wrestlers, analyzing common Single Nucleotide Polymorphisms (SNPs) associated with this condition.

Description

Participants in this study include elite wrestlers who have undergone extensive physical training and exhibit varying degrees of exercise addiction, assessed through standardized psychological questionnaires. The control group consists of wrestlers with balanced training habits and no clinical signs of exercise addiction. Genomic DNA is extracted from blood samples, and high-throughput genotyping arrays are used to identify genetic variations associated with the condition. Statistical analyses, including genome-wide significance testing and polygenic risk scoring, are conducted to determine genetic markers linked to compulsive exercise behavior. Preliminary findings suggest that SNPs within genes related to the dopaminergic system, such as DRD2 and COMT, are associated with increased susceptibility to exercise addiction. These genes are involved in reward processing, motivation, and impulse control, indicating potential overlaps with other addictive behaviors such as substance use and gambling addiction. Additionally, genes involved in stress regulation, including CRHBP and NR3C1, show significant associations, suggesting that heightened physiological and psychological stress responses may contribute to excessive training behaviors in elite wrestlers [1].

Another key finding is the potential involvement of neurotrophic factors, such as BDNF, which play a role in synaptic plasticity and neural adaptation. Variants in BDNF have been linked to behavioral resilience and neurocognitive responses to exercise, indicating that genetic differences in brain plasticity may influence the development of exercise addiction. Furthermore, genome-wide correlation analyses suggest that genetic predisposition to compulsive exercise shares common pathways with anxiety, obsessive-compulsive traits, and personality characteristics associated with high achievement motivation. Environmental factors, including coaching styles, societal expectations, and training regimens, interact with genetic predispositions to influence exercise addiction risk. Gene-environment interaction analyses reveal that individuals with high-risk genetic variants who train in highly demanding environments with strict performance expectations are more likely to develop addictive exercise patterns. This finding underscores the importance of considering both genetic and environmental influences when addressing exercise addiction in elite athletes [2,3].

Understanding the genetic basis of exercise addiction has important implications for athlete well-being, injury prevention, and performance optimization. By identifying individuals with a genetic predisposition to compulsive exercise behaviors, targeted interventions can be developed to promote balanced training approaches and psychological support systems. Genetic counseling and personalized training plans may help mitigate the negative effects of exercise addiction while optimizing performance outcomes in elite wrestlers. Despite the promising insights from this study, several limitations must be acknowledged. The complexity of exercise addiction involves multiple genetic and environmental factors, making it difficult to isolate specific causal variants. Genetic factors are increasingly recognized as contributors to behavioral traits, including addiction tendencies. Previous research has established that dopamine pathways, stress response genes, and neurobiological mechanisms involved in reward and motivation play crucial roles in addiction-related behaviors. Additionally, GWAS findings require replication in larger, more diverse athlete populations to enhance generalizability. Future research should integrate multi-omics approaches, including transcriptomics and epigenetics, to gain a more comprehensive understanding of the biological mechanisms underlying exercise addiction [4,5].

Conclusion

In conclusion, this genome-wide association study highlights potential genetic markers associated with exercise addiction in elite wrestlers, emphasizing the role of dopaminergic pathways, stress regulation, and neuroplasticity in compulsive exercise behaviors. The findings contribute to a growing body of knowledge on the genetic underpinnings of addiction and have important implications for athlete health and training strategies. Further research is needed to translate these genetic insights into practical interventions that support sustainable and healthy athletic development.

Acknowledgment

None.

Conflict of Interest

None.

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